AYÇA TURGAY ZIRAMAN IMPACT OF OBJECT SALIENCE IN PHYSICAL AND DIGITAL EXHIBITIONS Bilkent University 2018

IMPACT OF OBJECT SALIENCE IN PHYSICAL AND DIGITAL EXHIBITIONS: A VISITOR ATTENTION STUDY

A Ph.D. Dissertation

by

AYÇA TURGAY ZIRAMAN

Department of
Interior Architecture and Environmental Design
İhsan Doğramacı Bilkent University
Ankara
October 2018

To the memories of my grandparents

IMPACT OF OBJECT SALIENCE IN PHYSICAL AND DIGITAL EXHIBITIONS: A VISITOR ATTENTION STUDY

The Graduate School of Economics and Social Sciences
of
İhsan Doğramacı Bilkent University

by

AYÇA TURGAY ZIRAMAN

In Partial Fulfillment of the Requirements for the Degree of
DOCTOR OF PHILOSOPHY IN
INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN

THE DEPARTMENT OF
INTERIOR ARCHITECTURE AND ENVIRONMENTAL DESIGN
İHSAN DOĞRAMACI BİLKENT UNIVERSITY
ANKARA

October 2018

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy in Interior Architecture and Environmental Design.

Assist. Prof. Dr. Çağrı İmamoğlu
Supervisor

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy in Interior Architecture and Environmental Design.

Prof. Dr. Halime Demirkan
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy in Interior Architecture and Environmental Design.

Prof. Dr. Billur Tekkök Karaöz
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy in Interior Architecture and Environmental Design.

Prof. Dr. Ayşe Filiz Yenişehirlioğlu
Examining Committee Member

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Doctor of Philosophy in Interior Architecture and Environmental Design.

Assoc. Prof. Dr. Yasemin Afacan
Examining Committee Member

Approval of the Graduate School of Economics and Social Sciences

---

Prof. Dr. Halime Demirkan
Director

ABSTRACT

IMPACT OF OBJECT SALIENCE IN PHYSICAL AND DIGITAL EXHIBITIONS: A VISITOR ATTENTION STUDY

Turgay Zıraman, Ayça

Ph.D., Department of Interior Architecture and Environmental Design

Supervisor: Assist. Prof. Dr. Çağrı İmamoğlu

October 2018

More often than not, multiple exhibit objects are displayed, rather than a single exhibit object, in a single exhibition space. This situation might induce a competition for visitor attention between the objects. As an attempt to elucidate the nature of this competition, this study addresses the influence of the salience layout of exhibit objects on the distribution of visitor attention in physical and digital environments. Among various salience parameters previously determined in the literature, size and three-dimensionality are investigated in this thesis. A set of field experiments utilizing unobtrusive observation, and self-administered questionnaires were employed to collect data. In an alternative approach to the existing visitor studies in Turkey, the empirical design involved a high level of control. The results have revealed the ways visitor attention to individual exhibit objects and exhibitions in overall could be influenced by [1] the presence of a more salient object within a set of less salient objects, [2] ordinal position of exhibit objects with different salience levels, [3] the physical or digital nature of the exhibition space, and [4] size and three-dimensionality as exhibit object parameters.

Keywords: Digital Exhibition, Exhibit Object Salience, Timing Study, Visitor Attention, Visitor Behavior

ÖZET

SERGİ NESNESİ ÇARPICILIĞININ FİZİKSEL VE DİJİTAL SERGİLERDEKİ ETKİLERİ: ZİYARETÇİ DİKKATİ ÜZERİNE BİR ÇALIŞMA

Turgay Zıraman, Ayça
Doktora, İç Mimarlık ve Çevre Tasarımı Bölümü
Tez Danışmanı: Dr. Öğr. Üyesi Çağrı İmamoğlu

Ekim 2018

Genellikle, bir sergi mekanında tek bir nesnedense, birden fazla nesne sergilenir. Bu durum, sergilenen nesnelerin, ziyaretçilerin dikkatini çekebilmek için bir yarışa girmesine sebep olabilir. Bu çalışma, bu yarışın doğasını ortaya çıkarmak amacıyla, fiziksel ve dijital sergilerde nesne çarpıcılığının, ziyaretçi dikkatinin dağılımı üzerindeki etkilerine yoğunlaşmaktadır. Bu tezde geçmiş çalışmalarda nesne çarpıcılığını belirlediği ortaya konulmuş olan özelliklerden büyüklük ve üç boyutluluk incelenmektedir. Veri toplamak için katılımsız gözlem ve anketler kullanılarak gerçekleştirilen bir dizi saha deneyi uygulanmıştır. Türkiye'deki sergilerde gerçekleştirilmiş ziyaretçi çalışmalarından farklı bir yaklaşımla, deney tasarımı yüksek seviyede kontrol sağlamıştır. Çalışmanın sonucunda, [1] sergi içerisinde mevcut nesnelerden daha çarpıcı bir nesne olup olmadığı, [2] farklı çarpıcılık seviyelerindeki nesnelerin sergi mekanı içerisindeki sıralamaları, [2] serginin fiziksel veya dijital bir ortamda gerçekleşmesi, ve [3] nesne çarpıcılığını belirleyen büyüklük ve üç boyutluluk özelliklerinin, sergi nesnelerine ve serginin bütününe verilen ziyaretçi dikkati üzerindeki etkileri ortaya çıkmıştır.

Anahtar Kelimeler: Dijital Sergi, İzleme Süresi, Sergi Nesnesi Çarpıcılığı, Ziyaretçi Davranışı, Ziyaretçi Dikkati

ACKNOWLEDGMENTS

First and foremost, I would like to express my deepest gratitude to my thesis supervisor Assist. Prof. Dr. Çağrı İmamoğlu. Without his constructive guidance and reassuring motivation, this thesis would be incomplete. I cannot thank enough for such unwavering patience and trust.

I am also thankful for having Prof. Dr. Halime Demirkan and Prof. Dr. Billur Tekkök Karaöz as our committee members, and for all the invaluable comments and endless encouragement, which took this thesis to the next level. I am also grateful for their support and guidance throughout these very first years of my academic journey.

Besides, this study was kindly supported by the Municipality of Çankaya's Contemporary Arts Center, which provided a gallery and relevant equipment for the field research. I would like to thank Kenan Metin Utkan, the manager of the Contemporary Arts Center, for his understanding and support. I also thank the

friendly staff of the Contemporary Arts Center for accepting me as one of their own during the field study.

I would like to thank my dear friend Zeynep Öktem for her affection and companionship, for just being there whenever I needed her. Also, I feel privileged for having all my lovely friends, especially Alican Baran, who always found a way to cheer me up no matter what.

Last but not least, I am indebted to my devoted parents Şeyda and Ahmet Turgay, my loving husband and best friend Ali Zıraman, and all the other members of my precious family – including the family of my husband no less than my own. I feel blessed for such endless love and unconditional support from each and every one of them.

TABLE OF CONTENTS

ABSTRACT iii
ÖZET iv
ACKNOWLEDGEMENTS v
TABLE OF CONTENTS vii
LIST OF TABLES x
LIST OF FIGURES xii

CHAPTER I: INTRODUCTION 1
1.1. Aim of the Study 5
1.2. Structure of the Thesis 5
CHAPTER II: EXHIBITION PARAMETERS AND VISITOR ATTENTION 8
2.1. Visitor Attributes 9
2.2. Spatial Attributes 14
2.3. Exhibit Attributes 20
CHAPTER III: DIGITAL EXHIBITIONS 26
3.1. Virtual, Cyber or Digital 27
3.2. Advantages and Disadvantages of Digital Exhibitions 30
3.3. Perceived Presence 33
CHAPTER IV: RESEARCH DESIGN AND METHODOLOGY 35
4.1. Research Questions and Hypotheses 35
4.2. Indicators of Visitor Attention 40
4.3. Venue 42
4.4. Participants 44
4.5. Structure of the Empirical Research 45
4.5.1. Exhibit Objects 47
4.5.2. Technical Considerations for the Digital Exhibitions 49

4.5.3. Data Collection 51
4.5.4. Pilot Study in the Physical Medium 56
4.5.5. Pilot Study in the Digital Medium 58
CHAPTER V: RESULTS 60
5.1. Experiment P1: Testing Size in the Physical Medium 60
5.1.1. Demographic Data 62
5.1.2. Analysis of the Timing Data 63
5.1.2.1. Trends Observed in AP Values 64
5.1.2.2. Trends Observed in AHT Values 67
5.1.2.3. Overall Attention Differences between Conditions 70
5.1.2.4. Trends Observed in Deviation Scores 71
5.1.2.5. Visual Summary of the Timing Results 73
5.1.3. Behavioral Indicators 75
5.1.4. Interest Levels 76
5.1.5. Preliminary Discussion on the Findings of Experiment P1 78
5.2. Experiment D1: Testing Size in the Digital Medium 82
5.2.1. Demographic Data 82
5.2.2. Analysis of the Timing Data 85
5.2.2.1. Trends Observed in AP Values 85
5.2.2.2. Trends Observed in AHT Values 89
5.2.2.3. Overall Attention Differences between Conditions 92
5.2.2.4. Trends Observed in Deviation Scores 93
5.2.2.5. Visual Summary of the Timing Results 95
5.2.3. Behavioral Indicators 97
5.2.4. Interest Levels 98
5.2.5. Preliminary Discussion on the Findings of Experiment D1 100
5.3. Experiment D2: Testing Three-Dimensionality in the Digital Medium 104
5.3.1. Demographic Data 104
5.3.2. Analysis of the Timing Data 106
5.3.2.1. Trends Observed in AP Values 106
5.3.2.2. Trends Observed in AHT Values 111

5.3.2.3. Overall Attention Differences between Conditions 115
5.3.2.4. Trends Observed in Deviation Scores.....116
5.3.2.5. Visual Summary of the Timing Results.....118
5.3.3. Behavioral Indicators.....120
5.3.4. Interest Levels.....121
5.3.5. Preliminary Discussion on the Findings of Experiment D2.....123
5.4. Comparative Review of the Results.....126
5.4.1. Experiments P1 and D1.....127
5.4.2. Experiments D1 and D2.....132
CHAPTER VI: DISCUSSION.....137
CHAPTER VII: CONCLUSION.....146
REFERENCES.....155
APPENDICES.....164
A. QUESTIONNAIRE OF EXPERIMENT P1.....165
B. SUS PRESENCE QUESTIONNAIRE.....170
C. STATISTICAL TEST RESULTS ON PARTICIPANTS' PERSONAL INFORMATION – EXPERIMENT P1.....171
D. ONE-WAY ANOVA RESULTS FOR MEAN VIEWING DURATIONS IN EXPERIMENT P1.....174
E. STATISTICAL TEST RESULTS ON PARTICIPANTS' PERSONAL INFORMATION – EXPERIMENT D1.....179
F. ONE-WAY ANOVA RESULTS FOR MEAN VIEWING DURATIONS IN EXPERIMENT D1.....182
G. STATISTICAL TEST RESULTS ON PARTICIPANTS' PERSONAL INFORMATION – EXPERIMENT D2.....187
H. ONE-WAY ANOVA RESULTS FOR MEAN VIEWING DURATIONS IN EXPERIMENT D2.....190

LIST OF TABLES

1. Eight hypotheses generated in light of the independent variables. 38
2. Frequencies and percentages of demographic categories in each condition of Experiment P1. 63
3. Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment P1. 65
4. Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment P1. 66
5. ANOVA results involving AHTs of seven EOs within each condition for Experiment P1. 67
6. Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with larger objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment P1. 72
7. Frequencies and percentages of demographic categories in each condition of Experiment D1. 84
8. Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment D1. 87
9. Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment D1. 87
10. ANOVA results involving AHTs of seven EOs within each condition for Experiment D1. 91

11. Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with larger objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment D1. 94

12. Frequencies and percentages of demographic categories in each condition of Experiment D2. 105

13. Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment D2. 107

14. Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment D2. 109

15. ANOVA results involving AHTs of seven EOs within each condition for Experiment D2. 111

16. Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with 2.5D objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment D2. 117

17. ANOVA results involving the interest ratings of seven EOs within the experimental conditions of Experiment D2. 121

18. Significance levels of parameters regarding ordinal position, object salience, adjacency to a salient object, and general suppression effect for the three experiments. 126

LIST OF FIGURES

1. Screenshots from the Google Art Project's website, accessed from https://artsandculture.google.com. 4
2. Diagram illustrating the exit attraction effect, which changes according to the position of the exit. 17
3. Ground floor plan of The Contemporary Arts Center. The highlighted area is the Z-Gallery, in which the experiments took place. 42
4. Photographs of the venue on the left column, and snapshots from the CAD model on the right column. 44
5. The structure of the experiments and conditions. Hatched squares indicate the salient objects in the conditions. 46
6. Photographs of the exhibit objects used in Experiment P1. 48
7. Digitally produced exhibit objects used in Experiments D1 (top row) and D2 (bottom row) 48
8. Artworks described as two-and-a-half-dimensional by their artists Mark Croxford (on the left; accessed from: http://markcroxford.com/exhibitions.html), Lin Yan (in the middle; accessed from: https://www.linyan.us/small?lightbox=dataItem-jerzva8x), and Enno de Kroon (on the right; accessed from: http://www.fondazionegeiger.org/images/stories/eggcubism/006.jpg) ... 49
9. A snapshot from the digital exhibition (S#4 of Experiment D2) 50
10. A view from the pilot exhibition. 57

11. A snapshot from the digital exhibition, showing the marker added to the zoomed out scene.....58

12. Snapshots from the four conditions in Experiment P1.....61

13. APs of the exhibit objects in the four conditions of Experiment P1. The large objects are indicated with larger markers. 64

14. AHTs of the exhibit objects in the four conditions of Experiment P1. The large objects are indicated with larger markers. Standard deviations are indicated within parentheses. 68

15. Visual summary of the timing data test results for Experiment P1. 74

16. Frequencies of behavioral indicators observed in the four conditions of Experiment P1. 75

17. Mean interest levels of the exhibit objects in the four conditions of Experiment P1. The larger objects are indicated with larger markers. Standard deviations are indicated within parentheses.....77

18. APs of the exhibit objects in the four conditions of Experiment D1. The large objects are indicated with larger markers. 86

19. AHTs of the exhibit objects in the four conditions of Experiment D1. The large objects are indicated with larger markers. Standard deviations are indicated within parentheses. 90

20. Visual summary of the timing data test results for Experiment D1.....96

21. Frequencies of behavioral indicators observed in the four conditions of Experiment D1. 97

22. Mean interest levels of the exhibit objects in the four conditions of Experiment D1. The larger objects are indicated with larger markers. Standard deviations are indicated within parentheses.....98

23. APs of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers. 108

24. AHTs of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers. Standard deviations are indicated within parentheses. 112

25. Visual summary of the timing data test results for Experiment D2..... 119

26. Frequencies of behavioral indicators observed in the four conditions of Experiment D2. 120

27. Mean interest levels of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers. Standard deviations are indicated within parentheses..... 122

28. APs of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers. 129

29. AHTs of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers. 130

30. Interest levels of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers. 131

31. APs of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers. 134

32. AHTs of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers. 135

33. Interest levels of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers. 136

34. APs and AHTs of the exhibit objects in S#7 conditions of the three experiments. 143

CHAPTER 1

INTRODUCTION

More often than not, multiple exhibit objects are displayed, rather than a single exhibit object, in a single exhibition space. This spatial coalescence of individual exhibit objects can be used as a powerful means to convey a collective meaning. However, it might as well induce a competition for visitor attention between the objects (Bitgood, Patterson, & Benefield, 1988; Bitgood, 2002, 2013), as the visitor is obliged to make relative preferences due to the objects' co-presence. Since it is not possible for visitors to allocate their attention on multiple exhibit objects at a time, attention would be withdrawn from all the other objects in order to be invested on the object that wins the competition (Bitgood, 2010). As a result, the increased number of stimuli around an exhibit object would decrease its chances of being noticed, unless it displays an exceptionally high level of salience (Bitgood, 2002, 2013).

Many studies have addressed the effects of exhibit objects' spatial arrangement in collective exhibition settings on attention distribution schemes, which result in some objects to be overshadowed by others (e.g., Bitgood, 1994, 2010, 2013; Donald, 1991; Melton, 1935; Robinson, 1928; Rounds, 2004). However, the reasons for and the nature of this overshadowing effect remain ambiguous. In an effort to bridge this gap in the literature, this thesis has focused on the effect of certain exhibit parameters on the distribution of visitor attention. As an important facet of spatial arrangement, the significance of layout was also addressed by considering ordinal position of exhibit objects in conjunction with these attributes. Exhibit parameters and ordinal position were investigated collectively in order to reveal the relationship between varying exhibit attributes throughout an exhibition and the way visitors allocate their attention to each exhibit object.

This study has also focused on digital exhibition environments besides physical ones while investigating the effect of ordinal position and attributes of exhibit objects on attention distribution. Although digital medium is relatively new as a host for exhibitions, there are already a variety of exhibitions available online. For example, Google Art Project provides unlimited access to numerous art pieces from museums all around the world, and presents a tool to create custom galleries out of these pieces (Figure 1). Also, many museums, such as the Louvre, MoMA, British Museum, Tate Modern, and the Hermitage Museum offer online access to exhibits or digital tours in their venues. Moreover, paintings, sculptures, and other artwork in several museums (e.g., Guggenheim Museum,

Musée d'Orsay, Getty Center, Rijksmuseum) can be examined through the mobile applications of the institutions. It is also possible to visit many touristic sites in Turkey such as Hagia Sophia, Cappadocia – Göreme Open-Air Museum, or the Museum of Anatolian Civilizations online. Besides, there are some museums that only exist in the digital medium without a physical counterpart, and Virtual Museum of Art El Pais is a famous example. Therefore, this increasing prevalence and popularity of digital exhibitions stimulate the necessity of further research, and this thesis has attempted to respond to this necessity.

In brief, whether in a physical or digital exhibition environment, to have control over visitor attention is essential to a good process of communication between visitors and exhibit objects. Since "capturing visitor attention is the first step in the process of communicating the educational message" (Bitgood, 2002, p. 468), this study aims to assist exhibition designers in maintaining the consistency between the intended distribution of visitor attention and the way visitors distribute their attention in practice. Nevertheless, an exhibition is "an event at which objects (such as works of art) are put out in a public space for people to look at" (*Exhibition*, n.d.). Departing from this definition, this thesis intended to guide the professionals in the field toward an optimum arrangement of exhibits, so every exhibited object will be looked at. Thus, the results of this study are expected to expand and reinforce the existing knowledge to be used when designing physical and digital exhibitions, and pave the path for further studies in the field.

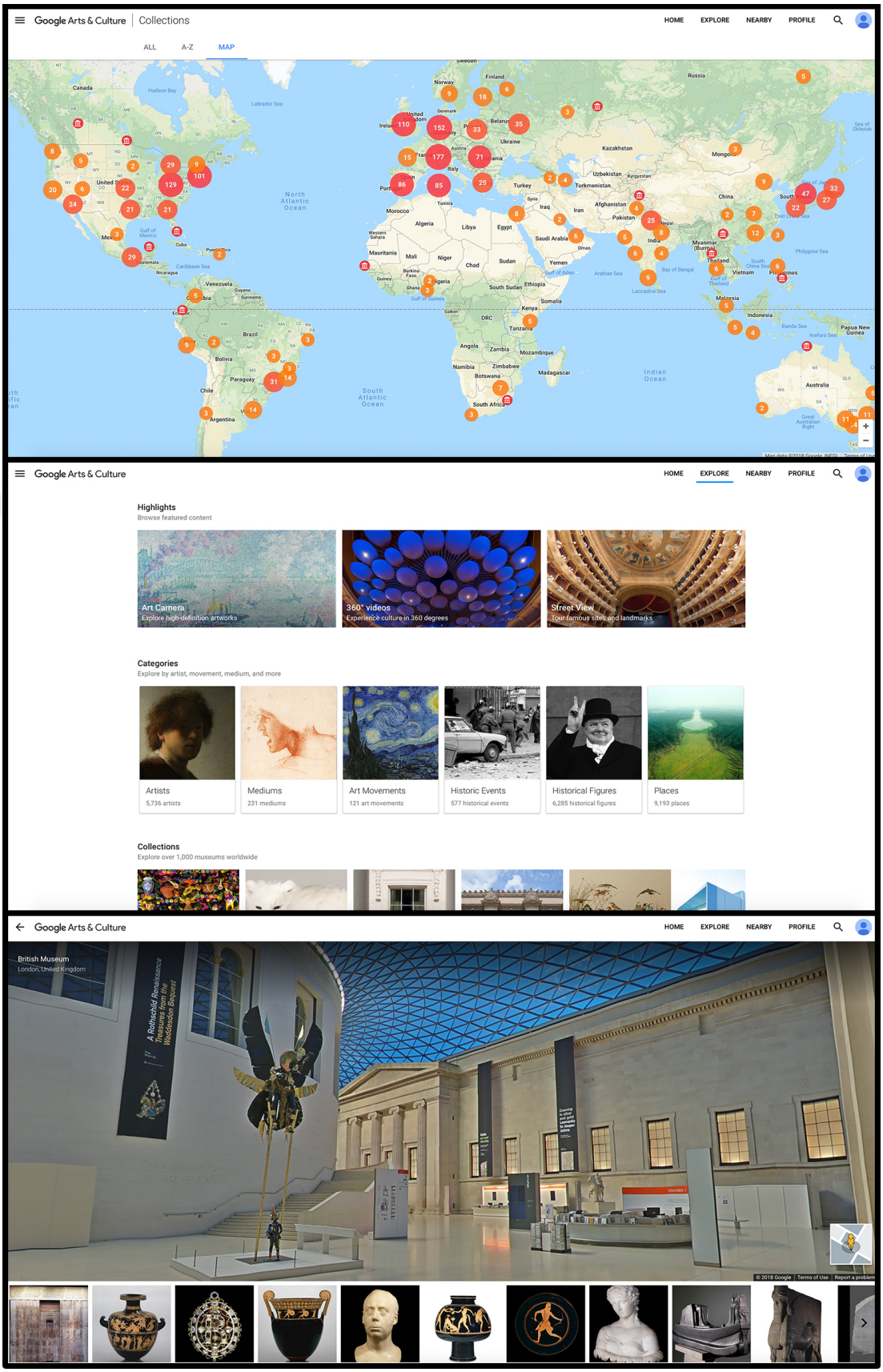


Figure 1: Screenshots from the Google Art Project's website, accessed from https://artsandculture.google.com

1.1. Aim of the Study

Based on the aforementioned necessity of controlling attention distribution in exhibitions, the primary aim of this study is to reveal the way salience layouts of exhibit objects influence the amount of visitor attention attracted and held by each object on display. The results are expected to help the professionals in the field in managing object salience levels in exhibitions for providing satisfactory visitor experiences. Moreover, the relationship between the salience layouts of exhibit objects and visitor attention were explored in the digital medium as well, since digital exhibitions are already indispensible counterparts of physical ones, and further research is needed for enhanced digital experiences.

1.2. Structure of the Thesis

This thesis consists of seven chapters. Following the introduction in Chapter 1, the second chapter elaborates on the components of exhibitions in relation with visitor behavior and attention. Building upon a definition of *exhibition*, the parameters influencing visitor behavior and attention are examined in three categories: visitor attributes, spatial attributes, and exhibit attributes. Although exhibit attributes come forward as one of the main independent variables in this study, visitor attributes and spatial attributes are also discussed, since these three groups of interdependent parameters always act in a collective and simultaneous manner.

The third chapter presents a definition of digital exhibitions, and seeks a suitable way to refer to exhibitions held in a digital environment in light of the

current opportunities in the digital age. Next, advantages and disadvantages of digital exhibitions are discussed. Finally, *perceived presence* is introduced as an important concept regarding user experiences in digital environments.

In the fourth chapter, research design and methodology is explained, addressing the aim of the study, the research questions, and the hypotheses. The indicators of visitor attention to be used for measuring visitor attention are also explained in this chapter. Following the description of the venue and the participants of the study, design and structure of the experiments in physical and digital environments are elaborated. Next the exhibit objects employed in the study are described, which were produced specifically for the experiments. The chapter is concluded with the presentation of the technical issues considered in the design of digital exhibitions, data collection methods, and pilot studies in the physical and digital environments.

The findings of the empirical research are presented in the fifth, Results chapter. Demographic data, analysis of the timing data, behavioral indicators, interest levels and a preliminary discussion for each of the three experiments, namely Experiments P1, D1, and D2, are expounded together in this chapter. The chapter ends with the comparative review of the findings from the three experiments.

The seventh chapter presents an overall discussion of the findings gathered from the three experiments in relation with the literature review, which is

followed by the eighth chapter that briefly identifies the main conclusions, indicates the limitations of the study, lists the implications of the findings, and proposes suggestions for future research.

CHAPTER 2

EXHIBITION PARAMETERS AND VISITOR ATTENTION

Parameters that may influence visitor behavior and attention in exhibitions were categorized as “the characteristics of the exhibit object”, “the characteristics of exhibit architecture” and “the characteristics of the visitors” (Bitgood & Patterson, 1987, p. 4). This categorization complies with the previously mentioned definition of exhibitions, that is, “an event at which objects (such as works of art) are put out in a public space for people to look at” (Exhibition, n.d.). Therefore, it can be suggested that exhibitions involve three main actors, which are the exhibit objects, the exhibition space, and the audience. The resulting schemes of visitor behavior and attention are determined by the collaborative interplay of these three actors. Accordingly, parameters influencing visitor attention will be discussed under three categories in this section, which are visitor attributes, spatial attributes, and exhibit attributes.

2.1. Visitor Attributes

Visitor attributes can be examined in two groups. One group consists of general principles of visitor behavior and attention, whereas the other group includes certain parameters that influence the behavioral tendencies and attention allocation patterns of specific visitor categories (e.g., age, gender, nationality, educational background, experience preferences).

General principles regarding visitor behavior and attention include right-turn bias (Melton, 1935; Shettel, 1976), warming-up effect (Robinson, 1928), inertia (Bitgood, 1996), museum fatigue (Bitgood & Patterson, 1987; Gilman, 1916; Melton, 1935; Robinson, 1928), and the general value principle (Bitgood, 2006). Right turn bias is the tendency of visitors to turn right upon entering a symmetrical exhibition space, in which exhibit objects are equally distributed among the walls on the left and right (Melton, 1935; Shettel, 1976). As an instance indicating the influence of the right-turn bias, Melton (1935) has observed that placing the artworks on the wall to the right-hand side of the entrance increased their chance of attracting visitors' attention. Warming-up effect was introduced by Robinson (1928) to describe the increase in the amount of attention that visitors allocate to the exhibits during the initial stages of their visits. Moreover, Bitgood (1996) proposed the concept of inertia as the tendency of visitors to keep walking in a straight path, in the absence of other factors that would have pulled or pushed them away (e.g., a salient exhibit object, or an obstacle). Museum fatigue concept was first described by Gilman (1916), putting emphasis on its relationship with the required effort for viewing

the exhibits. In general, the concept refers to a gradual decrease in the amount of attention that visitors allocate to exhibit objects throughout their visits due to prolonged physical or mental effort (Bitgood, 2009a, 2009b, 2009c; Bitgood & Patterson, 1987; Melton, 1935; Robinson, 1928). Last, the general value principle is associated with the comparative valuation process of the visiting experience. Regarding the general value principle, Bitgood (2006) has explained that, since visitors have limited attention to devote to exhibits, they instinctively make decisions about how they will distribute it by intuitively weighing the experience's costs (e.g., time, energy, money) against its benefits (e.g., enjoyment, knowledge). Throughout this process, certain exhibits receive more attention than others due to personal preferences, the way objects are exhibited, or intrinsic properties of the exhibits that make them less or more salient. Thus, the value ratio of the experience is identified as the ratio of benefit divided by cost (Bitgood, 2010). As a result, certain exhibits receive more attention than others due to certain parameters determining the cost and benefit of the experience.

In addition to above, visitors' ways of perceiving an exhibition as a whole and its individual parts can be explained with references to Gestalt principles (e.g., the principles of *figure-ground, similarity, focal points, continuity, closure, symmetry,* and *proximity*). Depending on the organization of the elements forming the exhibition in relation with each other (including those extrinsic to the exhibit objects, such as lighting elements, partitions, plinths, backdrops, etc.), these principles might generate distinct perceptions, and perception of the same

elements may differ under other circumstances. For example, according to the Gestalt *principle of similarity*, when several objects have common characteristics (in terms of their shape, size, color, material, direction, etc.) they are likely to be perceived as a group by the visitors (Arnheim, 1974; Sternberg & Sternberg, 2012). Correspondingly, the *focal points principle* asserts that, when certain objects are different from the majority of others in terms of such characteristics as the above-mentioned ones, they tend to stand out (Lauer & Pentak, 2008). Also, visitors might perceive objects that are close to each other as a group, according to the *principle of proximity* (Arnheim, 1974; Sternberg & Sternberg, 2012). These principles should be considered while organizing multiple exhibit objects in a single space, since such groupings could alter visitors' perception of both the whole exhibition and individual exhibit objects, and consequently, they might influence the behavioral patterns and attention distribution schemes.

The second group of visitor attributes enables the categorization of visitors in terms of their experience preferences, demographic attributes, or whether they are visiting alone or with others. In each instance, specific behavioral tendencies of visitors belonging to a category are consistent with the others in the same category, but may differ from the behavioral tendencies of the visitors belonging to other categories. To start with, behavioral tendencies can be partially predicted based on visitors' experience preferences, and these preferences can be categorized as *ideas*, *people, objects*, and *physical,* according to the IPOP model (Pekarik, Schreiber, Hanemann, Richmond, & Mogel, 2014). In this model, the visitors are grouped according to their interest levels toward each category.

Another categorization was done by distinguishing the diligent visitors that stop at 51% of exhibits among all the visitors (Serrell, 1997b). The rest of the visitors are called drifters, who move through the exhibition in a random and unsystematic manner (Rounds, 2004). This distinction is important since these two types of visitors might display two different behavioral patterns in the same exhibition, which may result in distinct attention distribution schemes.

There are also similar categorizations of visitors that are proposed for digital exhibitions. Sookhanaphibarn and Thawonmas (2009) determined three types of audience in terms of their activities inside digital museums. Specifically, 90% of the whole audience is the visiting audience who "just stops and looks around the exhibitions"; 9% is the interacting audience who occasionally contributes to the exhibitions; and 1% is the participating audience who contributes a lot (Sookhanaphibarn & Thawonmas, 2009, p. 1131). Another categorization was made according to the movement patterns observed in digital exhibitions, such that the frequency of *crawling* was determined as 46%, which is associated with a comprehensive and long visit; the frequency of *leaping* was determined as 44%, which was associated with a certain level of selectiveness; and the frequency of *swimming* was determined as 10%, which was associated with a quick visit without approaching individual exhibits (Sookhanaphibarn & Thawonmas, 2009).

In terms of demographic characteristics, a study by Imamoğlu and Yılmazsoy (2009) has demonstrated that preferences for types of exhibits are different for

women and men, and for local and foreign visitors. Moreover, in their study addressing curiosity as a motivation for exploring exhibits, Koran, Morrison, Lehman, Koran, and Gandara (1984) found that women and female children interact with hands-on exhibits more than men and male children do. Furthermore, Pekarik and Schreiber (2012) have discovered that the expectations of elderly visitors are different from others, such that they are particularly more interested in informative, rare, in person, and real experiences than other visitors. On the other hand, children tend not to read the written materials in exhibitions (Donald, 1991), whereas they explore hands-on exhibits at a higher rate compared to adults (Koran et al., 1984).

In addition, previous research has shown that the behavioral outcomes of visits with companions are different than visits made alone (Heath, Luff, vom Lehn, Hindmarsh, & Cleverly, 2002; vom Lehn, 2010; vom Lehn, Heath, & Hindmarsh, 2001; McManus, 1994; Packer & Ballantyne, 2005; Serrell, 2002). More specifically, presence of a companion and interactions between visitors can encourage response to the exhibits (Heath et al., 2002; vom Lehn, 2010). In other words, through the interactions among the group, the individual visitors gain access to a higher level of communication with the exhibits. Even in the case of an individual visit, presence of others in the exhibition space can affect the interaction and participation rates of the visitors (vom Lehn et al., 2001). Despite the positive aspects of group visits, it should also be noted that in a group of visitors, the presence of children has a hindering effect on the adults' performance of reading the texts in the exhibition (Ross & Gillespie, 2008).

2.2. Spatial Attributes

The second group of parameters involves spatial attributes, having a strong influence on visitor behavior and attention. Any parameter concerning the exhibit environment, such as the architectural features of the building, locations of exits and entrances, temperature, soundscape, or lighting can influence visitor attention, circulation efficiency, and amount of invested time (Bitgood, 2010). First of all, the optimum environmental conditions should be maintained, since "collection objects must be controlled as precisely as possible" (Dean, 1994, p. 67). Dean (1994) has listed the environmental factors that should be considered in exhibition environments as temperature, relative humidity, particulate matter and pollutants, biological organisms, reactivity of materials, and light. Moreover, acoustics is another concern for such environments, and architectural elements and interior design features – such as windows, carpets, or acoustic wall and ceiling panels – can be used to adjust the reverberation times and noise levels according to the ideal values (Carvalho, Gonçalves, & Garcia, 2013).

Whereas there are established standards for the above-mentioned environmental factors in exhibition settings, some spatial parameters are subject to discussion. For example, layout of spatial features may imply a viewing sequence, which constitutes one of the most common debates about exhibition environments (e.g., Bitgood, 2010; Devine-Wright & Breakwell, 1996; Falk, 1993; Kaynar, 2005). According to Bitgood (2010), "the most effective design manages attention in a sequential rather than simultaneous searching

process since it will increase the chance that each element captures attention" (p. 6). The results of a study by Devine-Wright and Breakwell (1996) support this argument by showing that visitors spent less time in the gallery when they failed to view the exhibits in the correct order. Spending less time might indicate lack of attention, which was interpreted as a consequence of visitors' inability to understand the information presented in the inverted order (Devine-Wright & Breakwell, 1996). However, according to Kaynar (2005), designs that do not dictate a viewing order enable "individualized paths and therefore individualized encounters with exhibit elements" (p. 192). Correspondingly, Falk (1993) has observed that "unstructured arrangement proved moderately superior to structured arrangement" (p. 145), yet only concluded that visitor behavior was affected by physical context. Additionally, unstructured arrangements are not suitable for directional presentations; therefore, the content and composition of the exhibits should also be considered while choosing between these two types of arrangements (Dean, 1994).

Another spatial factor that might influence visitor behavior and attention is the number and locations of access points to exhibition spaces. It should always be considered that doors that are intended to allow visitors into the exhibition would also function as exits. The importance of this situation is emphasized by Melton (1935), who has discovered that as soon as the visitors inside the gallery noticed an open door, they tended to exit. Moreover, this effect was reduced to a certain extent when the door was closed. Also, Melton (1935) has demonstrated the effect of exit attraction by showing that the amount of attention allocated to

individual exhibit objects decreased as the visitors proceeded toward the exit. In other words, exhibit objects closer to the exit attracted less attention, which was later supported with another study conducted by Bourdeau and Chebat, (2001). However, in conjunction with the concept of inertia, Melton (1935) also explained that, "when the object is located along the route between the entrance and the exit it receives less attention the nearer it is to the exit, but when it is located along the route beyond the exit, i.e., when the visitors must pass the exit before reaching the object, it receives more attention the nearer it is to the exit" (p. 144). That is, if the exit is located along the path leading toward the objects, exhibit objects further away from the exit could attract less attention than those closer to the exit (Figure 2). In such a situation, visitors tend not to spare much energy or time for viewing the exhibits that are located further away from the exit, since "the attraction value of the exit or some other factor such as a conflict with the visitors' directional orientation, object satiation, or fatigue, becomes progressively stronger the farther the visitors move away from an exit after having passed it" (Melton, 1935, p. 145). Therefore location of the access points should be determined carefully in relation to the location of the exhibits. Additionally, exhibition halls having multiple points of access may reduce the circulation efficiency (Bitgood, 2006; Melton, 1935). The circulation patterns of the visitors are influenced by the entrance choice, such that the entrance that visitors use to approach the exhibition space can invert the direction of circulation (Devine-Wright & Breakwell, 1996).

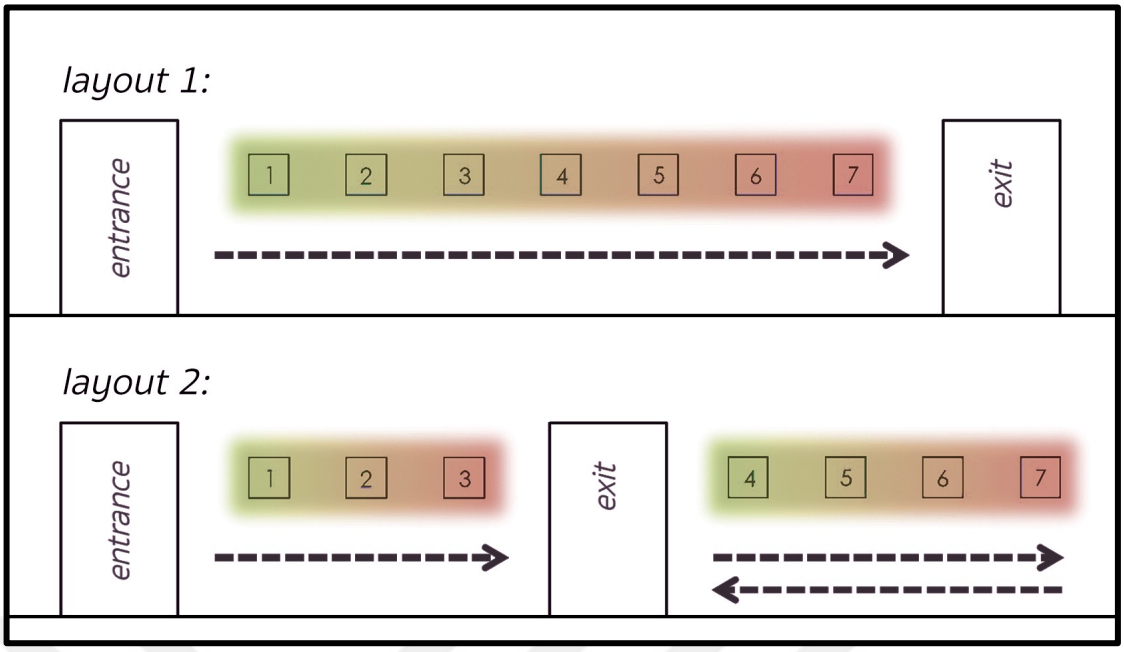


Figure 2: Diagram illustrating the exit attraction effect, which changes according to the position of the exit.

Another active parameter in exhibition settings is visibility, which affects the attention paid to the exhibits by the visitors (Bitgood & Patterson, 1987; Kaynar, 2005). Increased visibility contributes to the process of interpreting the communications of exhibitions, since visual and spatial contact between exhibit objects enable visitors to understand the associations between relevant objects (Tzortzi, 2007; Wineman & Peponis, 2010). Furthermore, being exposed to views from adjacent exhibition spaces encourages visitors to exploration and expands their experience beyond the current space (Kaynar-Rohloff, Psarra, & Wineman, 2009).

Although exhibit objects that are clear of visual obstacles (e.g., walls, other objects) tend to attract a higher amount of visitor attention due to an increased possibility of being noticed, their co-visibility might also induce competition

between them for visitor attention (Bitgood, 1992, 2010; Bitgood, Patterson, & Benefield, 1988, Melton, 1972). For example, Serrell (2002) has argued that open plan schemes hindered attraction of visitor attention although they ensured ultimate visibility. This negative influence can be associated with an intensified competition among the exhibit objects. In this regard, Robinson (1928) conducted an experiment by showing 100 pictures to participants and recording the viewing times. The first group of participants was shown one picture at a time, the second group two pictures at a time, and the third group 10 pictures at a time. As a result, Robinson found that the viewing time per picture decreased as the number of pictures shown at a time increased. Similarly, Melton (1935) found "increases in the number of paintings did not produce proportional increases in the total gallery time" (p. 163).

Exhibit object layout has a strong influence on visitor circulation as well, leading to "hot and cold spots of visitor attention" (Bitgood, 2002, p. 9). Considering the general value principle and inertia, it can be inferred that the amount of attention paid to an exhibit object would decrease as its distance to the visitors' path through the exhibition space increases (Bitgood, 1996, 2002, 2010; Serrell, 2002). Also, the extent of competition among exhibit objects could be influenced by their layout. So, while making decisions about exhibit layout, it should be considered that attractive exhibits might alter the circulation paths of the visitors, such that they might pull visitors away from less attractive ones (Bitgood, Hines, Hamberger, & Ford, 1991). Since increased competition could impede the efficiency of the visiting experience, "exhibits should be placed in

locations that minimize competition with each other" (Bitgood et al., 1988, p. 490). Thus, the amount of attention received by the individual exhibit objects can be increased in the absence of sensory distraction, when they are isolated from visual, auditory, or olfactory stimuli from other exhibits (Bitgood, 1992, 2009b, 2010, 2013). Besides sensory distraction, competition may also occur due to selective choice, which refers to visitors being selective in choosing to view objects that have larger value ratios between benefit and cost (Bitgood, 2009b, 2013). Considering selective choice, Melton (1935) has long ago recommended future research to focus on "the effect of an adjacent exhibit of great or small attractiveness" (p. 151), with an adequate degree of control and isolation of the competition factor. In this regard, Bitgood (1986) found that individual exhibit objects received less attention when exhibits were arranged on both sides of the visitors' path, compared to one-sided situations. In a similar vein, increasing the number of paintings in a gallery resulted in the visitors skipping some of the paintings, but did not change the time spent at individual paintings they viewed (Bitgood, McKerchar, & Dukes, 2013). These examples reveal that an increase in the number of exhibits may result in visitors becoming more selective and skipping some of the options rather than distributing their attention across the exhibits.

Even if it is not possible to isolate exhibit objects to increase the amount of attention they receive, some alternative spatial solutions could be used to put perceptual emphasis on them. One of these solutions could be to choose a favorable location in terms of attracting visitor attention, such as one of the

choice points at which the circulation density is intensified (Bollo & Dal Pozzolo, 2005). Nevertheless, “the more accessible an exhibit element is from all other exhibit elements, the more likely it is to be visited” (Wineman & Peponis, 2010, p. 104). Also, some spatial interventions could be used for this purpose, such as a contrasting background, spotlights, platforms, means to frame target views (Bitgood, 2010), or seats in front of the exhibit object (Bollo & Dal Pozzolo, 2005).

These concerns about spatial attributes not only apply to physical exhibition spaces, but also to digital ones. Although digital exhibitions do not involve some of the listed issues (e.g., temperature, humidity, pollutants, biological organisms), some of the above-mentioned topics also apply to digital exhibitions as well: viewing sequence, number and location of access points, visibility relationships, configuration of circulation paths, exhibit layout, and organization of spatial features can be counted among important considerations for the designers of digital exhibitions. Therefore, research is needed to reveal the impact of spatial factors on visitor behavior and attention in digital environments.

2.3. Exhibit Attributes

The last group focuses on exhibit attributes as the last category of parameters influencing visitor behavior and attention in exhibitions. These parameters can be related with either the messages that the objects intend to convey, or their physical properties. According to Falk (1993), “the nature of specific objects,

rather than the nature of intended messages, may be the primary influence on visitor behavior" (p. 134). Upon Falk's argument, and also considering the potential subjective nature of messages conveyed by the exhibits, the physical properties of exhibit objects will be addressed in the context of this study.

To start with, according to previous research, being exposed to repetitive and similar exhibit objects might result in a gradual downtrend in visitor attention, due to object satiation (Bitgood, 2002, 2009a, 2009b, 2009c, 2013; Melton, 1935). For example, in an art museum, Melton (1935) found that the percentage of paintings viewed by the visitors and average time spent at each painting decreased as the number of paintings increased; and that the amount of attention allocated to individual exhibit objects decreased as the visitors proceeded toward the end. To avoid such decrements in visitor attention, Bitgood (2002) recommends "heterogeneous exhibits rather than monotonous displays with similar objects all in a row" (p. 472). However, as discussed previously, distinct properties of exhibit objects may start to compete for visitor attention in a heterogeneous organization. In such a case, visitors prefer to skip less salient objects and allocate their limited attention reserves to more salient objects, due to selective choice (Bitgood, 2002, 2009b). This possibility should be carefully taken into account, since "the goal of the exhibit may not be achieved if the secondary objects overpower the primary objects in some other way" (Bitgood, 1992, p. 9).

As elaborated above, the relational properties of objects exhibited in the same space cause some of the objects being perceived as more salient by visitors, in line with the previously explained visual Gestalt principles of grouping (Arnheim, 1974; Lauer & Pentak, 2008; Sternberg & Sternberg, 2012). Bitgood (1992) has specified size, color, motion, dimension, shape, sense modality, texture, and material as the salience parameters regarding exhibit objects that might influence visitor attention. Research has shown that object salience in exhibitions depends on several object parameters: [1] size (Bitgood, 2014; Bitgood et al., 1986; Bitgood & Patterson, 1987; Bitgood, Patterson, & Benefield, 1988; Donald, 1991; Marcellini & Jenssen, 1988), [2] three-dimensionality (Peart, 1984), [3] sense-modality (Bitgood & Patterson, 1987; Donald, 1991; Peart, 1984), and [4] motion (Bitgood et al., 1986; Bitgood et al., 1988; Melton, 1972, Washburne & Wagar, 1972). Specifically, larger, three-dimensional, multi-sensory, and dynamic objects tend to attract and hold visitor attention more successfully (Bitgood, 1992). In addition, Koran et al. (1984) have found that exhibits that can be manipulated by visitors attract more attention due to increased curiosity. Moreover, Chiozzi and Andreotti (2001) have shown that exhibits that required reading labels aroused less response from the visitors than self-explanatory exhibits did.

Interactions of these parameters are also important. For example, in the machine-tool section of a museum, Melton (1972) found that a massive gear-shaper exhibit attracted more visitors than the panels of moving mechanisms only when it was in motion, despite its larger size. Even though it received very

little attention while motionless, it became the focus of attention when operated, such that it hindered the attention paid to the panels of moving mechanisms in the center of the gallery, which were previously in the focus of attention.

Novelty might also increase an exhibit object's perceived salience independently from the parameters listed above, due to the relative nature of the concept (Screven, 1986). In fact, even familiar objects might be perceived as novel if they appear out of context (Screven, 1986). Namely, an exhibit object might be perceived as more salient than a larger object, only because it is unique or unexpected.

Among the object parameters that can influence visitor attention, size was selected as the primary salience parameter in the context of this study for three main reasons:

1. Robinson (1928) listed size as the most effective extrinsic factor influencing the way an exhibit would attract and hold attention.
2. Among the parameters listed above, size is the most basic one, which is applicable to any exhibition.
3. Size is a relative parameter, such that the same exhibit object can be the larger or smaller one in an exhibition, depending on the sizes of other objects in the same space.

In order to find out if there was a difference between the salience parameters in terms of their influence on the distribution of visitor attention in an exhibition, three-dimensionality was selected as the second salience parameter to be investigated in the digital medium. It was preferred over sense-modality and motion for the sake of having a high level of control, since it was considered as more analogous with size, both pertaining to dimensions of the objects. The other two salience parameters were eliminated, which were sense-modality and motion. In order to study sense-modality, the digital exhibit objects should appeal to at least one more sense besides sight, and the only sense that would be available in the digital medium was sound or touch. As a result, sense-modality was eliminated because [1] sound or touch in the digital exhibition would require the use of devices such as headphones or electronic gloves, which might interfere with the *perceived presence* levels of the participants (see section 3.3), and [3] in the digital medium, participants could have difficulties in distinguishing the object emitting the sound among all objects (multi-sensory, and therefore, the salient object in the set), or they could perceive it as an ambient sound of the whole exhibition. Motion was eliminated, because, in the tablet computer used for viewing the digital exhibitions, there occurred lags and glitches while viewing the objects featuring motion, which interfered with the viewing experience and attention. As a result, size and three-dimensionality were selected as two exhibit object salience parameters to be investigated in this study.

Based on the literature review presented above, spatial and exhibit attributes were addressed by investigating the effects of ordinal position (as a facet of spatial layout) and two salience parameters (size and three-dimensionality) on visitor attention. Visitor attributes were not completely excluded, but utilized in the research design and during the interpretation of the results. Therefore, rather than "person-centered" or "setting-centered" perspectives, this study adopts an "interaction-centered perspective" (Bitgood, 2006, p. 2), hence the awareness of inseparability of the parameters that are extrinsic (spatial and exhibit attributes) and intrinsic (visitor attributes) to the visitors. Herein, the concept of *setting* is broadened to include digital environments as well as physical ones, considering that the irrepressible influx of technology into people's daily lives has already given rise to digital correspondents of most of the museums. Thus, it is targeted that the influences of exhibition parameters – which were widely revealed for physical exhibitions – will also be explored in digital exhibition environments, in order to begin filling this rapidly expanding gap in visitor studies.

CHAPTER 3

DIGITAL EXHIBITIONS

As the World Wide Web has rapidly become indispensible for both professional and personal needs, it is an expected circumstance that museums and galleries are giving birth to their digital counterparts online. There are already a vast number of digital museums, which are extremely diverse in terms of their ways of representing space and interacting with their audiences. Under the circumstances, museums and cultural institutions are left with no choice, but to evolve in this direction (Negrini, Paolini, & Rubegni, 2012).

Consequently, the prevalence of digital exhibitions increases the need for further research addressing the confluence of the present findings of visitor studies and the relatively new concept of digital exhibitions. In an attempt to respond to this need, this thesis investigated the influence of exhibit objects' salience levels on visitor attention in digital exhibitions as well as in physical ones, aiming to identify the differences between the two media.

3.1. Virtual, Cyber or Digital

Andrews and Schweibenz (1998, p. 24) present a detailed definition of virtual museums:

> [T]he virtual museum is a logically related collection of elements composed in a variety of media, and, because of its capacity to provide connectedness and the various points of access available, lends itself to transcending traditional methods of communicating with the user; it has no real place or space, and dissemination of its contents are theoretically unbounded.

This early definition has been widely used in the field, and was also adopted by The International Council of Museums (ICOM). However in a reference document among ICOM resources that describes the key concepts concerning museology, it is argued that the proper term should be *digital* or *cyber* museum, since the opposite of physical is not *virtual* (Desvallées & Mairesse, 2010). Hence, the word *digital* will be used instead of *virtual* to describe such environments in the context of this study.

Numerous digital museums can already be accessed from all around the world, which vary in terms of the presence or absence of a three-dimensional space representation, or whether the organization of the spaces and exhibits are consistent with the physical version or not (Paolini et al., 2000). For example, rather than merely displaying an online catalogue of their collection, Louvre Museum provides the opportunity of digitally experiencing the artifacts in their contexts, with a three-dimensional representation of each space within the building.

Digital exhibitions can also be distinguished in terms of the technologies employed in their designs. Virtual reality (VR), augmented reality (AR), mixed reality (MR), and haptics can be listed among the methods and tools utilized in the production of digital exhibitions (Styliani, Fotis, Kostas, & Petros, 2009). VR involves a 3D-representation of a physical or imaginary setting. While both the figure and the ground are artificial in VR environments, the actual (physical) surrounding of the person constitutes the ground in AR, and virtual elements are seen as figures. However, the figures do not interact with the ground in AR (i.e., the virtual objects do not move when the view of the physical environment is rotated). MR takes the experience one step further by providing the consistency between the experiences of the figure on that of the physical ground. Namely, the virtual object becomes a part of the physical surrounding in MR. Moreover, haptic technologies involve the sense of touch, by the use of stimuli such as vibrations, forces, or motions. An example for applications using haptics is the *touchable holography* installation, in which the users see virtual raindrops falling down on a holographic display, and when they put their hands in the display, ultrasound is radiated from above to imitate the feeling of raindrops hitting the users' palms (Hoshi, Takahashi, Nakatsuma, & Shinoda, 2009). These technologies can be used via several types of devices, such as head-mounted displays, smart phones, tablet computers, and specially designed devices offered by the museums and exhibition venues.

In fact, there are various projects that utilize these technological opportunities, such as the Monet Experience exhibition currently taking place Italy, in which

head-mounted displays can be used to explore Monet paintings in VR. There are examples of large-scale exhibits as well, such as the Virtual Asukakyo Project that involved the reconstruction of the city of Asukakyo, being the oldest city of Japan (Kakuta, Oishi, & Ikeuchi, 2008). Through the proposed MR application, buildings that have been destroyed long ago could be virtually reconstructed, and observed in situ. Although there were already similar examples, Virtual Asukakyo Project increased the consistency between the digital and physical environments by introducing shades and shadows to the 3D models. A similar project was called *Circa 1948* by National Film Board of Canada and artist Stan Douglas, which was an interactive art installation demonstrating the mid-century postwar Vancouver (McKim, 2017; Rothman, 2014). The viewers were not obliged to follow a specific route, but could navigate through the digital environment as they wished to, which enabled personalized interactive experiences. As the viewers wandered around the digitally reconstructed Vancouver, they could listen to the dialogues between the digital residents of the city, which worked as an interactive storytelling.

All of the above-mentioned innovations reveal the incredible progress made since André Malraux's idea of *Le Musée Imaginaire* – a museum without walls, which could eliminate the contextual influence of the museum institutions on the exhibited objects. Indeed, the immense possibilities brought about by new technologies, seem to point at limitless and accessible museums. It is expected that, by means of digital media, invisible boundaries between the exhibits and the audience will be further diminished in the immediate future.

3.2. Advantages and Disadvantages of Digital Exhibitions

Digital exhibitions are favorable considering numerous advantages they offer. First, museums frequently face problems of a collection that is too extensive to be exhibited as a whole, consists of extremely fragile and delicate artifacts, or includes items that require very expensive display systems (Walczak, Cellary, & White, 2006). These problems do not apply for an exhibition in the digital medium, since it would be possible to arrange an entire collection of a museum regardless of its size, without any risk of damage to the exhibited items. Also, the practicality of the digital media enables museums to organize their archives in a more systematic and accessible manner (Erbay, 2011).

Digital exhibitions offer several advantages to visitors as well, besides their advantages for the museum institutions. They provide considerably easier and instant access compared to physical exhibitions due to the eliminated effort, time and expenses of travelling, in addition to the ability or ease of access for specific visitor groups such as disabled and elderly people. Also, they are accessible at all times, whereas physical exhibitions are usually closed to public at night and on certain days. These benefits might also increase the likelihood of repeat visits.

In terms of visitor engagement, digital exhibitions may allow new ways of interacting with exhibits which would not always be possible in a physical environment (Carreras & Mancini, 2014; Desvallées & Mairesse, 2010; Lester, 2006). As Simona Panseri has indicated in an interview by Gasperi (2012),

“physical spaces - like museums - can change their exhibitions from time to time to propose different perspectives to visitors, but they can provide only one perspective at a time” (p. 55).

Above all, it might be possible to promote and bring the visitors in the actual exhibition - if there is one - by the use of a digital exhibition (Carmo & Cláudio, 2013). In a study by Loomis, Elias, and Wells (2003), 70% of participants indicated that visiting the website of a museum would induce visiting the museum. Also, a survey conducted by Statistics Canada showed that visits to a museum’s digital exhibitions increased the probability of visits to the physical ones (2004 Survey, 2005). Despite the emphasized cooperation between digital and physical exhibitions, they are both autonomous and the audience they appeal is probably different (Carreras & Mancini, 2014). However, this level of remoteness might as well be a favorable feature, since digital exhibitions might attract people who would never visit the physical version. Nevertheless, digital exhibitions have a growing potential to impact the way museums manage their collections and visitors (Desvallées & Mairesse, 2010).

On the other hand, there are currently some technical drawbacks of digital exhibitions, some of which will most probably be eliminated in the immediate future. First of all, most of the digital exhibitions do not allow social interactions between different visitors, but allow for individual visits only. This is because such exhibitions require less sophisticated software, and hence, they are more efficient and favorable for institutions. Considering that interactions between

visitors contribute to the response rates to the exhibits (Heath et al., 2002; vom Lehn, 2010), Paolini et al. (2000) proposed a model that would overcome the anti-social character of digital exhibitions. This model makes it possible to share the experience with other visitors through a chat tool, which was claimed to increase the engagement of visitors (Paolini et al., 2000). Thus, the social property of visits to physical museums can be translated to digital environments.

In addition, there is a reduced tangibility in digital exhibitions, regarding the way environment and exhibit objects are experienced, even if they are modeled in a highly realistic way, or viewed through advanced VR devices. In other words, the encounter with the exhibit is more intense in a physical exhibition, hence the authenticity and uniqueness of the object (Lester, 2006), and its *aura* originating from its *non-reproduced* and singular existence in its physical context (Benjamin, 2002). Besides, the artifacts may look different in the digital medium for several reasons, such as unsophisticated modeling techniques, poor lighting conditions, or low quality hardware devices. Moreover, the software might work in different performance levels on different devices, which might occasionally result in an unsatisfactory experience of the exhibition. Furthermore, movements in a digital space are usually unnatural, which may lead to distorted perspectives and experiences. In order to avoid such problems, it is necessary "to consider the experience from the point of view of the virtual visitor" (Bowen, Bennett, & Johnson, 1998, Some Advice section, para. 1), and to provide "an intuitive human-computer interface based on well-known

metaphors" in digital exhibitions (Wojciechowski, Walczak, White, & Cellary, 2004, p. 135). Technological innovations can provide realistic perceptions through advanced devices and interfaces, which might facilitate improved and satisfying digital experiences. However, it should also be considered that the experience of the exhibits might be overshadowed by the experience of those novel devices or interfaces due to their unfamiliarity and extraordinariness.

3.3. Perceived Presence

If the digital exhibition is planned as a three-dimensional representation of the physical museum, it should provide a strong sense of being in the cyber space represented; that is *perceived presence* (Sylaiou, Mania, Karoulis, & White, 2010). More specifically, when more attention is allocated to the mediated environment than to the environment in which an individual is physically located, the sense of being in the digital environment is strengthened, leading to a strong perceived presence (Kim & Biocca, 1997). This phenomenon of perceived presence in a virtual environment (VE) was described as follows (Slater, 1999, p. 561):

> […] they report that they'd had an experience of being in a place, just like any other place they had been earlier in the day. This 'experiencing-as-a-place' is very much what I have tried to convey as a meaning of presence in VEs: people are 'there', they respond to what is 'there', and they remember it as a 'place'. If during the VE experience it were possible to ask the question 'where are you?' - an answer describing the virtual place would be a sign of presence. However, this question cannot be asked - without itself raising the contradiction between where they know themselves to be and the virtual place that their real senses are experiencing.

Perceived presence can be determined by variables categorized as *media characteristics* and *user characteristics* (Lessiter, Freeman, Keogh, & Davidoff, 2001). While user characteristics are hardly modifiable, media characteristics can be adjusted according to different circumstances. Multi-sensory stimuli can be employed as a media characteristic in order to strengthen the perception of presence, which would result in a more natural interaction with the environment (Mania & Robinson, 2005). Attention and involvement are user responses associated with perceived presence (Lessiter et al., 2001) and there is a close relation between perceived presence and enjoyment (Sylaiou et al., 2010). So, a high level of attention and involvement are expected to result in a high level of perceived presence, which would consequently produce a satisfactory and enjoyable experience.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

This thesis aimed to investigate the effect of exhibit object salience and ordinal position on the distribution of visitor attention. To explore this effect in both physical and digital environments, an empirical research was designed with experiments involving both of these environment types. This chapter presents the research questions, hypotheses, and the method that was followed to test these hypotheses.

4.1. Research Questions and Hypotheses

Four independent variables were determined as (i) presence of a salient object in a set of relatively less salient objects, (ii) ordinal position of the salient object in the exhibition, (iii) physical or digital quality of an exhibition environment, and (iv) size and three-dimensionality as salience parameters. In order to investigate their impact on the attention attracted by individual exhibit objects, and overall exhibition, eight research questions were formulated as follows:

Q1. Does the introduction of an object that is more salient than the others in the exhibition affect the amount of visitor attention attracted by individual objects on display?

Q2. Does the introduction of an object that is more salient than the others in the exhibition affect the amount of visitor attention attracted by the exhibition as a whole?

Q3. Does the sequential position of the object that is more salient than the others in the exhibition affect the amount of visitor attention attracted by individual objects on display?

Q4. Does the sequential position of the object that is more salient than the others in the exhibition affect the amount of visitor attention attracted by the exhibition as a whole?

Q5. Is there a difference between physical and digital exhibition environments in terms of their effects on the amount of visitor attention attracted by individual objects on display?

Q6. Is there a difference between physical and digital exhibition environments in terms of their effects on the amount of visitor attention attracted by the exhibition as a whole?

Q7. Is there a difference between salience parameters (i.e. size and three-dimensionality) in terms of their effects on the amount of visitor attention attracted by individual objects on display?

Q8. Is there a difference between salience parameters (i.e. size and three-dimensionality) in terms of their effects on the amount of visitor attention attracted by the exhibition as a whole?

The previously presented literature review included findings, which addressed the impact of the independent variables listed above on visitor attention and behavior. For example, regarding exhibit object salience, previous studies have shown that, larger exhibit objects tend to attract and hold more attention compared to smaller objects, and three-dimensional objects tend to attract and hold more attention compared to two-dimensional objects. Furthermore, considering Gestalt *principle of similarity*, objects that share certain properties (such as size or three-dimensionality as in the context of this study) might be perceived as a group (Arnheim, 1974; Sternberg & Sternberg, 2012), and objects that are different from others in terms of such properties might stand out according to the *focal points principle* (Lauer & Pentak, 2008). Also, when multiple exhibit objects with distinct properties are displayed together, they start to compete with each other for visitor attention, and those with less salient properties might be overshadowed (Bitgood, 1992, 2002, 2009b, Screven, 1986). Moreover, according to Bitgood (2002) heterogeneous exhibit organizations might help in keeping visitor attention alive throughout visits.

Ordinal position of exhibit objects were shown to be influencing visitor attention, hence such effects as museum fatigue, object satiation, or exit attraction (e.g., Bitgood & Patterson, 1987; Gilman, 1916; Melton, 1935; Robinson, 1928). However, the relationship between exhibit object salience and ordinal position as a facet of layout was not addressed in previous studies. In this vein, Melton (1935) has long ago recommended future research to focus on

"the effect of an adjacent exhibit of great or small attractiveness" (p. 151), with an adequate degree of control and isolation of the competition factor.

Regarding the physical or digital quality of an exhibition environment, Carreras and Mancini (2010) stated that the audience of digital exhibitions is probably different than that of physical exhibitions. Also, physically being in the same space with the artifacts would result in more authentic experiences than viewing the exhibition in the digital medium (Lester, 2006). Therefore, it can be inferred that attention distribution schemes in physical and digital exhibitions would probably differ from each other.

Previous studies found that there are several salience parameters influencing visitor attention, such as size (Bitgood, 2014; Bitgood & Patterson, 1987; Bitgood, Patterson, & Benefield, 1988; Donald, 1991), three-dimensionality (Peart, 1984), sense-modality (Bitgood & Patterson, 1987; Donald, 1991; Peart, 1984), and motion (Bitgood, Patterson, & Benefield, 1988; Melton, 1972). However, there are no studies that show whether there is a difference between the effects of these parameters on visitor attention. For this reason, further studies comparing the influences of different salience parameters are needed fill this gap in the literature.

Table 1: Eight hypotheses generated in light of the independent variables.

Independent Variables	Individual Objects	Overall Exhibition
i. Introduction of a salient object	H1: Salient ↑ Others ↓	H2: ↑
ii. Ordinal position of the salient object	H3: Adjacent(s) to salient ↓	H4: No effect
iii. Physical vs. digital environment	H5: Physical > Digital	H6: Physical > Digital
iv. Salience parameters	H7: 3D > Size	H8: 3D > Size

In light of the research questions and findings of the previous studies summarized above, the hypotheses of the thesis are generated as follows:

H1. When an object that is more salient than the others is introduced in an exhibition, visitors tend to allocate more attention to the salient object, so the amount of attention allocated to less salient objects decreases.

H2. The introduction of an object that is more salient than the others contributes to the amount of attention paid to the exhibition as a whole.

H3. Salient object has a stronger overshadowing effect on the non-salient objects that are located in an adjacent position compared to others.

H4. The amount of attention paid to the exhibition as a whole does not change with the ordinal position of the salient object.

H5. Introduction of the salient object has a greater impact on the amount of attention attracted by individual exhibit objects in a physical exhibition compared to that in a digital exhibition.

H6. Introduction of the salient object has a greater impact on the amount of attention attracted by the overall exhibition in the physical medium compared to that in a digital medium.

H7. Three-dimensionality is a stronger salience parameter than size, such that it has a larger positive influence on the salient object, and a larger negative influence on the adjacent object(s), in terms of their attention attracting and holding capabilities.

H8. An exhibition featuring a three-dimensional object would attract more attention in overall than an exhibition featuring a larger object, all other things being equal.

4.2. Indicators of Visitor Attention

Since a low level of obtrusiveness is targeted in this study, only behavioral indicators were used rather than highly obtrusive data collection methods that employ physiological monitoring or eye tracking. According to Bitgood (2013), the behavioral indicators that occur as the exhibit object starts to capture attention are "looking at, approaching, and stopping" (p. 18). Secondly, concentrating on a single exhibit object by excluding others indicates that the visitor has moved on to the focusing stage (Bitgood, 2013). Last, the indicators of the engagement stage are "highly focused examination of the exhibit content, reading text passages, discussing the content with group members, and thinking about the implications of the exhibit material" (Bitgood, 2013, p. 18).

Another method utilizes the time spent for viewing each exhibit object in order to determine the amount of visitor attention allocated to them. In the field of visitor studies, many researchers have been employing attention indicators regarding such timing data (e.g., Bitgood & Patterson, 1987; Bollo & Dal Pozzolo, 2005; Jensen, 2006; Klein, 1993; Peart, 1984; Ross & Gillespie, 2008; Yalowitz & Bronnenkant, 2009). These timing-based indicators are *attracting power*, *average holding time*, and *holding power*.

Attracting power (AP) represents the percentage of visitors that stop at a particular exhibit object. According to Serrel (1997a), a stop should be recorded whenever a visitor is observed as "both feet planted on the floor, [their] head or eyes pointing in the direction of the element for two or three seconds" (p. 112).

Secondly, average holding time (AHT) is the average time that visitors spent at a particular exhibit object. Finally, holding power is defined by Peart (1984) as "the ratio of actual viewing time divided by the required minimum viewing time" (p. 222).

"Recognizing that time alone is an empty vessel" (Shettel, 1997, p. 246), and considering the characteristics of the exhibit objects employed in this thesis, stopping at, returning to, having a closer look at, and touching an exhibit object are regarded as behavioral indicators of a high level of attention. Moreover, AP values provide information about the exhibit object's ability to attract attention, whereas AHT values provide information about the exhibit object's ability to hold attention. Since the required viewing time would be equal for all the exhibit objects employed in the experiments in the context of this thesis, holding power was not used during the analysis of the timing data.

In light of the attention-value model by Bitgood (2010, 2013), AP and AHT data are intended to correspond to the *capture* and the *focus* stages, respectively. In addition, the frequencies of several behaviors observed during the visits might indicate a further level of attention, which would correspond to the *engage* stage. The combination of these three groups of data is expected to provide an outlook on attention as an inter-connected continuum (Bitgood, 2010, 2013).

4.3. Venue

The experiments were conducted at The Contemporary Arts Center (Çağdaş Sanatlar Merkezi) that has a central location in Ankara, Turkey. It is a well-known and established venue for experiencing art, and attracts visitors of all types since 1994. Besides temporary art exhibitions, various cultural activities, such as concerts, theater plays, conferences and symposiums taking place in the auditorium attract visitors to the building as well. Most of the events are for free for everyone, so they are available to a broadened audience varying widely in terms of social, cultural and economic conditions.

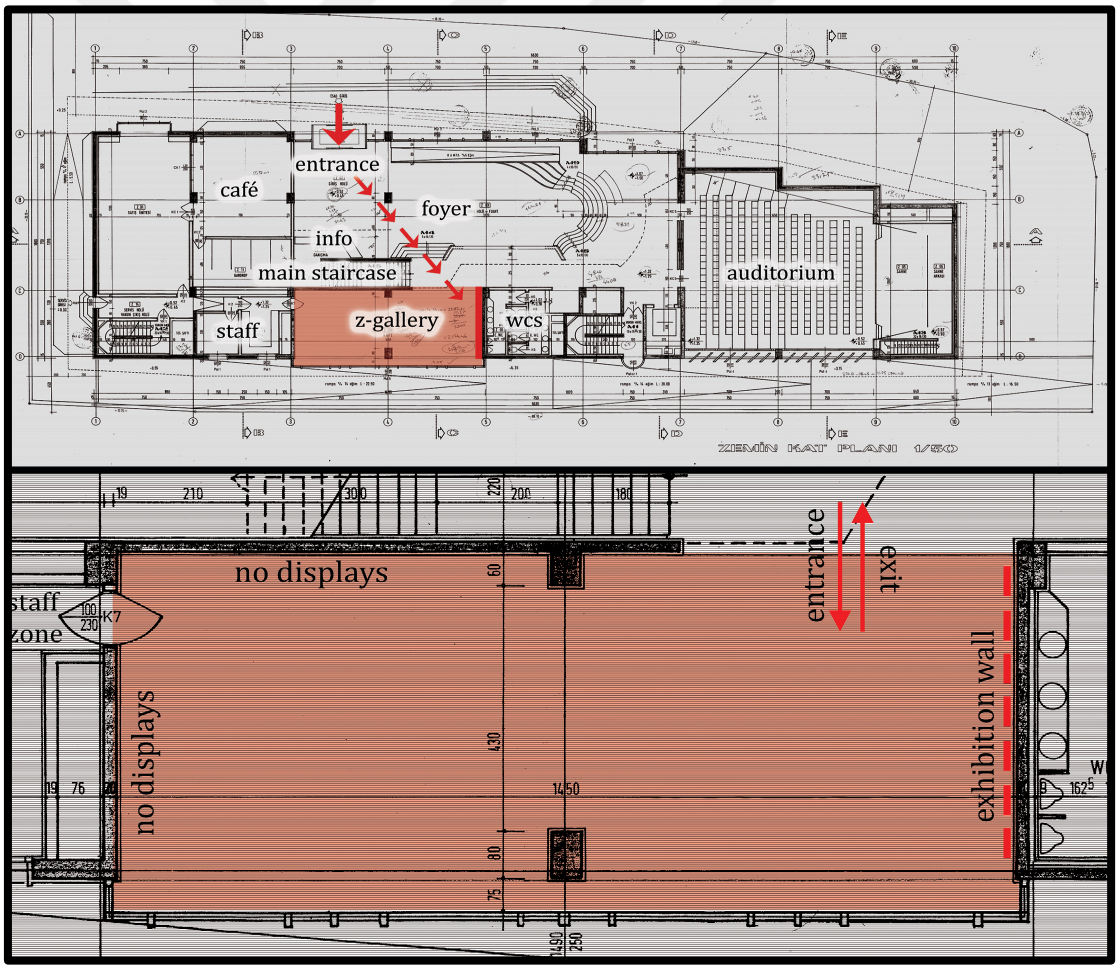


Figure 3: Ground floor plan of The Contemporary Arts Center. The highlighted area is the Z-Gallery, in which the experiments took place.

There is an exhibition hall on each of the four floors of the building, and the smallest one is Z-Gallery (note that this gallery was transformed into an office area by the management after the completion of this study). It is located on the ground level opposite the main entrance (Figure 3). Next to it is the main staircase leading to the larger exhibition halls, and ensuring that the visitors pass by Z-Gallery as they proceed toward the exhibitions on the upper floors. Although Z-Gallery has a frequented location within the building, it provides a highly isolated and confined environment, unlike the other galleries that are organized openly around a large atrium. Such isolation helps in eliminating the external distractions and makes Z-Gallery appropriate for the experiments. In Z-Gallery, the only wall visible from the main entrance was used for displaying the exhibit objects. This stimulated participation by attracting the visitors to the gallery. Also, the gallery has only one access point, which functions as both the entrance and the exit, and the exhibition wall used for the experiments is perpendicular to the main circulation in front of this access point, enabling the exhibition to imply a viewing order and avoid confusions in terms of circulation (Devine-Wright & Breakwell, 1996).

For the digital experiments, the venue was three-dimensionally modeled using AutoCAD software to create digital versions of the exhibitions (Figure 4). To achieve higher perceived presence levels, the entrance area, the atrium and the foyer were also included in the CAD model, since the display wall is visible from these areas upon entering the building. Thus, a similar experience of approaching the exhibition could be created.



Figure 4: Photographs of the venue on the left column, and snapshots from the CAD model on the right column.

4.4. Participants

Since a low level of obtrusiveness was targeted, visitors were not invited in person, but chose to participate - or not - upon noticing the exhibition. Convenience sampling was used to select subjects; therefore every visitor who chose to participate was included in the study until there were thirty participants per experimental condition. Thus, the participants consisted of the frequenters of The Contemporary Arts Center, or other casual visitors who came across the exhibition spontaneously.

As elaborated in Chapter 2, visitor attributes can influence attention distribution and behavioral patterns. Age, gender, educational background, exhibition-visiting frequency, and previous experiences with the space are determined as the visitor attributes that might have a significant influence on the results of this study. Therefore, data concerning these variables were collected, which are presented in Chapter 5.

4.5. Structure of the Empirical Research

This study employed three experiments, labeled as P1, D1 and D2. The letters P and D indicate whether the exhibition took place in a physical or a digital environment. The numbers 1 and 2 respectively indicate size and three-dimensionality as the exhibit object salience parameters investigated in the specific experiment (Figure 5).

Each of these three experiments consisted of one control condition and three experimental conditions - namely S#1, S#4, and S#7, where the letter S stands for *salient* - and each condition consisted of seven exhibit objects that make up an exhibition. In the control condition, all seven objects were equivalent in terms of their salience levels. That is to say, they were all two-dimensional and equal in size. In S#1, S#4, and S#7 of all the experiments, a more salient object replaced one of the equally salient objects. The first (initial), the fourth (mid) and the seventh (last) objects were the more salient ones in S#1, S#4, and S#7 respectively.

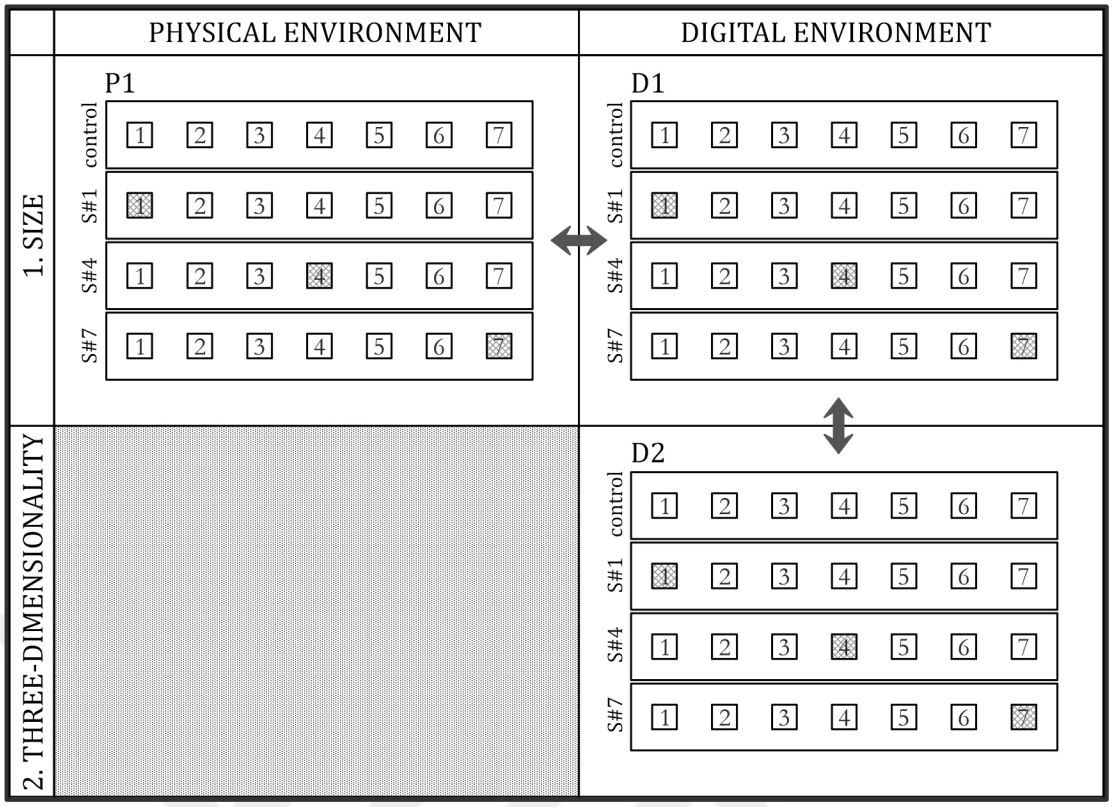


Figure 5: The structure of the experiments and conditions. Hatched squares indicate the salient objects in the conditions.

After the completion of all the experiments, the data collected through the four conditions within the experiments were compared with each other, to find whether the introduction of a more salient object influenced the distribution of visitor attention, and to investigate the effects of ordinal position. Next, the findings of Experiments P1 and D1 were compared in an attempt to reveal the differences between physical and digital exhibition environments in terms of their effects on attention distribution schemes. Also, the findings of Experiments D1 and D2 were compared to find whether there are any differences between the two salience parameters concerning the magnitude of their impact on visitor attention.

4.5.1. Exhibit Objects

As discussed in Chapter 2, visitor behavior and attention can also be affected by the conceptual contents of exhibit objects or personal preferences of visitors, as well as their physical properties like the two exhibit object parameters addressed in this thesis. In order to prevent such external factors from interfering with the actual independent variables, the exhibit objects used in the experiments were designed and produced particularly for this study. For control purposes, all the objects were produced in square shapes, and a black-and-white color scheme was specified, since individual color tastes and preferences may act as confounding variables. Considering that visitors tend to pay more attention to familiar-shaped exhibit objects (Bitgood, 2014), a high level of abstraction was employed to control the content of exhibit objects. In addition, there were no interpretive labels next to the exhibit objects to avoid the interference of extrinsic issues (e.g., competition of exhibits with labels as addressed by Bitgood and Patterson (1993), personal interests and preferences, or the artist's nationality, familiarity, popularity and gender).

For Experiment P1, which addressed size among the four object parameters in the physical environment, seven small and one large exhibit objects were produced. Each exhibit object consisted of six layers of black cardboard cut in irregular shapes, and five layers of square tracing paper inserted between these black cardboard layers. The dimensions of the smaller objects were 35 cm by 35 cm, and the dimensions of the larger object were 50 cm by 50 cm (Figure 6).

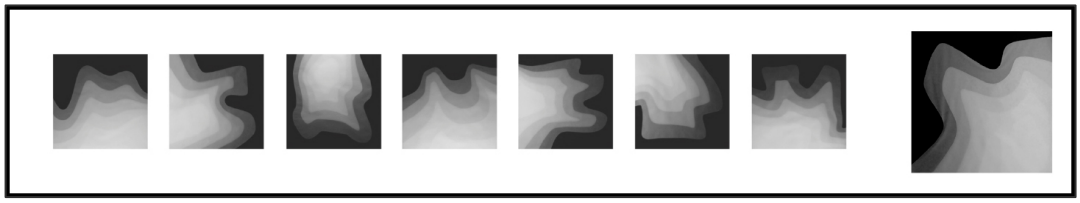


Figure 6: Photographs of the exhibit objects used in Experiment P1.

The same exhibit objects were transferred identically to the digital medium using AutoCAD software (Figure 7). For Experiment D1, the salient objects were achieved by digitally producing the larger versions of the objects. For Experiment D2, which was designed to test three-dimensionality, the same objects were extruded in the z-axis to achieve depth. Thus, two-and-a-half-dimensional (2.5D) exhibit objects were generated (The term *two-and-a-half dimensional* is adopted, based on its use by several artists to describe their own artworks shown in Figure 8, that are similar to those used in Experiment D2). By doing so, all the variables outside the scope of the thesis – such as display layout or surface, viewing direction, form, color scheme, texture, and scale – were kept constant by adapting three-dimensionality as depth, and using 2.5D objects as a substitute to 3D ones.

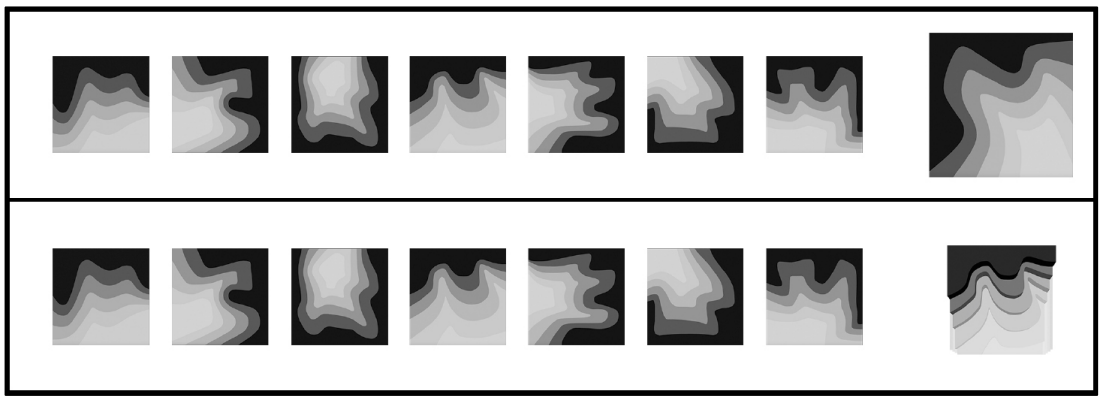


Figure 7: Digitally produced exhibit objects used in Experiments D1 (top row) and D2 (bottom row).

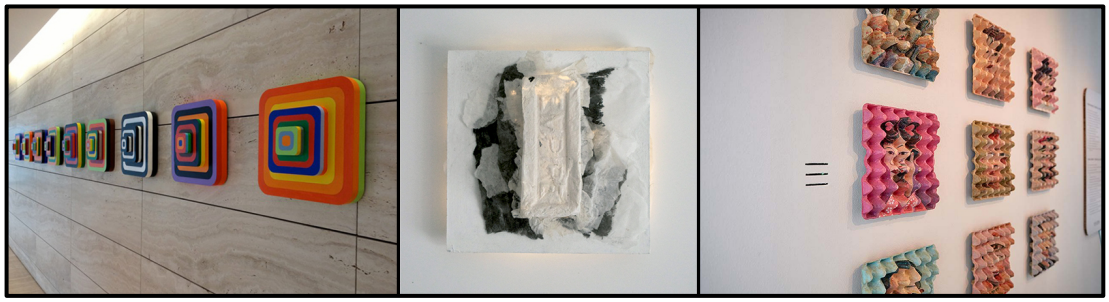


Figure 8: Artworks described as two-and-a-half-dimensional by their artists Mark Croxford (on the left; accessed from: http://markcroxford.com/exhibitions.html), Lin Yan (in the middle; accessed from: https://www.linyan.us/small?lightbox=dataItem-jerzva8x), and Enno de Kroon (on the right; accessed from: http://www.fondazionegeiger.org/images/stories/eggcubism/006.jpg).

4.5.2. Technical Considerations for the Digital Exhibitions

Digital exhibitions were prepared using Microsoft PowerPoint. Arrow buttons were integrated in order to enable the visitors to navigate through the exhibition. Also, there were small icons of all the exhibit objects on the bottom of each scene in the same order as they appeared in the exhibition, and the current exhibit object was highlighted among all seven. This provided a sense of orientation for the visitors. It also enabled visitors to skip certain exhibit objects, which has happened occasionally in the physical exhibition. In addition, by seeing all the objects together, the visitors could compare the current exhibit object with the others. Moreover, the faded images of the exhibit objects adjacent to the object currently being viewed were also included in each frame, imitating the peripheral vision in the physical medium (Figure 9).

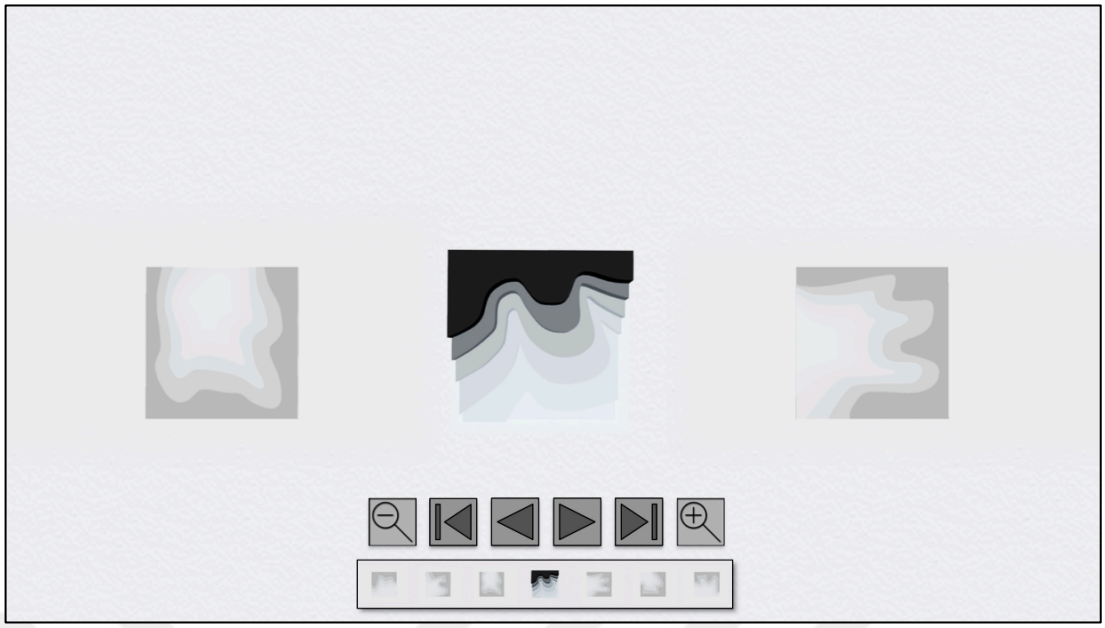


Figure 9: A snapshot from the digital exhibition (S#4 of Experiment D2).

Previous studies have shown that user attributes, such as age and previous experience, should be considered to find the appropriate input device (Rogers & Fisk, 2003; Taveira & Choi, 2009; Wood, Willoughby, Rushing, Bechtel, & Gilbert, 2005). The input device used in the digital experiments was selected by considering that the audience of The Contemporary Arts Center varies widely in terms of attributes such as age, profession, educational background or personal interests. Therefore, a touch-screen tablet computer was used, since it enabled direct user input, and an intuitive input-display relationship (Taveira & Choi, 2009). Last, a tutorial section was provided prior to entering the actual digital exhibition, in order to avoid problems of unfamiliarity or inexperience, which helped the visitors to learn and get used to the ways of navigating through the exhibition.

As already mentioned in section 2.1, previous studies have shown that the behavioral schemes could differ in the presence of a companion (Heath, Luff, vom Lehn, Hindmarsh, & Cleverly, 2002; vom Lehn, 2010; vom Lehn, Heath, & Hindmarsh, 2001; Serrell, 2002), children (Ross & Gillespie, 2008), or other random visitors in the exhibition (vom Lehn et al., 2001). It was also mentioned in section 3.2 that Paolini et al. (2000) have proposed a chat tool for digital exhibitions, which enabled social interactions, encouraging engagement with the exhibit. Since it was observed that only one or two participants visited the exhibitions in the Contemporary Arts Center at the same time, only one tablet computer was provided for the participants, and chat tools were not integrated in the digital exhibitions.

4.5.3. Data Collection

In general, surveys, physiological monitoring, and observation have been used for measuring visitor behavior and response in exhibition settings. Among these, surveys are commonly used for collecting data in the field of visitor studies for both physical and digital exhibitions. Questionnaires or interviews are employed in survey research for gathering information about the audience, measuring visitor attention, determining the rate of learning, or other similar purposes. Regarding digital exhibitions, questionnaires can be used to measure perceived presence as well, which is correlated with visitor attention. Two commonly used perceived presence questionnaires are Witmer and Singer (WS), and Slater, Usoh and Steed (SUS) questionnaires (Usoh, Catena, Arman, & Slater, 2000; Witmer & Singer, 1998). Usoh et al. (2000) tested these two

questionnaires with digital and physical environments and no significant difference was found between the results acquired of a digital and a physical environment through WS and SUS.

Besides the self-report methods described above, there are other data collection methods that can be used in visitor studies, such as physiological monitoring. For example, Tröndle, Greenwood, Kirchberg, and Tschacher (2012) and Tröndle (2014) have used a data glove as a data collection instrument, which can measure the participants' heart rates and skin conductance as indicators of aesthetic evaluation, and determine their location in the exhibition. The disadvantage of such an instrument is that it is highly obtrusive.

Moreover, observational methods can also be used in visitor studies to measure several variables, such as attention or interest. In a study involving observation of the visitors, three ways of interaction were detected as "viewing time", "manipulation of an exhibit", and "commenting and rating exhibit elements" (Bonis, Vosinaki, Andreou, & Panayiotopoulos, 2013, p. 195). *Viewing time* was assumed to be directly proportional with the visitors' interest levels. *Manipulation of an exhibit* involved visitor intervention to the exhibit objects, and provided the opportunity for the visitors to make adjustments according to their preferences. Therefore, it indicated a higher level of interaction with the visitor, than *viewing time*. Moreover, *commenting and rating exhibits* was the most influential way of interaction, since it revealed the visitors' attitude towards the exhibit object in the most direct way (Bonis et al., 2013).

Building upon these data collection methods used in the previous studies, this thesis employed questionnaires and unobtrusive observation for collecting data in each of the three experiments. Upon viewing the exhibition, participants voluntarily completed a questionnaire that consisted of two sections. The first section included personal questions about their age, occupation, gender, educational status, exhibition-visiting frequencies, and previous experience with the venue. In the second section of the questionnaire, the respondents were asked to rate the exhibit objects individually, and the exhibition as a whole, using a seven-point scale in terms of their interest levels. Interest levels were involved instead of attention or durations of looking at the objects because first, attention and interest were considered to be closely related, based on a very early investigation by Burnham (1908), who concluded "whenever we turn attention to a subject, we have a feeling called interest" (p. 15); and second, the participants might have considered the word attention awkward in this context and also find it easier to respond to a question referring to interest rather than duration. Their verbal comments were also collected by the use of an optional and open-ended section. Additionally, we provided a section for respondents to leave their names and contact information if they wished. A copy of the questionnaire used in Experiment P1 is included in Appendix A.

For the digital experiments, the questionnaires were created using Google Forms with the same questions as in the questionnaire of Experiment P1. An extra question was added to find out if participants have visited the exhibition before, to avoid any familiarity biases by eliminating those who have already

participated in any one of the experiments previously. Since the participants that were familiar with tablet computers or touch-screen devices were expected to be more comfortable using them, another extra question was included to find out if they used such devices in their daily lives. Although a study revealed that there was no significant correlation between previous computing experience and perceived presence or enjoyment (Sylaiou et al., 2010), familiarity with the device could interfere with the timing data, therefore the participants who did not use touch-screen devices in their daily lives were eliminated from the study. Last, a section consisting of presence questions adapted from the SUS questionnaire was integrated as seen in Appendix B (Usoh et al., 2000), considering that the questions in the SUS questionnaire were more relevant to the design of the experiments in this study compared to those in the WS questionnaire.

For the physical environment, the unobtrusive observation consisted of recording the visits of the participants using a webcam connected to a laptop computer. At the beginning of the exhibition, the visitors were informed through a notice on the wall that the visits to the exhibition were being video-recorded to collect data for an academic research, without revealing the specific topic of the study. The video-recordings were expected to reveal the behaviors of visitors that could indicate a higher level of attention to the exhibit objects, such as touching, stepping closer, or returning (Bitgood, 2013, p. 18). More importantly, they provided data pertaining to viewing durations for each exhibit object.

Concerning the digital environment, unobtrusive observation consisted of recording the screen of the tablet computer through which participants viewed the digital exhibition. Prior to entering the digital exhibition, the visitors were informed through a note on the screen that their visits were going to be recorded for academic research purposes. In order to provide the opportunity to engage with the exhibit objects at a higher level, an option of zooming into the exhibit objects was added to the digital exhibition. If a visitor chose to zoom into an exhibit object, it was recorded in the observation sheets while processing the screen recordings, and interpreted in the same way as the behavioral indicators that occurred in the physical exhibition (i.e. touching, stepping closer, returning, etc.). Such behaviors indicated that the specific exhibit object attracted the attention of the visitors at a high level such that they were eager to explore the object further. Moreover, an option of zooming out was also provided, to enable the visitors to view the objects all together from a distance.

Each condition of the three experiments was terminated as soon as a sample of thirty participants was reached with a balanced gender distribution. Upon completion of each experiment, the videos were analyzed to record viewing durations and frequencies of behavioral indicators for each exhibit object. Finally, timing data were converted to attracting power (AP) and average holding time (AHT) values to be statistically analyzed.

4.5.4. Pilot Study in the Physical Medium

Since the schedule of The Contemporary Arts Center was very busy, a pilot study was conducted in the exhibition hall of the Faculty of Art, Design and Architecture at İhsan Doğramacı Bilkent University. Third-year undergraduate students from the Department of Interior Architecture and Environmental Design were invited to visit the pilot exhibition and complete a questionnaire.

Eight students visited the pilot exhibition and completed a questionnaire. Their visits were video-recorded with a DSLR camera attached to a tripod. The first problem was that it was not possible to record a video longer than fifteen minutes due to the technical specifications of the camera, which made it impossible to record the visits continuously. A remote control was considered as a solution, so that the recording could be started when a visitor walked in, and paused when their visit was over. However, this option also failed since the remote control worked only when pointed toward the front of the camera from a short distance. Also, the DSLR camera and the tripod attracted too much attention from the participants, and the participants seemed to alter their ways of behaving upon noticing the camera. To solve these problems, the DSLR camera and the tripod were replaced by a webcam connected to a laptop computer and located in a corner of the gallery, which did not distract the participants.

The second problem involved the location of the table where the participants would complete the questionnaires. At the beginning of the pilot study, the table

was placed before the exhibit objects so as to prevent the questionnaires from going unnoticed. However, the participants stopped the moment they came across the table and started to complete a questionnaire, viewing the exhibition from that distance and never approaching the individual exhibit objects. This made it impossible to record separate viewing durations for individual objects. Therefore, the table was moved to a location after the exhibit objects, ensuring that the visitors viewed the exhibition first, and then approached the questionnaires (Figure 10).



Figure 10: A view from the pilot exhibition.

Last, the pilot study also revealed a problem about the questionnaire itself, such that half of the participants did not notice the second page of the questionnaire on the back of the sheet. This problem was eliminated by indicating on the bottom right corner of the first page that the rest of the questions were on the back of the sheet.

4.5.5. Pilot Study in the Digital Medium

In order to find whether the digital exhibitions and questionnaires functioned as they were intended to, a pilot study was conducted prior to the actual digital experiments took place in The Contemporary Arts Center. The first session of the pilot study was conducted with six first year design students with an age range of 19-22. Six adults participated in the second session, whose ages ranged between 41 and 57. The pilot study revealed several problems with the technical aspects, and design of both the digital exhibitions and questionnaires.

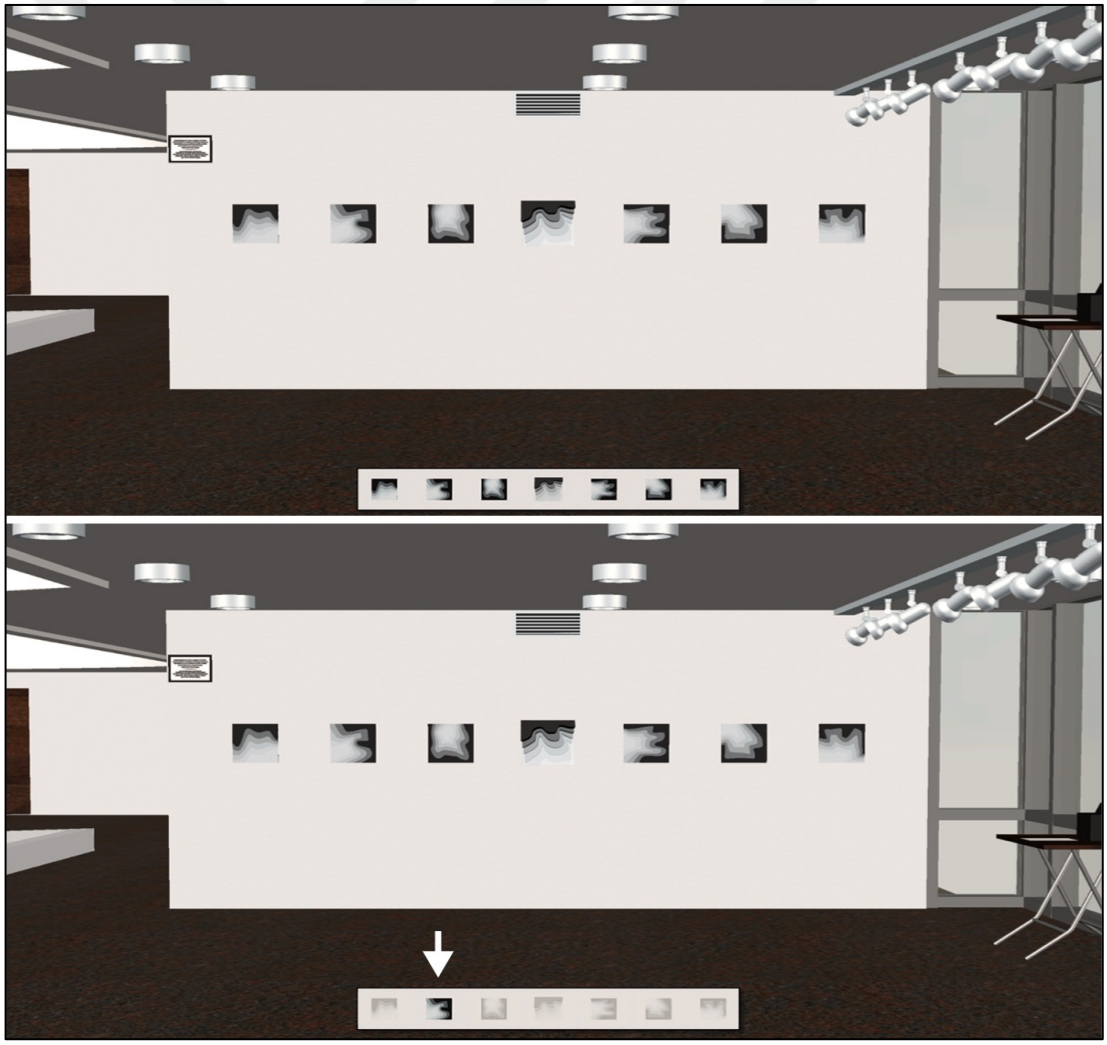


Figure 11: A snapshot from the digital exhibition, showing the marker added to the zoomed out scene.

The first problem involved the option of zooming out and viewing the objects all together from a distance. Apparently, the participants could not figure out where they were prior to zooming out, and some of them even started over. Such behaviors were not consistent with those observed in the physical exhibition. To solve this problem, a marker was added to the zoomed out scene, which indicated the exhibit object that they have been viewing when they zoomed out (Figure 11).

Besides, concerning the questionnaire, three participants were confused by the question that asked if they have visited this exhibition before. They reported that they could not understand which exhibition was being referred to, and also that it was not clear if their current visit counted. So, the question was rephrased and asked if they have seen this exhibition before in a physical space.

CHAPTER 5

RESULTS

This thesis employed three experiments, namely Experiment P1, Experiment D1, and Experiment D2, involving three separate samples. The results of these three experiments are presented together in a single chapter, rather than in three separate chapters, to avoid repetition and to have a comparative analyses section following the presentation and preliminary discussions of the results. The chapter is concluded with a comparative review of the three experiments.

5.1. Experiment P1: Testing Size in the Physical Medium

Experiment P1 was conducted in the Contemporary Arts Center in February 2015 (Figure 12). The information presented in this section pertains to [1] demographic data, [2] analysis of the timing data, [3] behavioral indicators, and [4] interest levels in the individual exhibit objects and the exhibition acquired through the questionnaire. A preliminary discussion on the results of Experiment P1 follows the presentation of these four groups of findings.



Figure 12: Snapshots from the four conditions in Experiment P1.

5.1.1. Demographic Data

The number of participants that visited the exhibition and completed the questionnaires in the control, S#1, S#4, and S#7 conditions were respectively 30, 32, 30, and 28 (N_{TOTAL} = 120). All of the visitors that viewed the exhibition and completed a questionnaire were included, except two, who did not fit the criteria for inclusion; i.e., belonging to the specified age range (Cohen, 1996; Matthew, 1996) and responding to all of the required questions in the questionnaire. The ages of the respondents ranged between 18 and 65 for the control condition (M = 40.13, SD = 17.96), between 18 and 65 for S#1 (M = 38.75, SD = 15.65), between 20 and 65 for S#4 (M = 40.77, SD = 14.34), and between 18 and 64 for S#7 (M = 34.07, SD = 14.36). Personal data provided by the participants in the questionnaires are compiled in Table 2, which represents the distribution of female and male visitors, those below and above the age of 45, highest education levels, exhibition visiting frequencies, and first-time or repeating visitors.

In order to find if viewing durations and interest ratings varied according to the personal information reported by the participants, independent samples t-tests for gender, age (below and above 45), and previous experiences with the venue; and one-way ANOVAs for educational levels and exhibition visiting habits were conducted. These tests did not reveal any significant effects of these personal variables on viewing durations or interest ratings at p = .05 level (see Appendix C).

Table 2: Frequencies and percentages of demographic categories in each condition of Experiment P1.

	Control	S#1	S#4	S#7	TOTAL
Gender					
Female	13 (43%)	22 (69%)	13 (43%)	17 (61%)	**65 (54%)**
Male	17 (57%)	10 (31%)	17 (57%)	11 (39%)	**55 (46%)**
Age					
<45	17 (57%)	19 (59%)	18 (60%)	22 (79%)	**76 (63%)**
≥45	13 (43%)	13 (41%)	12 (40%)	6 (21%)	**44 (37%)**
Highest Education Level					
High-School Diploma	5 (17%)	5 (16%)	2 (7%)	3 (11%)	**15 (13%)**
Bachelor's Degree	20 (66%)	15 (47%)	25 (83%)	18 (64%)	**78 (65%)**
Post-Graduate Degree	5 (17%)	12 (37%)	3 (10%)	7 (25%)	**27 (22%)**
Exhibition Visiting Frequencies					
Less than Once a Year	1 (3%)	1 (3%)	2 (7%)	1 (3%)	**5 (4%)**
1 to 5 Times a Year	13 (43%)	20 (63%)	7 (23%)	12 (44%)	**52 (43%)**
More than 5 Times a Year	16 (54%)	11 (34%)	21 (70%)	15 (53%)	**63 (53%)**
Previous Experience with Space					
First-Time Visitors	5 (17%)	12 (37%)	4 (13%)	7 (25%)	**28 (23%)**
Visited Before	25 (83%)	20 (63%)	26 (87%)	21 (75%)	**92 (77%)**
TOTAL	**30**	**32**	**30**	**28**	**120**

5.1.2. Analysis of the Timing Data

The timing data obtained from the video-recordings were then converted into the indicators that were previously compiled from the literature. The analyses of the timing data are presented in this section.

5.1.2.1. Trends Observed in AP Values

The APs were obtained by calculating the percentage of visitors who stopped at each of the exhibit objects in the four conditions (Figure 13). The recorded videos were analyzed and a stop was recorded whenever a visitor was observed as both of their feet planted on the floor, viewing the exhibit object for at least two seconds (Serrell, 1997a).

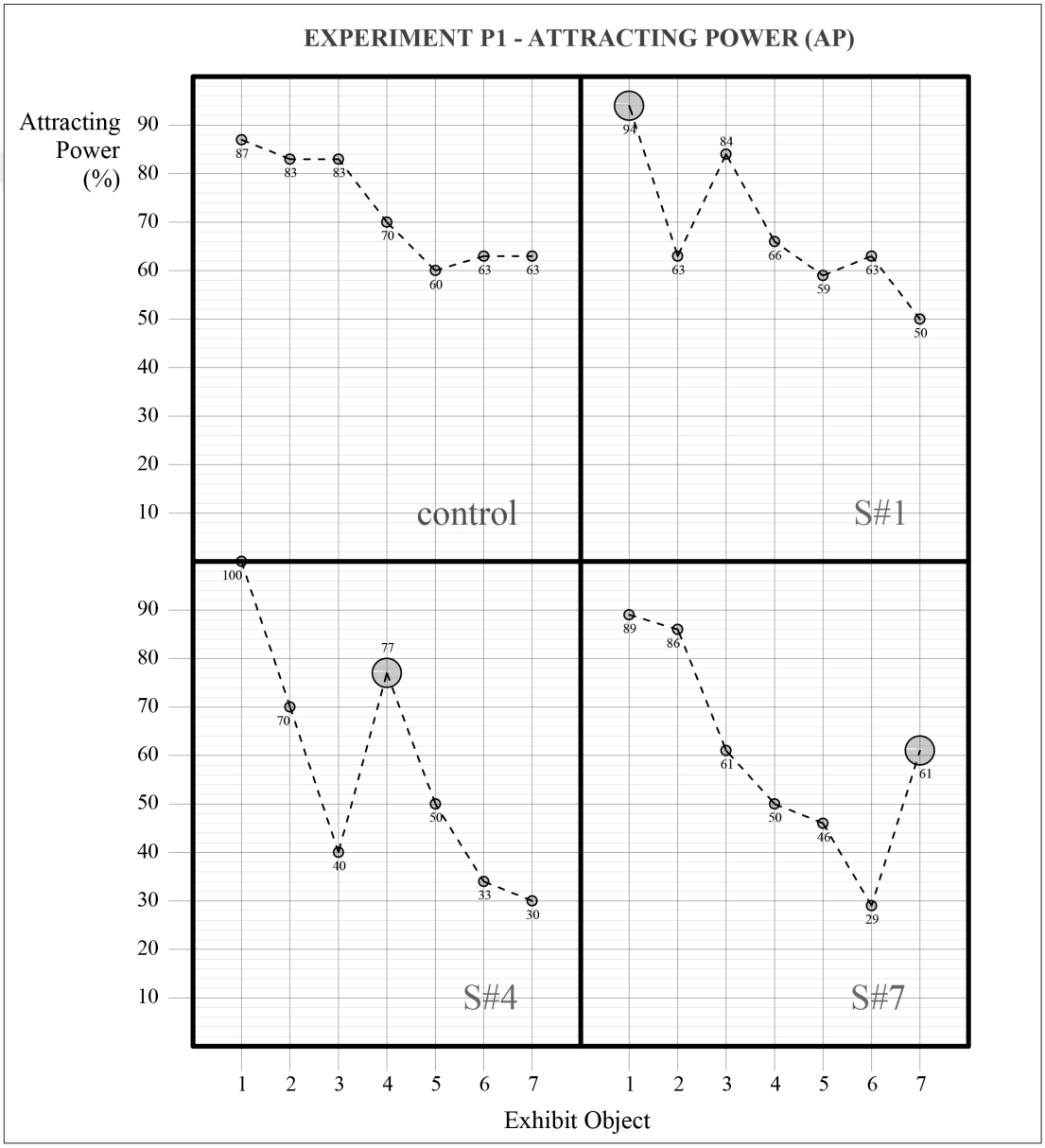


Figure 13: APs of the exhibit objects in the four conditions of Experiment P1. The large objects are indicated with larger markers.

In general, a gradual decrease can be observed in the APs of the pieces toward the end of the exhibition in each experimental condition (Figure 13). Separate z-tests for two proportions were conducted as described by Argyrous (1997, p. 279), which indicated that the AP values for the first exhibit objects were significantly greater than those for the last objects, as shown in Table 3. Another comparison showed that the first objects (93%) attracted significantly more attention than the last objects (51%) across conditions, $z = 7.16$, $p < .001$. In a similar vein, overall mean AP value calculated for the earlier three objects across all conditions (78%) exceeded the level for the later three objects across all conditions (51%, $z = 7.71$, $p < .001$).

Table 3: Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment P1

Conditions	AP of EO#1	AP of EO#7	Significance Level
Control	87%	63%	$p = .04$
S#1	94%	50%	$p < .001$
S#4	100%	30%	$p < .001$
S#7	89%	61%	$p = .01$

These gradual decrease trends were transiently interrupted in the conditions that had a larger piece in the set. A z-test for two proportions indicated that the AP value of the three large objects (78%) was significantly greater relative to the overall AP value of the 18 small objects (59%, $z = 3.32$, $p < .001$) in the three experimental conditions. On the other hand, considering the experimental conditions separately, it was found that the AP values of the larger objects exceeded the levels of the remaining six objects in S#1 and S#4, but not in S#7, in which the larger object appeared last (see Table 4a).

Table 4: Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment P1

(a) Large EO versus all the remaining objects in each condition

Condition	AP of Large EO	AP of Remaining EOs	Significance
S#1	94%	64%	$p < .001$
S#4	77%	54%	$p = .02$
S#7	61%	60%	$p = .95$

(b) Large EO versus adjacent EO(s) in each condition

Condition	Adjacent EO	AP of Large EO	AP of Adj. EO	Significance
S#1	#2	94%	63%	$p = .003$
S#4	#3	77%	40%	$p = .004$
S#4	#5	77%	50%	$p = .03$
S#7	#6	61%	29%	$p = .02$

(c) EO corresponding to large EO of each experimental condition versus adjacent EO in the control condition (CC)

Corresp. EO	Adjacent EO	AP of Corresp. EO	AP of Adj. EO	Significance
#1 in CC	#2 in CC	87%	83%	$p = .72$
#4 in CC	#3 in CC	70%	83%	$p = .22$
#4 in CC	#5 in CC	70%	60%	$p = .42$
#7 in CC	#6 in CC	63%	63%	$p = 1$

As shown in Table 4b, the AP values of the larger objects (i.e., Exhibit Object 1 in S#1, Exhibit Object 4 in S#4, and Exhibit Object 7 in S#7) were significantly greater than those of the adjacent objects. Repeating the same test for the control condition revealed no significant differences between the AP values of the exhibit objects corresponding to the larger objects in S#1, S#4 and S#7, and the objects adjacent to them (see Table 4c). Furthermore, the overall AP of the small objects adjacent to the larger objects in all three experimental conditions (i.e., #2 in S#1, #3 and #5 in S#4, and #6 in S#7; 46%) was significantly lower than both the overall AP of the corresponding objects in the control condition

(i.e., #2, #3, #5, and #6 in the control condition; 73%, $z = 4.20$, $p < .001$), and the overall AP of the other small objects that were not adjacent to the larger objects in all three experimental conditions (63%, $z = 3.44$, $p < .001$).

5.1.2.2. Trends Observed in AHT Values

AHTs were obtained by calculating the mean times spent at each object in the four conditions (Figure 14). The trends observed in AHT values within and between experimental conditions seemed to be similar to those in APs. Separate one-way analyses of variance (ANOVAs) conducted to test the significance of the differences between individual exhibit objects in terms of their AHTs for each condition yielded significant results, as shown in Table 5. As expected, AHTs gradually decreased toward the end of the exhibition. Follow-up Scheffé tests indicated that the time spent at Exhibit Object 1 was significantly greater than the time spent at Exhibit Objects 5 ($p = .002$), 6 ($p = .008$), and 7 ($p < .001$) in the control condition; all the other six objects in S#1 ($p < .001$ for all); Exhibit Objects 3 ($p < .001$), 5 ($p = .003$), 6 ($p < .001$), and 7 ($p < .001$) in S#4; and Exhibit Object 6 ($p = .02$) in S#7 (All means and standard deviations are indicated in Figure 14; see Appendix D for the test statistics).

Table 5: ANOVA results involving AHTs of seven EOs within each condition for Experiment P1

Conditions	F-Statistics	*MSE*	Significance	Effect Size
Control	F (6, 203) = 5.55	22.74	$p < .001$	$\eta^2 = .14$
S#1	F (6, 217) = 10.15	31.17	$p < .001$	$\eta^2 = .22$
S#4	F (6, 203) = 10.14	10.12	$p < .001$	$\eta^2 = .23$
S#7	F (6, 189) = 3.40	16.27	$p = .003$	$\eta^2 = .10$

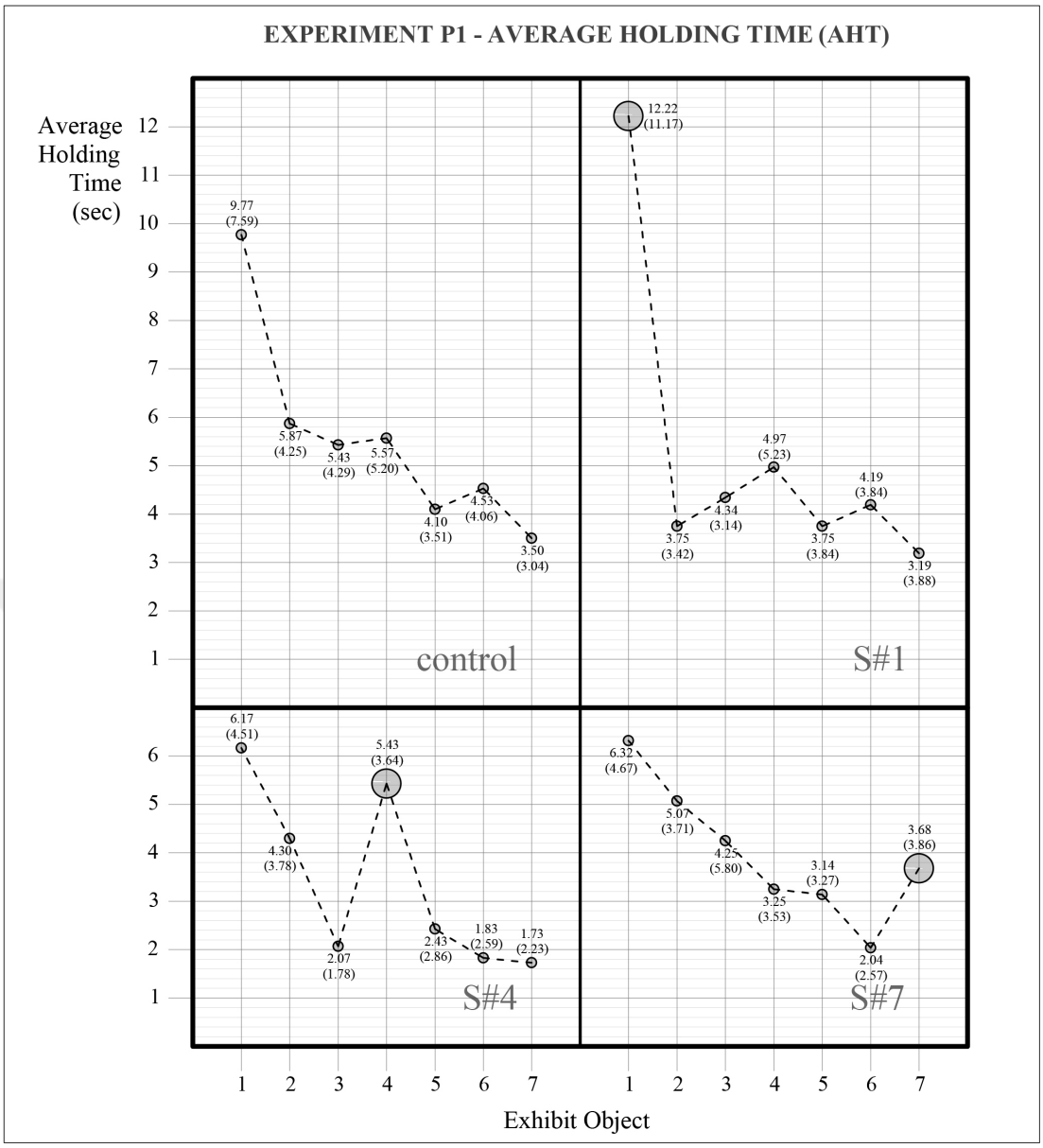


Figure 14: AHTs of the exhibit objects in the four conditions of Experiment P1. The large objects are indicated with larger markers. Standard deviations are indicated within parentheses.

In order to explore the significance of the gradual decrease, an independent samples t-test was conducted across conditions, which showed that the overall AHT of the first objects (M = 11.78, SD = 9.28) was significantly higher than that of the last objects (M = 3.02, SD = 3.37), t (161) = 7.24, p < .001, d = 0.94. Degrees of freedom were adjusted from 238 to 161 since Levene's test indicated

unequal variances (F (1, 238) = 31.75, p < .001). A similar test showed the participants spent significantly more time at the first three objects (M = 5.82, SD = 5.97) than they did at the last three objects (M = 3.19, SD = 3.43), t (573) = 7.25, p < .001, d = 0.54. Since Levene's test indicated unequal variances, degrees of freedom were adjusted from 718 to 573 (F (1, 718) = 31.70, p < .001).

Another independent samples t-test indicated that the mean AHT value of the three larger objects (M = 7.30, SD = 8.14) was significantly greater than the mean AHT value of the 18 small objects (M = 3.71, SD = 3.90) in the three experimental conditions, t (96) = 4.10, p < .001, d = .56. Since Levene's test indicated unequal variances [F (1, 628) = 40.23, p < .001], degrees of freedom were adjusted from 628 to 96.

Separate independent samples t-tests showed that the mean time spent at the four small objects adjacent to the larger ones (M = 2.60, SD = 2.80) was significantly less than;

- the mean time spent at the larger objects (M = 7.30, SD = 8.14) across the experimental conditions, t (105) = 5.25, p < .001, d = .77 (Note first, that Levene's test indicated unequal variances, F (1, 208) = 30.94, p < .001, so degrees of freedom were adjusted from 208 to 105; second, that a similar test conducted for the corresponding objects in the control condition yielded a nonsignificant result);
- the mean time spent at the other small objects that were not adjacent to any larger objects in all three experimental conditions (M = 4.03, SD = 4.11), t (281) = 4.40, p < .001, d = 1.07 (Note that because Levene's test

indicated unequal variances [F (1, 538) = 16.45, p < .001], degrees of freedom were adjusted from 538 to 281);

- the mean time spent at the corresponding objects (Exhibit Objects 2, 3, 5, and 6) in the control condition (M = 4.98, SD = 4.05), t (212) = 5.31, p < .001, d = 1.36 (Note that Levene's test again indicated unequal variances, F (1, 238) = 25.90, p < .001; hence degrees of freedom were adjusted from 238 to 212).

5.1.2.3. Overall Attention Differences between Conditions

The data were also analyzed to find whether the presence and the ordinal position of the larger object made any difference in terms of the overall attention to the exhibition. First, based on the values shown in Figure 13, the overall AP values were calculated for all three experimental conditions and for the control condition. A z-test for two proportions based on those values indicated that the mean AP of the three experimental conditions (62%) was significantly lower than that of the control condition (73%, z = 2.84, p = .005). Next, the same test was repeated for all four conditions separately, comparing the APs of S#1 (68%), S#4 (57%), and S#7 (60%), with that of the control condition (73%). These analyses revealed that the APs of S#4 (z = 3.38, p < .001) and S#7 (z = 2.70, p = .007) were significantly lower than that for the control condition. Although S#1, in which the large object appeared first, also seemed to have a lower overall AP relative to the control condition, the difference did not reach significance (z = 1.04, p = .30).

Furthermore, based on the AHT values shown in Figure 14, the mean viewing times for each of the experimental and control conditions were calculated. To start with, an independent samples t-test showed that, in general, the mean time spent at the control condition (M = 5.54, SD = 5.07) was significantly greater than the mean time spent at the three experimental conditions altogether (M = 4.22, SD = 4.90), t (348) = 3.28, p = .001, d = .26. Levene's test indicated unequal variances (F (1, 838) = 4.00, p = .05), so degrees of freedom were adjusted from 838 to 348. Next, a one-way ANOVA indicated that the mean differences between the four conditions were also significant, F (3, 836) = 8.78, MSE = 24.06, p < .001, η^2 = .03. Follow-up analyses revealed that the participants spent significantly more time at the control condition (M = 5.54, SD = 5.07) than they did at S#4 (M = 3.42, SD = 3.58, p < .001) and S#7 (M = 3.96, SD = 4.18, p = .02) while the difference involving the mean AHT for the S#1 condition (M = 5.20, SD = 6.23, p = .92) was not significant, in a similar vein with the AP findings noted above. Besides, the visitors spent significantly more time at S#1 than they did at S#4 (p = .003).

5.1.2.4. Trends Observed in Deviation Scores

To further account for the confounding of size and ordinal position, deviation scores were also calculated. That is, using the control data as baseline, which presumably reflect how attention would be affected when all objects are of similar size, deviations were calculated for each experimental condition from those starting points. The deviation scores involving AP and AHT for each of the exhibit objects in the three experimental conditions are reported in Table 6a

and Table 6b, respectively. Those scores provided additional support for the hypotheses of this thesis by enabling an overall visualization of the effects described above. Scores shown in Tables 6a and 6b demonstrate a suppression trend in overall attention levels observed in the experimental conditions, which seems to be stronger for S#4 and S#7. Specifically, the objects in the control condition not only seem to attract more attention (in more than 70% of the cases), but also to hold it longer (in approximately 90% of the cases) than the experimental conditions. Interestingly, the only two experimental objects that did not perform below the corresponding control objects, in terms of viewing time, were the large objects appearing first and last.

Table 6: Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with larger objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment P1.

(a) Deviations involving AP Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**+7**	-20	+1	-4	-1	0	-13
S#4	+13	-13	-43	**+7**	-10	-30	-33
S#7	+2	+3	-22	-20	-14	-34	**-2**

(b) Deviations involving AHT Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**+2.45**	-2.12	-1.09	-.60	-.35	-.35	-.31
S#4	-3.60	-1.57	-3.37	**-.13**	-1.67	-2.70	-1.77
S#7	-3.45	-.80	-1.18	-2.32	-.96	-2.50	**+.18**

Regarding the AP decrements involving comparisons of pre- and post-large objects, as can be seen in Table 6a, in S#4, the AP decrement (revealed in deviation scores) to Exhibit Object 3 [(+7) - (-43) = 50] was much larger than

that for Exhibit Object 5 [(+7) - (-10) = 17]; $z = 5.29$, $p < .001$. A similar trend could also be observed when the decrease of the mean AP at the pre-large object in S#4 (50) and S#7 (32) was compared with the decrease at the post-large object in S#1 (27) and S#4 (17); that is, the means of 41 and 22, respectively ($z = 2.89$, $p = .004$). However, due to the confounding effects resulting from large ordinal position differences (i.e., first and last) involving conditions S#1 and S#7, comparisons across those two conditions should be viewed with caution. As for AHT, a similar but nonsignificant trend was observed when the means of the decrements for each participant were calculated for pre-large ($M = 3.37$, $SD = 2.89$) and post-large objects ($M = 3.00$, $SD = 3.98$) in S#4, and compared through a paired samples t-test; t (29) = .66, $p = .52$, $d = .12$. Thus, AP comparisons suggested a greater impact of distraction for the pre-large object than the post-large object, which did not seem to be significant for AHT data.

5.1.2.5. Visual Summary of the Timing Results

Figure 15 presents a visual summary of the results obtained from each statistical test conducted for the timing data. The diagrams show the exhibit objects that were compared through z-tests for two proportions for the AP data, and independent samples t-tests for the AHT data. The first two rows address the gradual downtrend in attention toward the end; third, fourth, and fifth rows address the salience of the larger object; fifth, sixth, seventh, and eighth rows address the overshadowing effect of the larger objects on the adjacent small objects; and the last two rows address the effect of the larger objects' presence and ordinal position on the attention to the overall exhibition.

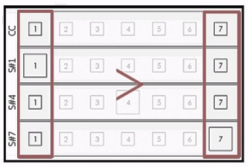
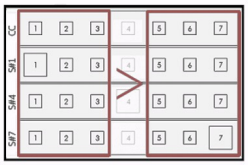
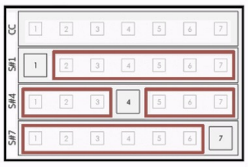
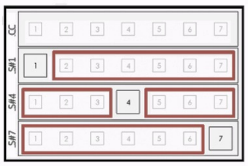
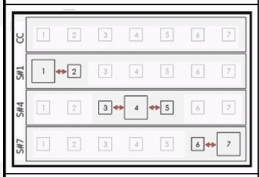
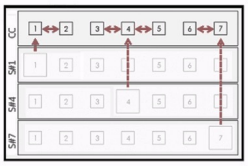
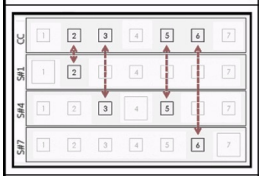
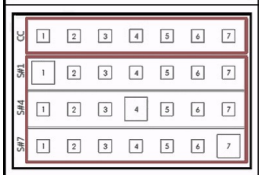
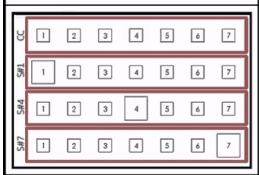
	ATTRACTING POWER (AP)	AVERAGE HOLDING TIME (AHT)
	first vs. last: → significant ($p < .001$)	first vs. last: → significant ($p < .001$)
	first three vs. last three: → significant ($p < .001$)	first three vs. last three: → significant ($p < .001$)
	three large vs. remaining eighteen: → significant ($p < .001$)	three large vs. remaining eighteen: → significant ($p < .001$)
	one large vs. remaining six: → significant ($p < .001$) → significant ($p = .02$) → not significant ($p = .95$)	
	large vs. adjacent: → significant ($p = .003$) → significant ($p = .004; .03$) → significant ($p = .02$)	large vs. adjacent: → significant ($p < .001$)
	corresponding vs. adjacent: → not significant ($p = .72$) → not significant ($p = .22; .42$) → not significant ($p = 1$)	
	adjacents vs. corresponding EOs: → significant ($p < .001$)	adjacents vs. corresponding EOs: → significant ($p < .001$)
	adjacents vs. non-adjacents: → significant ($p < .001$)	adjacents vs. non-adjacents: → significant ($p < .001$)
	CC vs. experimental conditions: → significant ($p = .005$) CC : 73% ECs : 62%	CC vs. experimental conditions: → significant ($p = .001$) CC : $M = 5.54$ ECs : $M = 4.22$
	CC vs. experimental conditions: → not significant ($p = .30$) - 68% → significant ($p < .001$) - 57% → significant ($p = .007$) - 60%	CC vs. experimental conditions: → not significant ($p = .92$) → significant ($p < .001$) → significant ($p = .02$)

Figure 15: Visual summary of the timing data test results for Experiment P1.

5.1.3. Behavioral Indicators

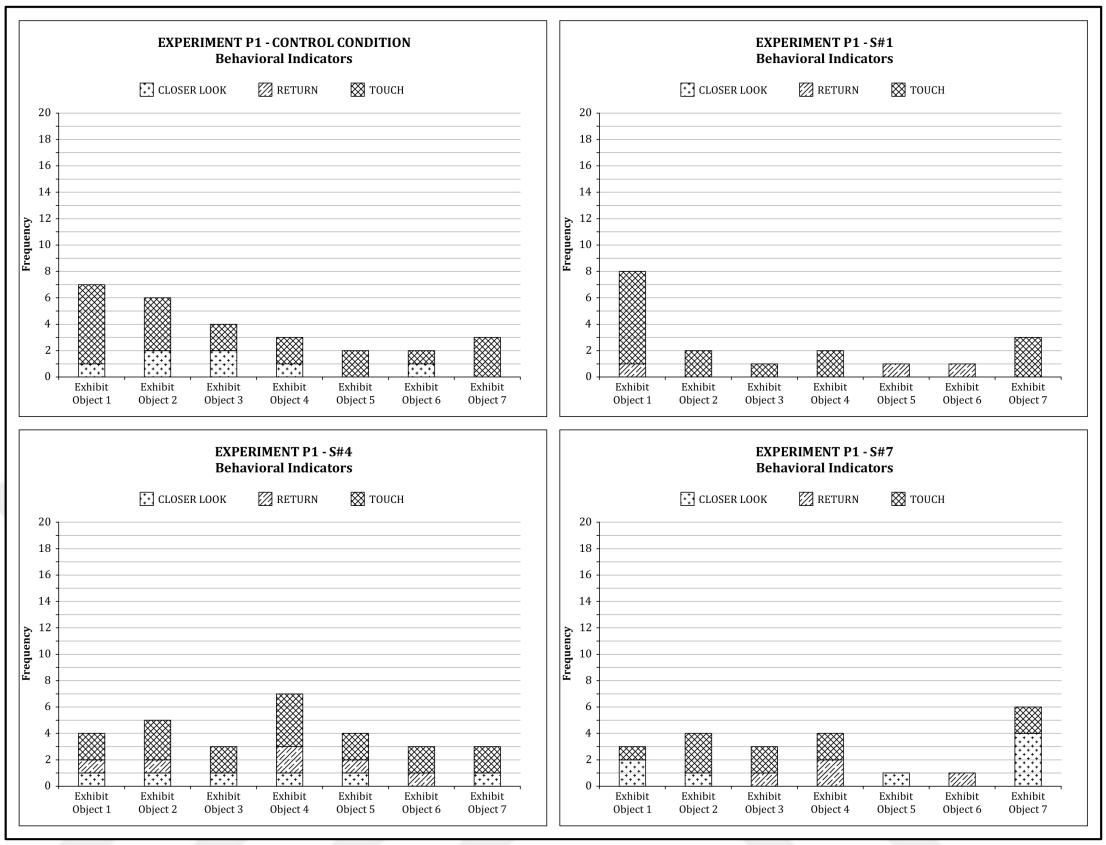


Figure 16: Frequencies of behavioral indicators observed in the four conditions of Experiment P1.

Additionally, several behavioral indicators of attention and interest were observed (i.e., returning, having a closer look, and touching) from the exhibition visits. As seen in Figure 16, similar trends with the timing data can be observed in the frequencies of these behaviors, such as a decline towards the end, instant increases at the larger objects in the experimental conditions, and slight decreases at those adjacent to the larger objects.

5.1.4. Interest Levels

Means and standard deviations involving interest ratings are presented in Figure 17. Separate one-way ANOVAs for the four conditions indicated no significant differences between the interest ratings of exhibit objects. Consistent with the ANOVA results, planned comparisons also yielded nonsignificant results.

On the other hand, an independent samples t-test regarding the saliency effect of size on the interest levels indicated that, the mean interest rating of the three larger objects (M = 4.52, SD = 1.86) was significantly greater than that of the 18 small objects (M = 3.93, SD = 1.75) across the three experimental conditions, t (628) = 2.96, p = .003, d = .03.

Analyses conducted to explore the suppression effect of adjacency to the larger object indicated that the mean interest rating of the adjacent objects in the three experimental conditions (M = 3.88, SD = 1.70) was significantly lower than both the mean of the three larger objects (M = 4.52, SD = 1.86, t (208) = 2.59, p = .01, d = .04), and the mean of the objects corresponding to the adjacent ones in the control condition (M = 4.38, SD = 1.79, t (238) = 2.13, p = .03, d = .29); but did not differ from the mean interest rating of the remaining small objects that were not adjacent to the larger objects (M = 3.94, SD = 1.76) across the three experimental conditions, t (538) = 3.16, p = .75, d < .01).

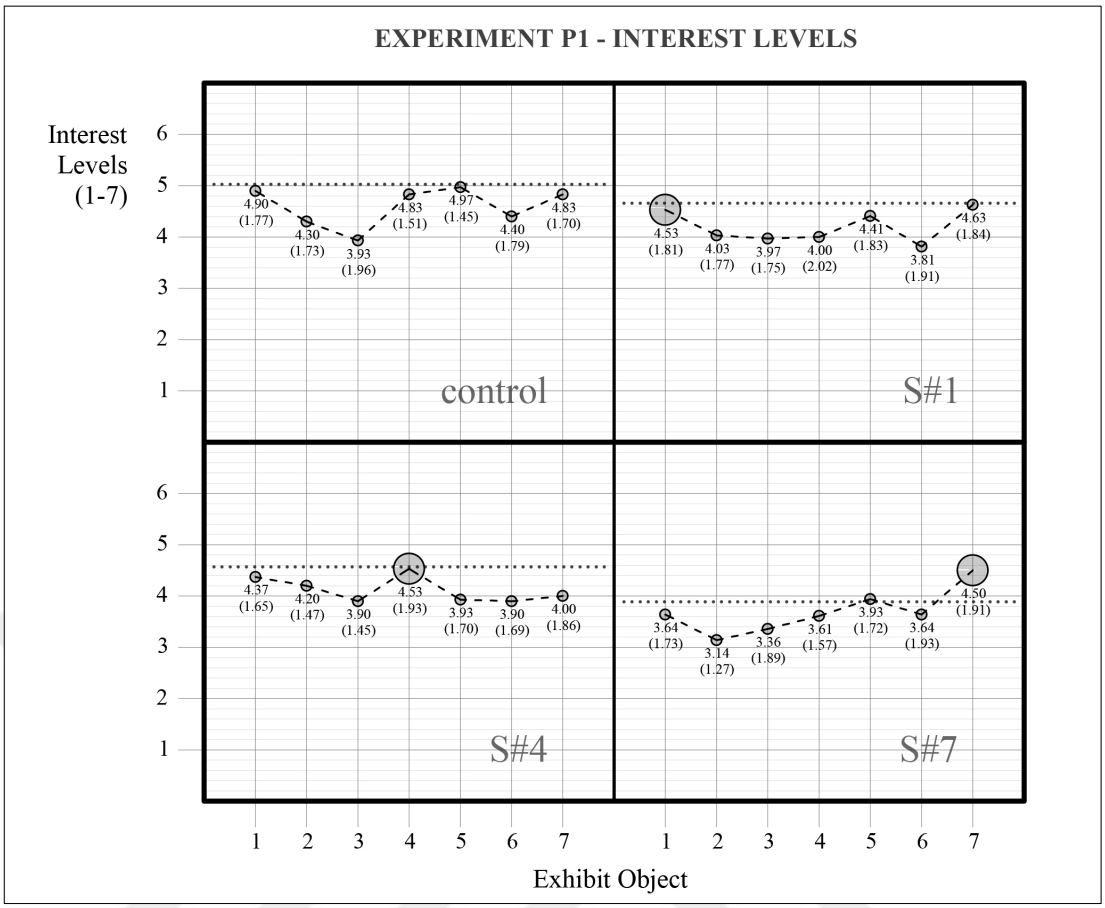


Figure 17: Mean interest levels of the exhibit objects in the four conditions of Experiment P1. The larger objects are indicated with larger markers. Standard deviations are indicated within parentheses.

In addition, another independent samples t-test, conducted to find whether the generalized suppression effect noted in the timing data would also be observed in the interest data, revealed that the mean of the interest ratings reported for the control condition (M = 4.58, SD = 1.74) was significantly greater than the mean of the interest ratings reported for the three experimental conditions altogether (M = 4.01, SD = 1.77), t (838) = 4.04, p < .001, d = .32, in congruence with the attention findings.

5.1.5. Preliminary Discussion on the Findings of Experiment P1

Analyses of the timing data, which were processed as attracting power (AP) and average holding time (AHT) values, indicated that the first exhibit objects were likely to attract and hold more attention than the last ones in all the conditions. Comparisons between the APs and AHTs of the first three and the last three exhibit objects also yielded similar results.

The steadiest decrease in viewing durations occurred in the control condition, in which there was no larger piece to affect attention levels. Therefore, the gradual decline in attention due to object satiation or exit attraction was not interrupted, since attention allocation process is likely to be stimulated by "looking for something of interest" and "responding to powerful sensory attractors such as large objects, loud noises or movement" (Bitgood, 2014, p. 6). Hence, the effects of object satiation and exit attraction were most clearly apparent in the control condition consisting of same-size objects.

Another important finding involved the instant increase in attention regarding the large piece in each experimental condition. As expected, both the AP and the AHT values involving the larger objects were significantly greater than the ones for the small objects (except when the large object appeared last, as is considered later on). This finding, supporting Hypothesis 1, is also congruous with the results of previous research on size as a salience parameter (i.e., Bitgood, 2014; Bitgood et al., 1986; Bitgood & Patterson, 1987; Bitgood et al., 1988; Donald, 1991; Marcellini & Jenssen, 1988).

The impact of contrast or visual competition was apparent mostly in the negative effect of the larger piece on the amount of attention attracted by the adjacent piece(s). More specifically, the small exhibit objects adjacent to the larger ones attracted significantly less attention relative to (a) the larger objects; (b) other small objects that were not adjacent to the larger ones; and (c) objects in the control condition corresponding to the objects adjacent to the larger ones in the three experimental conditions; hence suggesting that the presence of the larger object could have a negative influence on the adjacent objects' capability of attracting and holding attention. Thus, Hypothesis 3, which asserted that salient exhibit objects might overshadow less salient objects displayed in an adjacent location, was supported. Also, an interesting trend was observed for this overshadowing effect involving AP to be stronger for the adjacent object positioned before than after the salient object. This finding, which was not predicted, suggests that the object positioned before the larger one seems to experience a stronger impact of the negative effects arising from the visual competition with the salient object in attracting attention. However, this trend was not significant for the AHT data.

The results also pointed to the importance of considering the interrelationships between ordinal position, size, and proximity effects. That is, although S#1, S#4 and S#7 of Experiment P1 all consisted of one large and six small exhibit objects, they yielded distinct schemes of attention distribution depending on the larger object's position within the set. For example, when the larger object was also the first object, the above-noted saliency effect seemed to be enhanced by

the effects of object satiation and exit attraction, favoring the first appearing objects. In contrast, when the larger object appeared last (i.e., S#7), the saliency effect seemed to be overshadowed by the effects of object satiation and exit attraction such that the difference between the amounts of attention received by the larger object and the other objects did not reach significance. In this latter condition (in which the larger object appeared last), only the time spent at the first object seemed to be significantly different from (greater than) the time spent at Object 6, which was adjacent to the larger object appearing last. On the other hand, when the larger object appeared in the middle (the fourth object in S#4), it seemed to attract more attention only relative to the adjacent objects and those closer to the end.

In sum, significant differences were obtained between AP and AHT values of the large objects and those of the remaining objects in S#1 and S#4 (favoring the large objects appearing first and in the middle, respectively), whereas the differences did not reach significance when the large object appeared last, as in S#7. Thus, although the attention-attracting and -holding capability of object size was supported by the findings, they also suggested that the effect of object size may be reduced or canceled by the particular ordinal position of the objects (e.g., when object satiation or exit attraction may be involved). The results also suggested that the influence of object satiation or exit attraction may be stronger than the effect of object size, since the piece that attracted the highest amount of attention in all the experimental conditions was not the larger piece but the first appearing exhibit object.

Finally, regarding the specific and general effects of the salient object, the findings pointed to an interesting dilemma, which contradicted Hypothesis 2: Despite the significantly superior attention-attracting capability of the larger object, its presence seemed to have a negative effect on the overall amount of attention paid to the exhibition as a whole. This effect was evident when the AP and AHT values in the control condition were compared with those in the three experimental conditions. Although the steadiest attention decline was observed in the control condition, the overall level of visitor attention in the control condition exceeded the overall attention level for the experimental conditions involving larger objects. This finding seems to suggest that one needs to be cautious when designing heterogeneous exhibits to avoid decreases in visitor attention (Bitgood, 2002), since the increased amount of attention attracted by the larger object may fail to compensate for the decreased attention to the smaller objects when compared with the control condition. Separate comparisons also showed that the overall AP and AHT of the control condition were higher than those of S#1, but the difference did not reach significance. This finding might indicate that placing the salient object at the beginning of the exhibition could help in avoiding the general suppression effect of the salient object to a certain extent (Hypothesis 4). Although the present results should be replicated to find out whether this finding is an exceptional case, a general suppression effect seems to be associated with the presence of a more salient exhibit object. In such a case, the salient object may be likely to appear as the figure and attract more attention, while the smaller objects may tend to recede

to the background. The implications of this finding may need to be carefully considered by those designing exhibitions.

It should also be noted that, although the above-mentioned salience and adjacency effects occurring with the presence of the larger object were also revealed in the interest data, other observational trends consistently detected in the timing data (e.g., attention declines toward the end of the visits, instant increases at larger exhibit objects) did not seem to appear in the interest levels reported by the participants. This finding suggests that attention levels might not reflect the perceived interestingness of the exhibit objects.

5.2. Experiment D1: Testing Size in the Digital Medium

Experiment D1 was conducted in the Contemporary Arts Center in January 2017. In this section, Experiment D1 is explained in terms of [1] demographic data, [2] analysis of the timing data, [3] behavioral indicators, and [4] interest levels in the individual exhibit objects and the exhibition. Next, a preliminary discussion of these four groups of findings is presented.

5.2.1. Demographic Data

Thirty participants visited the exhibition and completed the questionnaires in each of the control, S#1, S#4, and S#7 conditions (N_{TOTAL} = 120). Every visitor that viewed the exhibition and completed a questionnaire was included, since they were all within the age range of 18 and 65, all of them had been using touch-screen devices in their daily lives, and none of them have seen the exhibit

objects before. The ages of the respondents ranged between 18 and 63 for the control condition (M = 33.40, SD = 15.28), between 18 and 58 for S#1 (M = 32.17, SD = 10.51), between 19 and 63 for S#4 (M = 36.70, SD = 12.02), and between 18 and 65 for S#7 (M = 34.33, SD = 13.02). Personal data provided by the participants in the questionnaires are compiled in Table 7, which represents the distribution of female and male visitors, those below and above the age of 45, highest education levels, exhibition visiting frequencies, and first-time or repeating visitors.

As in Experiment P1, independent samples t-tests for gender, age (below and above 45), and previous experiences with the venue; and one-way ANOVAs for educational levels and exhibition visiting habits were conducted, in order to find out if viewing durations and interest ratings varied according to the personal information reported by the participants. None of these tests revealed significant effects of these personal variables on viewing durations or interest levels at p = .05 level (see Appendix E).

In addition, two independent samples t-tests were conducted to find whether the perceived presence levels (*1 to 5 = low; 6 and 7 = high*) influenced the viewing durations and the interest ratings of the participants. The test results indicated that, the viewing durations of participants with low perceived presence scores (M = 5.58, SD = 4.57) did not differ from those with high perceived presence scores (M = 4.43, SD = 2.31), t (118) = 1.30, p = .20, d = .32. On the other hand, those with high levels of perceived presence (M = 4.45, SD =

1.38) found the exhibit objects significantly more interesting than those with low perceived presence levels (M = 3.81, SD = 1.24), t (118) = 2.34, p = .02, d = .49.

Table 7: Frequencies and percentages of demographic categories in each condition of Experiment D1.

	Control	S#1	S#4	S#7	TOTAL
Gender					
Female	17 (57%)	18 (60%)	11 (37%)	15 (50%)	**61 (51%)**
Male	13 (43%)	12 (40%)	19 (63%)	15 (50%)	**59 (49%)**
Age					
<45	22 (73%)	25 (83%)	24 (80%)	23 (77%)	**94 (78%)**
≥45	8 (27%)	5 (17%)	6 (20%)	7 (23%)	**26 (22%)**
Highest Education Level					
High-School Diploma	7 (23%)	3 (10%)	4 (13%)	1 (3%)	**15 (12%)**
Bachelor's Degree	19 (64%)	18 (60%)	20 (67%)	23 (77%)	**80 (67%)**
Post-Graduate Degree	4 (13%)	9 (30%)	6 (20%)	6 (20%)	**25 (21%)**
Exhibition Visiting Frequencies					
Less than Once a Year	2 (7%)	2 (7%)	0	1 (3%)	**5 (4%)**
1 to 5 Times a Year	13 (43%)	12 (40%)	14 (47%)	13 (44%)	**52 (43%)**
More than 5 Times a Year	15 (50%)	16 (53%)	16 (53%)	16 (53%)	**63 (53%)**
Previous Experience with Space					
First-Time Visitors	7 (23%)	3 (10%)	4 (13%)	6 (20%)	**20 (17%)**
Visited Before	23 (77%)	27 (90%)	26 (87%)	24 (80%)	**100 (83%)**
TOTAL	**30**	**30**	**30**	**30**	**120**

5.2.2. Analysis of the Timing Data

The timing data obtained from the screen-recordings of the tablet computer were then converted into AP and AHT values. Next, they were analyzed to find if exhibit object size influenced visitor attention in digital exhibition environments. The analyses of the timing data are presented in this section.

5.2.2.1. Trends Observed in AP Values

The APs for Experiment D1 were also obtained by calculating the percentage of visitors who stopped at each of the exhibit objects in the four conditions. As previously explained, for Experiment P1, a stop was recorded whenever a visitor was observed as both of their feet planted on the floor, viewing the exhibit object for at least two seconds, based on a study by Serrell (1997). For the experiments in the digital medium, a stop was recorded whenever a participant viewed an exhibit object for at least two seconds before moving on.

In general, similar AP tendencies were observed, but their magnitudes decreased when Experiment P1 was repeated in the digital medium (Figure 18). To start with, the rate of the gradual decrease towards the end of the exhibition in terms of APs seemed to diminish in the experimental conditions of Experiment D1, when compared with those of Experiment P1. The results of z-tests for two proportions revealed significant differences between the APs of the first and last exhibit objects in all conditions except S#7, in which the last object was the larger one (see Table 8). In fact, in all four conditions, the first exhibit object yielded the highest AP value by 100%. Another comparison

involving the APs of the first and last objects showed that the first objects (100%) attracted significantly more attention than the last objects (91%) across conditions, $z = 5.74$, $p < .001$. Besides, overall mean AP of the earlier three objects across all conditions (87%) exceeded the level for the later three objects across all conditions (74%, $z = 4.40$, $p < .001$).

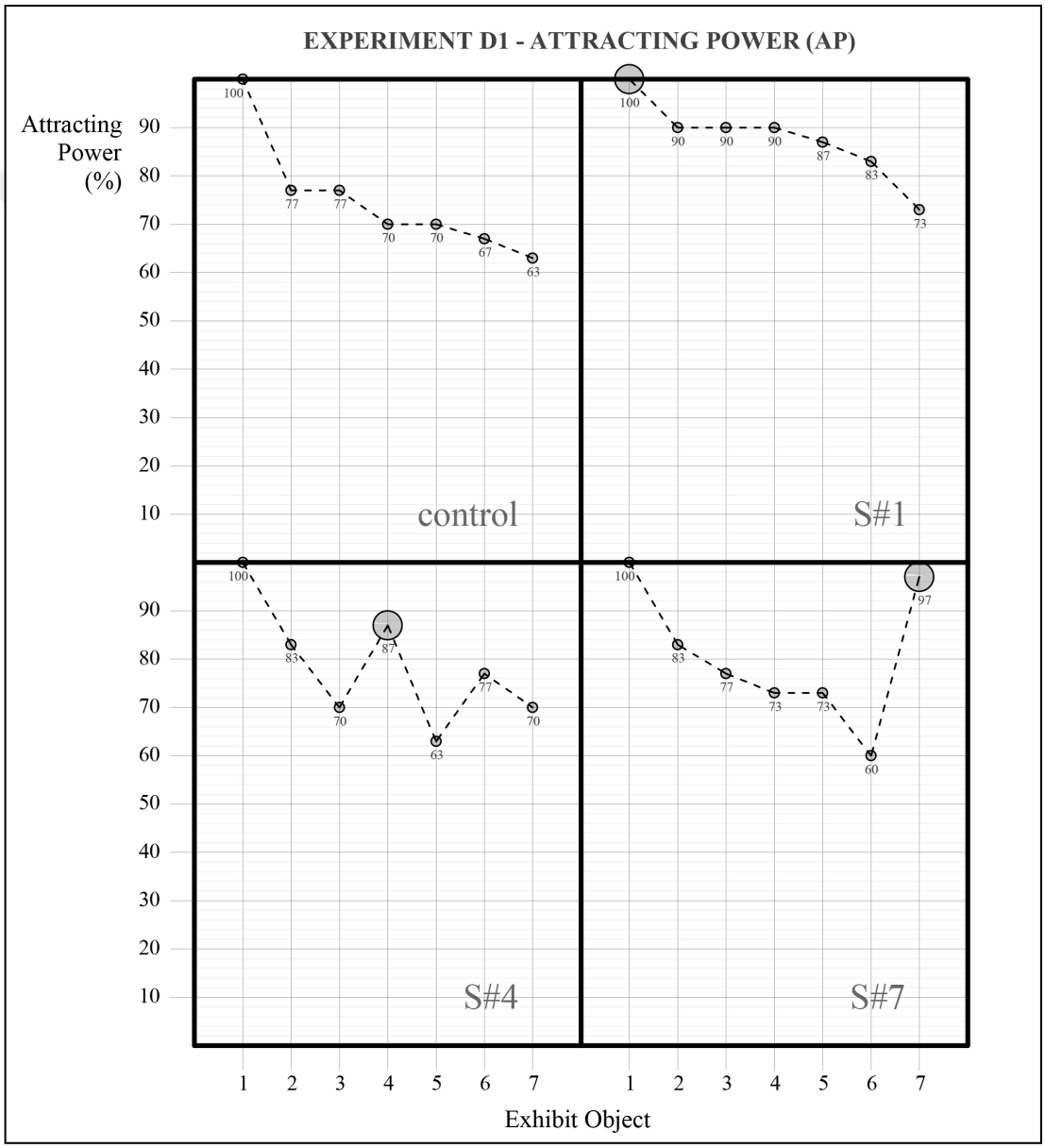


Figure 18: APs of the exhibit objects in the four conditions of Experiment D1. The large objects are indicated with larger markers.

Table 8: Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment D1

Conditions	AP of EO#1	AP of EO#7	Significance Level
Control	100%	63%	$p < .001$
S#1	100%	73%	$p = .002$
S#4	100%	70%	$p = .001$
S#7	100%	97%	$p = .40$

Table 9: Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment D1

(a) Large EO versus all the remaining objects in each condition

Condition	AP of Large EO	AP of Remaining EOs	Significance
S#1	100%	86%	$p = .02$
S#4	87%	70%	$p = .03$
S#7	97%	78%	$p = .01$

(b) Large EO versus adjacent EO(s) in each condition

Condition	Adjacent EO	AP of Large EO	AP of Adj. EO	Significance
S#1	#2	100%	90%	$p = .08$
S#4	#3	87%	70%	$p = .12$
S#4	#5	87%	63%	$p = .04$
S#7	#6	97%	60%	$p < .001$

(c) EO corresponding to large EO of each experimental condition versus adjacent EO in the control condition (CC)

Corresp. EO	Adjacent EO	AP of Corresp. EO	AP of Adj. EO	Significance
#1 in CC	#2 in CC	100%	77%	$p = .007$
#4 in CC	#3 in CC	70%	77%	$p = .55$
#4 in CC	#5 in CC	70%	70%	$p = 1$
#7 in CC	#6 in CC	63%	67%	$p = .70$

Introduction of a larger exhibit object seemed to interrupt the gradual downtrend observed in the APs in the control condition. In this respect, a z-test for two proportions indicated that the overall AP of the three large objects

(94%) was significantly greater relative to the overall AP of the 18 small objects (80%, $z = 3.31$, $p < .001$) in the three experimental conditions. In a similar vein, the differences between the APs of the large objects and the remaining objects were significant for S#1, S#4, and S#7 separately, as shown in Table 9a.

Concerning the instant decreases in terms of APs at the objects adjacent to large ones, three groups of z-tests were conducted. The first group addressed the differences between the AP values of the larger objects and the objects adjacent to them. No significant difference was found between the APs of Exhibit Objects 1 and 2 in S#1, and Exhibit Objects 3 and 4 in S#4. However, the APs of Exhibit Objects 4 and 5 in S#4 and Exhibit Objects 6 and 7 in S#7 were significantly different from each other (see Table 9b). Secondly, the same comparison was done for the APs of the objects in the control condition corresponding to the larger ones in S#1, S#4, and S#7 (i.e., Exhibit Objects 1, 4, and 7), and the objects adjacent to them. As a result of this comparison, only APs of Exhibit Objects 1 and 2 in S#1 were significantly different from each other (see Table 9c). On the other hand, unlike Experiment P1, the overall AP of the small objects adjacent to the larger objects in all three experimental conditions (i.e., #2 in S#1, #3 and #5 in S#4, and #6 in S#7; 71%) was not significantly different from the overall AP of the corresponding objects in the control condition (i.e., #2, #3, #5, and #6 in the control condition; 73%, $z = -.29$, $p = .80$). However, the overall AP of the small objects adjacent to the larger objects was significantly lower than the overall AP of the other small objects that were not adjacent to the larger objects in all three experimental conditions (83%, $z = -2.91$, $p = .004$).

5.2.2.2. Trends Observed in AHT Values

In general, the AHT trends observed in Experiment D1 resembled those in Experiment P1, except their magnitudes (Figure 19). Separate one-way ANOVAs conducted to test the significance of the differences between individual exhibit objects in terms of their AHTs for each condition yielded significant results, as shown in Table 10. Similar to those in Experiment P1, AHTs gradually decreased toward the end of the exhibition. Follow-up Scheffé tests indicated that (1) the time spent at Exhibit Object 1 was significantly greater than all the other objects in all conditions except Exhibit Object 2 in the control condition and Exhibit Object 4 in S#4, and (2) the participants spent significantly more time at Exhibit Object 7 than Exhibit Object 6 (All means and standard deviations are indicated in Figure 19; see Appendix F for the test statistics).

The significance of the gradual decrease toward the end of the exhibition was revealed in the timing data, as the participants spent significantly more time at the first objects (M = 11.78, SD = 9.28) than they did at the last objects (M = 4.14, SD = 3.82) across conditions, t (158) = 8.34, p < .001, d = 1.08. Since Levene's test indicated unequal variances, degrees of freedom were adjusted from 238 to 158 (F (1, 238) = 39.03, p < .001). Furthermore, an independent samples t-test conducted to compare the mean times spent at the first three objects (M = 7.21, SD = 7.89) with the last three objects (M = 3.68, SD = 3.55) across four conditions also revealed a significant difference, t (499) = 7.75, p < .001, d = 0.58. Degrees of freedom were adjusted from 718 to 499 since Levene's test indicated unequal variances (F (1, 718) = 81.87, p < .001).

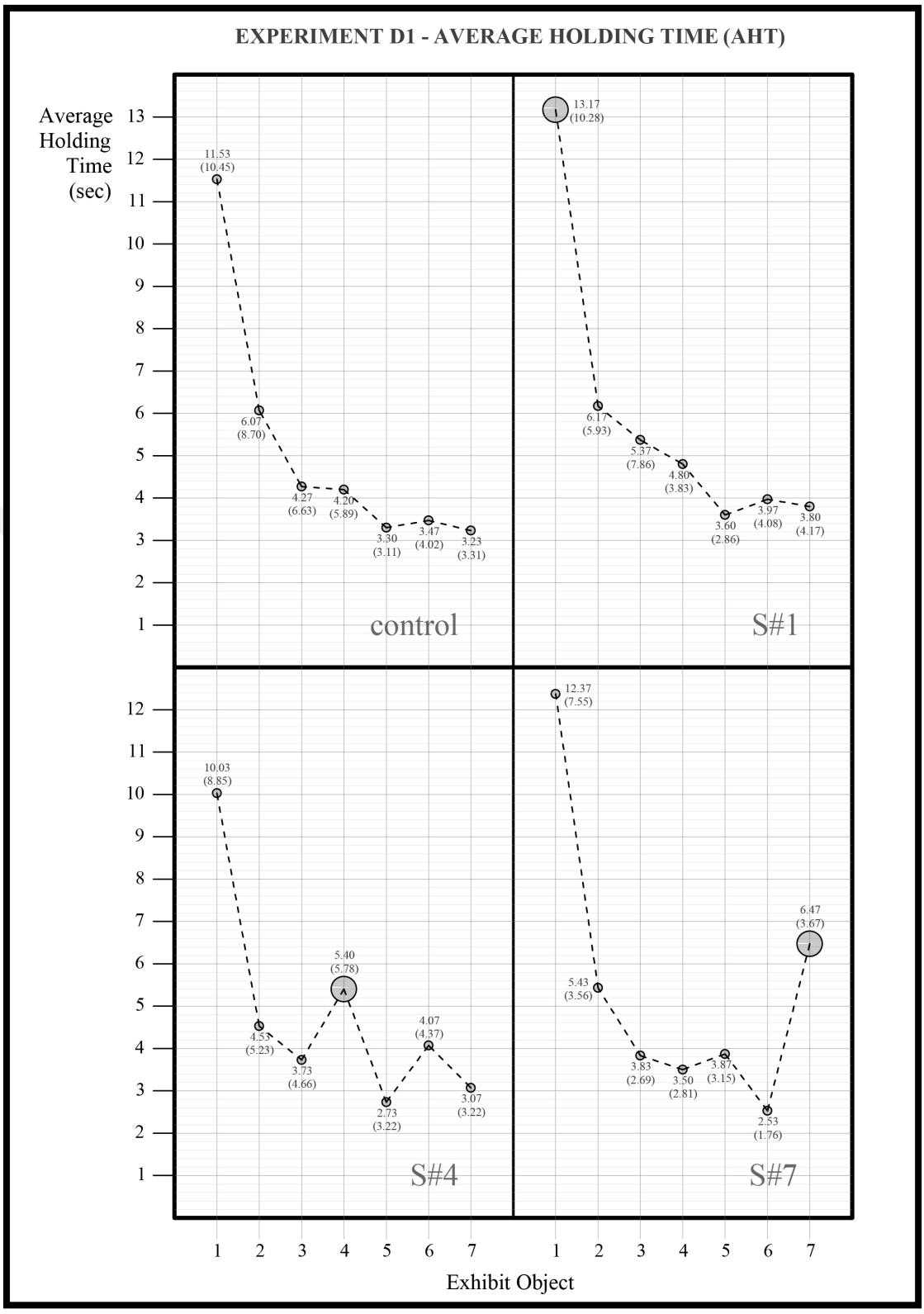


Figure 19: AHTs of the exhibit objects in the four conditions of Experiment D1. The large objects are indicated with larger markers. Standard deviations are indicated within parentheses.

Table 10: ANOVA results involving AHTs of seven EOs within each condition for Experiment D1

Conditions	F-Statistics	*MSE*	Significance	Effect Size
Control	F (6, 203) = 6.36	41.81	$p < .001$	$\eta^2 = .16$
S#1	F (6, 203) = 9.14	37.08	$p < .001$	$\eta^2 = .21$
S#4	F (6, 203) = 6.41	28.67	$p < .001$	$\eta^2 = .16$
S#7	F (6, 203) = 20.85	15.90	$p < .001$	$\eta^2 = .38$

Another independent samples t-test indicated that the mean AHT of the three larger objects (M = 8.40, SD = 7.87) was significantly greater than the mean AHT of the 18 small objects (M = 4.83, SD = 5.32) in the three experimental conditions, t (106) = 4.19, $p < .001$, d = .53. Since Levene's test indicated unequal variances [F (1, 628) = 15.62, $p < .001$], degrees of freedom were adjusted from 628 to 106.

Separate independent samples t-tests showed that the mean time spent at the four small objects adjacent to the larger ones (M = 3.79, SD = 4.39) was significantly less than;

- the mean time spent at the larger objects (M = 8.34, SD = 7.85) across the experimental conditions, t (130) = 4.95, $p < .001$, d = .72 (Note first, that Levene's test indicated unequal variances, F (1, 208) = 16.01, $p < .001$, so degrees of freedom were adjusted from 208 to 130; second, that a similar test conducted for the corresponding objects in the control condition yielded a nonsignificant result);
- the mean time spent at the other small objects that were not adjacent to any larger objects in all three experimental conditions (M = 5.16, SD = 5.55), t (239) = 2.83, p = .005, d = .27 (Note that because Levene's

test indicated unequal variances [F (1, 538) = 4.40, p = .04], degrees of freedom were adjusted from 538 to 239).

Although the mean time spent at the objects adjacent to the larger ones in the experimental conditions was less than the mean time spent at the corresponding objects (#2, #3, #5, and #6) in the control condition (M = 4.28, SD = 5.98), the difference did not reach significance, t (238) = .71, p = .48.

5.2.2.3. Overall Attention Differences between Conditions

Several analyses were conducted to find whether the presence and the ordinal position of the larger object made any difference in terms of the overall attention to the exhibitions in Experiment D1, as they did in Experiment P1. First, based on the values shown in Figure 18, the overall APs were calculated for all three experimental conditions and for the control condition. A z-test for two proportions based on those values indicated that the mean AP of the three experimental conditions (82%) was significantly higher than that of the control condition (75%, z = 2.36, p = .02), in contrast to Experiment P1. Next, the same test was repeated for all four conditions separately, comparing the APs of S#1 (88%), S#4 (79%), and S#7 (81%), with that of the control condition (75%). These analyses revealed that only the AP of S#1 (z = 3.37, p < .001) was significantly higher than that for the control condition. Although all three experimental conditions seemed to have a higher overall AP relative to the control condition, the difference did not reach significance for S#4 (z = .92, p = .36) and S#7 (z = 1.40, p = .16).

Furthermore, based on the AHT values shown in Figure 19, the mean viewing times for each of the experimental and control conditions were calculated. An independent samples t-test showed that, in general, there was no significant difference between the mean time spent at the control condition (M = 5.15, SD = 6.95) and the mean time spent at the three experimental conditions altogether (M = 5.35, SD = 5.89), t (838) = .41, p = .68. Similarly, a one-way ANOVA demonstrated nonsignificant differences between the four conditions in terms of overall AHTs, F (3, 836) = 1.07, MSE = 38.02, p = .36.

5.2.2.4. Trends Observed in Deviation Scores

Deviation scores involving AP and AHT values for Experiment D1 were also calculated by using the control data as baseline, which are reported in Table 11a and Table 11b, respectively. In contrast with the corresponding results of Experiment P1, deviations did not indicate a suppression trend in overall attention levels of the experimental conditions for Experiment D1. In fact, only two exhibit objects in S#4, and one exhibit object in S#7 yielded negative deviation scores of APs. Interestingly, both the APs and AHTs of all exhibit objects in S#1 were higher than the corresponding objects in the control condition, resulting in positive deviation scores, except for the AP of the first exhibit object (100% in both the control condition and S#1). Here, it should be noted that, the AP of the first object in the control condition was already 100%, so it was not possible for the first (and also the salient) object in S#1 to exceed this level and yield a positive deviation score.

Table 11: Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with larger objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment D1.

(a) Deviations involving AP Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**0**	+13	+13	+20	+17	+16	+10
S#4	0	+6	-7	**+17**	-7	+10	+7
S#7	0	+6	0	+3	+3	-7	**+34**

(b) Deviations involving AHT Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**+1.63**	+.10	+1.10	+.60	+.30	+.50	+.57
S#4	-1.50	-1.53	-.53	**+1.20**	-.57	+.60	-.17
S#7	+.83	-.63	-.43	-.70	+.57	-.93	**+3.23**

As can be seen in Table 11a, regarding the comparisons of pre- and post-large objects in S#4, the AP decrements (revealed in deviation scores) were equal for Exhibit Object 3 and Exhibit Object 5 [(+17) - (-7) = 24]. On the other hand, the mean AP decrement at the pre-large objects in S#4 (24) and S#7 (41) was significantly higher than the mean AP decrement at the post-large objects in S#1 (-13) and S#4 (24); that is, the means of 33 and 6, respectively ($z = 4.82$, $p < .001$). However, once again, due to the confounding effects resulting from large ordinal position differences (i.e., first and last) involving conditions S#1 and S#7, comparisons across those two conditions should be viewed with caution.

A contrasting trend was observed for AHTs, when the means of the AHT decrements for each participant were calculated for pre- and post-large objects and compared through a paired samples t-test: Although the mean viewing time

decrement involving the post-large object (M = 2.67, SD = 3.43) exceeded that of the pre-large object (M = 1.67, SD = 3.38) in S#4, the difference did not reach significance; t (29) = 1.98, p = .06, d = .29. Considering these findings, it can be inferred that the deviation scores in Experiment D1 did not indicate the effects of ordinal position, salience layout, and overall suppression as clearly as in Experiment P1.

5.2.2.5. Visual Summary of the Timing Results

Figure 20 presents a visual summary of the results obtained from each statistical test conducted for the timing data. The tests are illustrated via diagrams showing the exhibit objects that were compared through z-tests for two proportions for the AP data, and independent samples t-tests for the AHT data. The results presented in the first two rows address the gradual decrease in the amount of attention attracted by individual exhibit objects toward the end of the exhibitions; third, fourth, and fifth rows address the salience of the larger object; fifth, sixth, seventh, and eighth rows address the overshadowing effect of the larger objects on the adjacent small objects; and the last two rows address the effect of the larger objects' presence and ordinal position on the amount of attention attracted by the overall exhibition.

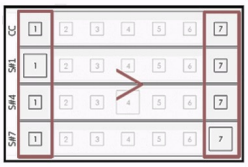
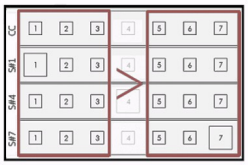
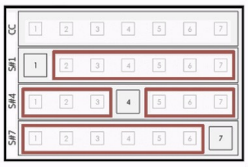
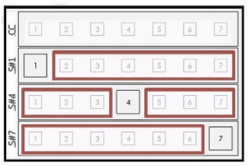
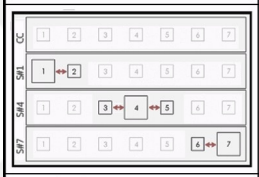
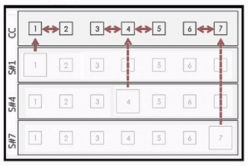
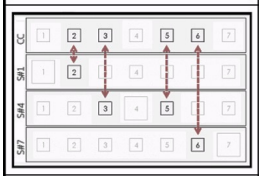
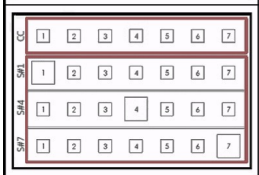
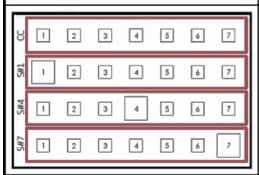
	ATTRACTING POWER (AP)	AVERAGE HOLDING TIME (AHT)
	first vs. last: → significant ($p < .001$)	first vs. last: → significant ($p < .001$)
	first three vs. last three: → significant ($p < .001$)	first three vs. last three: → significant ($p < .001$)
	three large vs. remaining eighteen: → significant ($p < .001$)	three large vs. remaining eighteen: → significant ($p < .001$)
	one large vs. remaining six: → significant ($p = .02$) → significant ($p = .03$) → significant ($p = .01$)	
	large vs. adjacent: → not significant ($p = .08$) → (not) significant ($p = .12$; $.04$) → significant ($p < .001$)	large vs. adjacent: → significant ($p < .001$)
	corresponding vs. adjacent: → significant ($p = .007$) → not significant ($p = .55$; 1) → not significant ($p = .70$)	
	adjacents vs. corresponding EOs: → not significant ($p = .80$)	adjacents vs. corresponding EOs: → not significant ($p = .48$)
	adjacents vs. non-adjacents: → significant ($p = .004$)	adjacents vs. non-adjacents: → significant ($p = .005$)
	CC vs. experimental conditions: → significant ($p = .02$) CC : 75% ECs : 82%	CC vs. experimental conditions: → not significant ($p = .68$) CC : $M = 5.15$ ECs : $M = 5.35$
	CC vs. experimental conditions: → significant ($p < .001$) - 88% → not significant ($p = .36$) - 79% → not significant ($p = .16$) - 81%	CC vs. experimental conditions: → not significant ($p = .36$)

Figure 20: Visual summary of the timing data test results for Experiment D1.

5.2.3. Behavioral Indicators

The behavioral indicators of attention and interest were identified as returning and having a closer look in Experiment D1. The frequencies of these behaviors are presented in Figure 21, which show similar trends with those in Experiment P1, as well as with the timing data of Experiment D1, such as a decline towards the end, an increase at the larger object, and slight decreases at the objects adjacent to the larger ones. Note that the frequencies are prominently higher than the frequencies observed in Experiment P1.

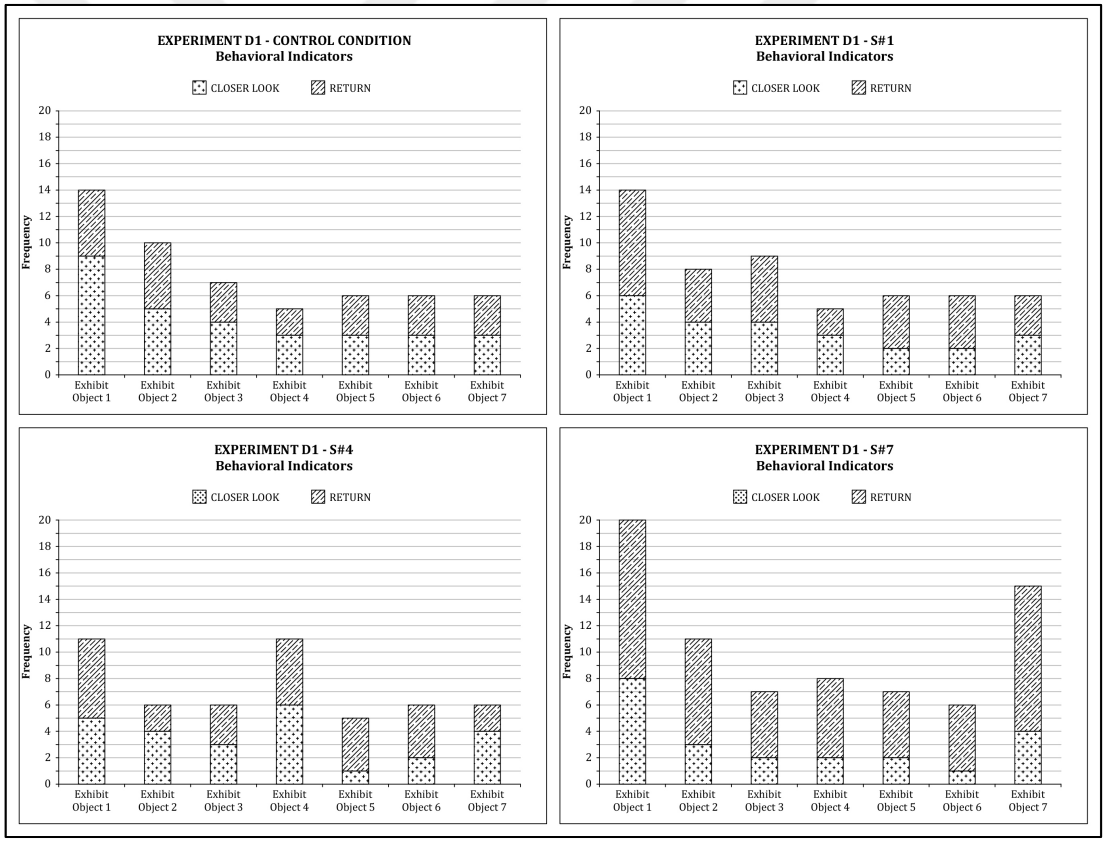


Figure 21: Frequencies of behavioral indicators observed in the four conditions of Experiment D1.

5.2.4. Interest Levels

Means and standard deviations involving interest ratings are presented in Figure 22. These scores did not indicate any trend suggesting that the larger exhibit objects could arouse a higher level of interest than others, as distinct from the interest data in Experiment P1. Using one-way ANOVAs, we did not find significant differences between the interest ratings of exhibit objects in any of the four conditions. Consistent with the ANOVA results, planned comparisons also yielded nonsignificant results.

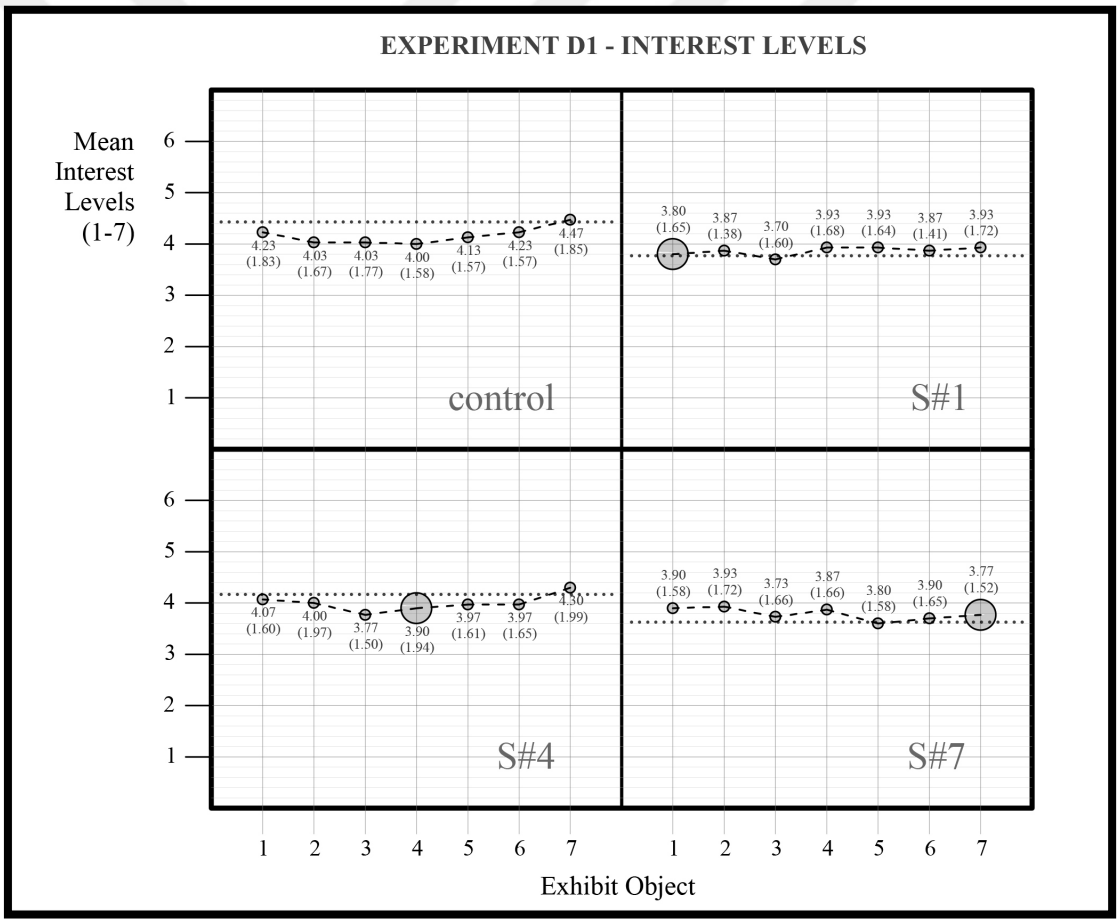


Figure 22: Mean interest levels of the exhibit objects in the four conditions of Experiment D1. The larger objects are indicated with larger markers. Standard deviations are indicated within parentheses.

In conflict with the interest results in Experiment P1, an independent samples t-test indicated no significant difference between the mean interest ratings of the three larger objects (M = 3.82, SD = 1.69) and the 18 small objects (M = 3.91, SD = 1.63) across the experimental conditions, t (628) = .49, p = .63. In fact, the mean interest rating of the small objects slightly exceeded that of the larger ones.

Analyses conducted to explore the suppression effect of adjacency to the larger object on interest ratings indicated that the mean interest rating of the adjacent objects in the three experimental conditions (M = 3.88, SD = 1.52) did not differ significantly from the mean interest ratings of [1] the three larger objects (M = 3.82, SD = 1.69, t (208) = .24, p = .81, d = .04), [2] the objects corresponding to the adjacent ones in the control condition (M = 4.11, SD = 1.63, t (238) = 1.15, p = .25, d = .15), and [3] the remaining small objects that were not adjacent to the larger objects (M = 3.92, SD = 1.66) across the three experimental conditions, t (538) = .29, p = .77, d = .03.

In addition, another independent samples t-test, conducted to explore whether a similar effect with the generalized suppression effect noted in the timing data would also be observed in the interest data, revealed that the mean of the interest ratings reported for the control condition (M = 4.16, SD = 1.68) was significantly greater than the mean of the interest ratings reported for the three experimental conditions altogether (M = 3.90, SD = 1.64), t (838) = 2.00, p = .05, d = .16, in contrast with the attention findings.

5.2.5. Preliminary Discussion on the Findings of Experiment D1

A prominent indication specific to Experiment D1 was that, the magnitudes of the effects that were observed in Experiment P1 were diminished in the digital environment. In this regard, it can be observed that AP and AHT values appear to be increased and converged within a narrower range when AHT and AP graphs of Experiments P1 and D1 are compared (Figures 18 and 19). Another distinct result was that the interest levels did not display any trends that could be associated with the two independent variables, being layout and exhibit object size. For example, unlike in Experiment P1, the larger objects were not rated as the most interesting within their conditions, which might be related with the difference between the nature of behavioral responses and conscious ratings. Also, it might be a consequence of viewing the exhibition in a digital environment, which might have reduced the influence of size regarding of salience perception – maybe because of the ease of zooming in the digital media – while they rated the objects in terms of interestingness (although size differences were apparent in the images used in the online questionnaire for the interest ratings). In addition, the suppression effect of the salient object on the overall attention to the exhibition was not observed in Experiment D1. In fact, the overall AP of the control condition (75%) was lower than the overall AP of the three experimental conditions together (82%), and separately (88% for S#1, 79% for S#4, and 81% for S%7), although the differences were not significant for S#4 and S#7 (Hypotheses 2 and 4). Moreover, neither the AHTs nor the interest ratings pointed to a general suppression effect of the salient object, such that there was no significant difference between the overall AHTs of the

four conditions, and the mean interest rating of the control condition was higher than the mean interest rating of the three experimental conditions.

Besides the above findings specific to Experiment D1, some results accorded with those in Experiment P1. First, the effects of object satiation or exit attraction were again revealed through the timing data, but not through the interest ratings. The gradual decreases in attention were clearly observed in the control condition, which yielded a similar attention distribution scheme with the control condition of Experiment P1. Analyses of the timing data indicated that the first exhibit objects were likely to attract and hold more attention than the last ones in all the conditions. Comparisons between the first three and the last three exhibit objects in terms of APs and AHTs also revealed similar results.

Moreover, the conflict between the effects of exhibit object size and object satiation or exit attraction was revealed once again in the timing data. In the experimental conditions, the introduction of the larger object altered the way attention was distributed to objects. For example, the first object in S#1 was also the larger object; therefore it was not affected by object satiation or exit attraction negatively. As a result, it was the object that attracted the highest amount of attention in S#1. However in S#4 and S#7, large size acted against object satiation or exit attraction, and caused undulations in the AP and AHT graphs (Figures 18 and 19). As expected, both the AP and the AHT values involving the three larger objects were significantly greater than the ones for the 18 small objects across conditions, supporting Hypothesis 1. This finding

shows that the results of previous research on object salience (e.g., Bitgood, 2014; Bitgood et al., 1986; Bitgood & Patterson, 1987; Bitgood et al., 1988; Donald, 1991; Marcellini & Jenssen, 1988) may be applicable for the digital exhibitions as well.

In addition, the larger objects affected the adjacent objects negatively in terms of their capability of attracting and holding attention (see Figures 17 and 18), which was again a finding in line with those in Experiment P1 (Hypothesis 3). Although this trend was apparent in the AP and AHT graphs, it was not significant in all cases. For example, the APs of only Exhibit Object 5 in S#4 and Exhibit Object 6 in S#7 were significantly lower than the APs of the larger objects within their own conditions; unlike Exhibit Object 2 in S#1 and Exhibit Object 3 in S#4, which were viewed by significantly fewer visitors. Also, the overall AP of the small objects adjacent to the larger objects was not significantly lower than the overall AP of the corresponding objects in the control condition. Moreover, the deviation scores did not indicate a difference between the pre- and post-large objects in terms of AP and AHT decrements compared to the larger object. These nonsignificant results might be caused by the narrowed range of the APs and AHTs, closing up the differences between the timing data regarding different exhibit objects. Nevertheless, the negative influence of adjacency to a larger object seems to be suppressed in the digital environment.

The four conditions in Experiment D1 yielded distinct schemes of attention distribution, as those in Experiment P1 did, pointing to the importance of

considering the interrelationships between ordinal position, size, and proximity effects. Again, the influence of object satiation and exit attraction seemed to counteract the effects of object salience depending on the ordinal position of the larger object in the set. For example, as explained above, the follow up Scheffé tests revealed that the first objects in all four conditions held the visitors' attention for longer than the other object in the same conditions, except Exhibit Object 2 in the control condition and Exhibit Object 4 in S#4. There was no significant difference between the AHTs of the first and the second object in the control condition, probably because the downtrend was not interrupted by object salience, whereas in S#1, the first (larger) object overshadowed the second (adjacent) one, resulting in a significant AHT difference between them. Also, in S#4, the attention-holding capability of Exhibit Object 4 was enhanced by its larger size, but damaged by object satiation or exit attraction, which resulted in an AHT value close to that of the first exhibit object. These examples indicate that, the effects of salience should be considered together with effects such as object satiation and exit attraction in digital exhibitions as well, supporting the discussion for Experiment P1.

Last, the interest ratings showed an even lower degree of congruence with the timing data in Experiment D1 than they did in Experiment P1. These ratings demonstrated none of the trends observed in the timing data, such that they seemed to be almost the same for all the exhibit objects in all conditions with an average score around 4 out of 7.

5.3. Experiment D2: Testing Three-Dimensionality in the Digital Medium

Experiment D2 was conducted in the Contemporary Arts Center in December 2017. This section includes the description of Experiment D2 in terms of [1] demographic data, [2] analysis of the timing data, [3] behavioral indicators, and [4] interest levels in the individual exhibit objects and the exhibition acquired through the questionnaire. Next, a preliminary discussion of these four groups of findings is presented.

5.3.1. Demographic Data

Thirty participants visited the exhibition and completed the questionnaires in each of S#1, S#4 and S#7 (N_{TOTAL} = 90). The control condition in Experiment D2 was used as the control condition for Experiment D2 as well, since it consisted of only equal-sized and two-dimensional objects (see section 5.2.1). All of the visitors that viewed the exhibition and completed a questionnaire were included, since they were all within the age range of 18 and 65, none of them have seen the exhibit objects before, all had been using touch-screen devices in their daily lives. The ages of the respondents ranged between 18 and 61 for S#1 (M = 35.07, SD = 14.06), between 18 and 61 for S#4 (M = 34.60, SD = 10.94), and between 18 and 62 for S#7 (M = 37.77, SD = 12.19). Personal data provided by the participants in the questionnaires are presented in Table 12, which represents the distribution of female and male visitors, those below and above the age of 45, highest education levels, exhibition visiting frequencies, and first-time or repeating visitors.

Table 12: Frequencies and percentages of demographic categories in each condition of Experiment D2.

	Control	S#1	S#4	S#7	TOTAL
Gender					
Female	17 (57%)	15 (50%)	14 (47%)	16 (53%)	**62 (52%)**
Male	13 (43%)	15 (50%)	16 (53%)	14 (47%)	**58 (48%)**
Age					
<45	22 (73%)	22 (73%)	25 (83%)	20 (67%)	**89 (74%)**
≥45	8 (27%)	8 (27%)	5 (17%)	10 (33%)	**31 (26%)**
Highest Education Level					
High-School Diploma	7 (23%)	3 (10%)	5 (17%)	2 (7%)	**17 (14%)**
Bachelor's Degree	19 (64%)	24 (80%)	17 (56%)	20 (67%)	**80 (67%)**
Post-Graduate Degree	4 (13%)	3 (10%)	8 (27%)	8 (26%)	**23 (19%)**
Exhibition Visiting Frequencies					
Less than Once a Year	2 (7%)	1 (3%)	1 (3%)	2 (7%)	**6 (5%)**
1 to 5 Times a Year	13 (43%)	14 (47%)	17 (57%)	13 (43%)	**57 (48%)**
More than 5 Times a Year	15 (50%)	15 (50%)	12 (40%)	15 (50%)	**57 (48%)**
Previous Experience with Space					
First-Time Visitors	7 (23%)	4 (13%)	4 (13%)	2 (7%)	**17 (14%)**
Visited Before	23 (77%)	26 (87%)	26 (87%)	28 (93%)	**103 (86%)**
TOTAL	**30**	**30**	**30**	**30**	**120**

Aiming to explore if viewing durations and interest ratings varied according to the personal information reported by the participants, independent samples t-tests for gender, age (below and above 45), and previous experiences with the venue; and one-way ANOVAs for educational levels and exhibition visiting

habits were conducted. These tests showed that these personal variables did not have significant effects on viewing durations or interest levels at $p = .05$ level (see Appendix G).

In addition, two independent samples t-tests were conducted to find whether the perceived presence levels (*1 to 5 = low; 6 and 7 = high*) influenced the viewing durations and the interest ratings of the participants. The test results indicated that, the viewing durations of participants with low perceived presence scores ($M = 5.95$, $SD = 4.20$) did not differ from those with high perceived presence scores ($M = 5.35$, $SD = 2.96$), $t\ (88) = .57$, $p = .57$, $d = .16$. On the other hand, those with high levels of perceived presence ($M = 4.60$, $SD = 1.05$) found the exhibit objects significantly more interesting than those with low perceived presence levels ($M = 3.83$, $SD = 1.09$), $t\ (88) = 2.68$, $p = .009$, $d = .72$.

5.3.2. Analysis of the Timing Data

In the same way as Experiment D1, the timing data were obtained from the screen-recordings of the tablet computer. Timing data were converted into AP and AHT values as described previously. The analyses of the timing data are presented in this section.

5.3.2.1. Trends Observed in AP Values

APs for Experiment D2 were obtained in the same way as in Experiment D1 (see section 5.2.2.1). Distinctively, APs of the exhibit objects were generally

increased compared to those in Experiment P1 and D1. To start with, the rate of the gradual decrease towards the end of the exhibition in terms of AP values seemed to diminish in all of the conditions. The introduction of a 2.5D object to each experimental condition caused an instant increase at the 2.5D object, so the gradual decrease was interrupted and became even less distinguishable than in the uninterrupted situation in the control condition, as seen in Figure 23. Nevertheless, mean AP of the earlier three objects across all conditions (90%) exceeded the level for the later three objects across all conditions (78%, $z = 4.41$, $p < .001$). Moreover, the results of a z-test for two proportions revealed significant differences between the AP values of the first and last exhibit objects in all conditions, except S#7 (see Table 13). It should also be noted that, in every condition, Exhibit Object 1 yielded the highest AP value by 100%, as in Experiment D1. Exhibit Object 7 in S#7 was the only object with a 100% AP other than the first appearing objects in all conditions. Nevertheless, the mean AP of the first objects (100%) significantly exceeded the mean AP of the last objects (79%) across conditions, $z = 5.28$, $p < .001$.

Table 13: Differences between the first and the last exhibit objects (EO) in each condition in terms of attracting power (AP) for Experiment D2

Conditions	AP of EO#1	AP of EO#7	Significance Level
Control	100%	63%	$p < .001$
S#1	100%	77%	$p = .005$
S#4	100%	77%	$p = .005$
S#7	100%	100%	$p = 1$

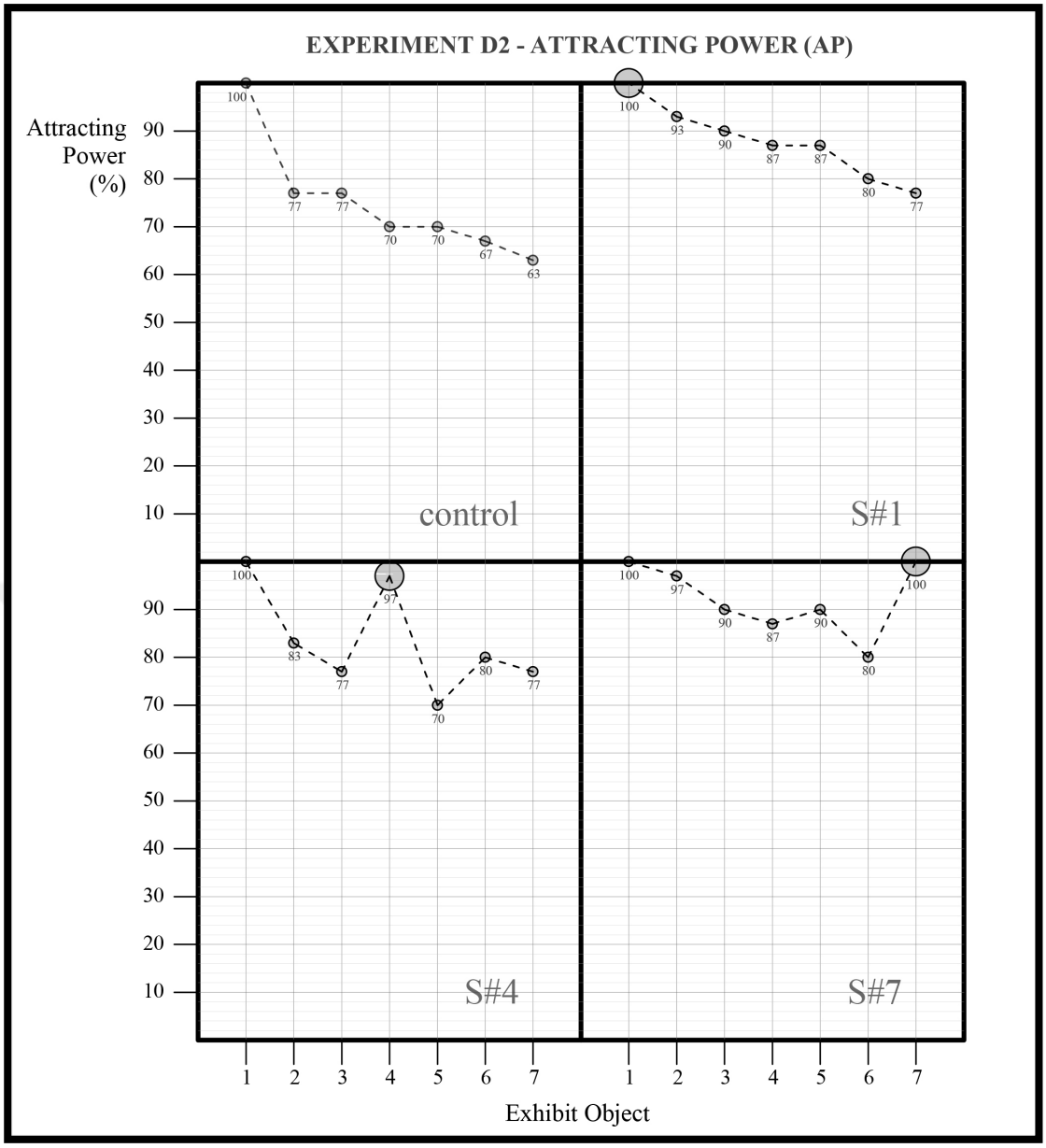


Figure 23: APs of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers.

Similar to Experiment P1 and D1, instant increases were observed in the AP values of the 2.5D objects (i.e., Exhibit Object 1 in S#1, Exhibit Object 4 in S#4, and Exhibit Object 7 in S#7), and sudden decreases in the AP values of the objects adjacent to 2.5D ones (i.e., Exhibit Object 2 in S#1, Exhibit Objects 3 and 5 in S#4, and Exhibit Object 6 in S#7). These trends were observed at similar

rates with those in Experiment D1. Addressing the attention increases at the salient objects, a z-test for two proportions indicated that the overall AP value of the three large objects (99%) was significantly greater relative to the overall AP value of the 18 small objects (85%, $z = 3.65$, $p < .001$) in the three experimental conditions. Considering the experimental conditions separately, the difference between the AP values of the large object and the remaining objects were significant in S#1 and S#4, but not in S#7 (see Table 14a).

Table 14: Comparisons of exhibit objects (EO) in terms of their attracting power (AP) values within conditions for Experiment D2

(a) 2.5D EO versus all the remaining objects in each condition

Condition	AP of 2.5D EO	AP of Remaining EOs	Significance
S#1	100%	86%	$p = .03$
S#4	97%	81%	$p = .03$
S#7	100%	91%	$p = .08$

(b) 2.5D EO versus adjacent EO(s) in each condition

Condition	Adjacent EO	AP of 2.5D EO	AP of Adj. EO	Significance
S#1	#2	100%	93%	$p = .15$
S#4	#3	97%	77%	$p = .02$
S#4	#5	97%	70%	$p = .006$
S#7	#6	100%	80%	$p = .01$

(c) EO corresponding to 2.5D EO of each experimental condition versus adjacent EO in the control condition (CC)

Corresp. EO	Adjacent EO	AP of Corresp. EO	AP of Adj. EO	Significance
#1 in CC	#2 in CC	100%	77%	$p = .007$
#4 in CC	#3 in CC	70%	77%	$p = .55$
#4 in CC	#5 in CC	70%	70%	$p = 1$
#7 in CC	#6 in CC	63%	67%	$p = .70$

Concerning the instant decreases in terms of AP values at the exhibit objects adjacent to 2.5D ones, the AP values of the 2.5D objects were compared with the objects adjacent to them. No significant difference was found between the AP values of Exhibit Objects 1 and 2 in S#1, but the AP values of Exhibit Objects 3 and 4, and 4 and 5 in S#4, and Exhibit Objects 6 and 7 in S#7 were significantly different (see Table 14b). Secondly, the same comparison was done for the AP values of the objects in the control condition corresponding to 2.5D ones in S#1, S#4, and S#7 (i.e., Exhibit Objects 1, 4, and 7), and the objects adjacent to them. As a result of this comparison, only the AP values of Exhibit Objects 1 and 2 in S#1 were found to be significantly different from each other, revealing an opposite trend to the same analyses done for the experimental conditions (see Table 14c). This conflict might be demonstrating the influence of the 2.5D object's presence on the adjacent objects in the experimental conditions. However, in line with Experiment D1, there was no significant difference between the overall AP of the 2D objects adjacent to the 2.5D objects in all three experimental conditions (i.e., #2 in S#1, #3 and #5 in S#4, and #6 in S#7; 80%) and the overall AP of the corresponding objects in the control condition (i.e., #2, #3, #5, and #6 in the control condition; 73%, $z = 1.37$, $p = .17$). On the other hand, the overall AP of the 2D objects adjacent to the 2.5D objects was significantly lower than the overall AP of the other 2D objects that were not adjacent to the 2.5D objects in all three experimental conditions (87%, $z = -2.04$, $p = .04$).

5.3.2.2. Trends Observed in AHT Values

Overall, the trends in Experiment D2 resembled those in Experiment P1 and D1 to a high extent, but the intensities of the trends were increased (Figure 24). As in Experiment P1 and D1, the variations in AHTs within and between conditions were again similar to those in APs. Likewise, there occurred gradual decreases towards the end of the exhibition in AHTs in all of the conditions, increases at the salient objects, and also steep falls at the exhibit objects adjacent to salient ones; these effects were evidently magnified in the case of Experiment D2, compared to the corresponding effects in Experiments P1 and D1. Distinctly, the first objects in the three conditions of Experiment D2 did not receive the highest amount of attention from the visitors within their conditions, except for Exhibit Object 1 in S#1, which was also the salient (2.5D) object in its condition. The introduction of the 2.5D objects disrupted the steady downtrends in S#1, S#4, and S#7, in Experiment D2 as well, when compared to the control condition in the digital environment.

Table 15: ANOVA results involving AHTs of seven EOs within each condition for Experiment D2

Conditions	F-Statistics	*MSE*	Significance	Effect Size
Control	F (6, 203) = 6.36	41.81	$p < .001$	$\eta^2 = .16$
S#1	F (6, 203) = 15.77	24.75	$p < .001$	$\eta^2 = .32$
S#4	F (6, 203) = 6.61	59.72	$p < .001$	$\eta^2 = .16$
S#7	F (6, 203) = 21.80	24.10	$p < .001$	$\eta^2 = .39$

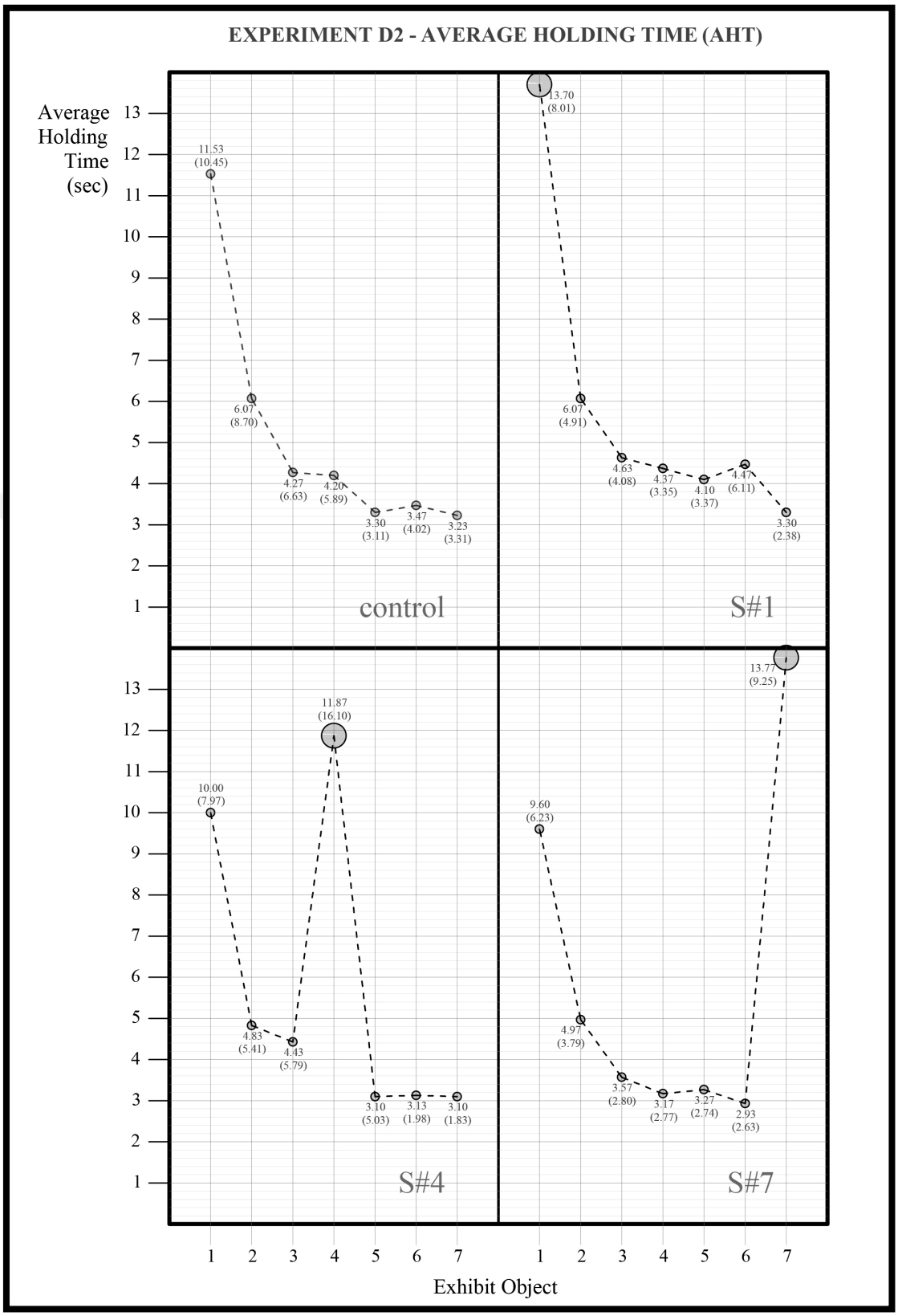


Figure 24: AHTs of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers. Standard deviations are indicated within parentheses.

Separate one-way ANOVAs conducted to test the significance of the differences between individual exhibit objects in terms of their AHTs for each condition yielded significant results, as shown in Table 15. Follow-up Scheffé tests indicated that;

- in S#1, participants spent significantly more time at Exhibit Object 1 (2.5D object) than all other six objects ($p < .001$ for all);
- in S#4, participants spent significantly more time at Exhibit Object 4 than they did at Exhibit Objects 3 ($p = .04$), Exhibit Object 5 ($p = .005$), Exhibit Object 6 ($p = .005$), and Exhibit Object 7 ($p = .005$);
- in S#7, participants spent significantly more time at Exhibit Object 1 than the rest of the exhibit objects, except Exhibit Object 7. In addition, the mean time spent at Exhibit Object 7 was also significantly higher than the mean time spent at Exhibit Objects 2, 3, 4, 5, and 6 (All means and standard deviations are indicated in Figure 24; see Appendix H for the test statistics).

In order to explore the significance of the gradual decrease, an independent samples t-test was conducted across conditions, which showed that the overall AHT of the first objects ($M = 11.21$, $SD = 8.32$) was significantly higher than that of the last objects ($M = 5.85$, $SD = 6.84$), $t\ (229) = 5.45$, $p < .001$, $d = 0.70$. Degrees of freedom were adjusted from 238 to 229 since Levene's test indicated unequal variances ($F\ (1, 238) = 7.76$, $p = .006$). Furthermore, an independent samples t-test conducted to compare the mean times spent at the first three

objects (M = 6.97, SD = 7.20) with the last three objects (M = 4.26, SD = 5.14) across four conditions also revealed a significant difference, t (649) = 5.81, p < .001, d = 0.43. Degrees of freedom were adjusted from 718 to 649 since Levene's test indicated unequal variances (F (1, 718) = 36.25, p < .001).

Another independent samples t-test indicated that the mean AHT value of the three salient (2.5D) objects (M = 13.11, SD = 11.58) was significantly greater than the mean AHT value of the 18 non-salient (2D) objects (M = 4.61, SD = 4.77) in the three experimental conditions, t (94) = 6.87, p < .001, d = .96. Since Levene's test indicated unequal variances [F (1, 628) = 73.33, p < .001], degrees of freedom were adjusted from 628 to 94.

Addressing the effect of adjacency to a salient object, an independent samples t-test showed that the mean time spent at the 2D objects adjacent to 2.5D ones (M = 4.13, SD = 4.85) was significantly less than the mean time spent at the 2.5D objects (M = 13.11, SD = 11.58) across the experimental conditions, t (112) = 6.92, p < .001, d = .17 (Note that Levene's test indicated unequal variances, F (1, 208) = 27.81, p < .001, so degrees of freedom were adjusted from 208 to 112). On the other hand, another independent samples t-test showed that there was no difference between the mean time spent at the 2D objects adjacent to the 2.5D ones, and the mean time spent at the other 2D objects that were not adjacent to 2.5D objects in all three experimental conditions (M = 4.75, SD = 4.75), t (538) = 1.25, p = .21, d = .13. Although the mean time spent at the objects adjacent to the 2.5D ones in the experimental conditions was less than

the mean time spent at the corresponding objects (#2, #3, #5, and #6) in the control condition (M = 4.28, SD = 5.98), the difference did not reach significance, t (238) = .20, p = .84.

5.3.2.3. Overall Attention Differences between Conditions

In order to find whether the presence and the ordinal position of the 2.5D object made any difference in terms of the overall attention to the exhibitions in Experiment D2, another group of analyses were conducted. First, based on the values shown in Figure 23, the overall AP values were calculated for all three experimental conditions and for the control condition. In congruence with Experiment D1, but in contrast with Experiment P1, a z-test for two proportions based on those values indicated that the mean AP of the three experimental conditions (88%) was significantly higher than that of the control condition (75%, z = 4.45, p < .001). Next, the same test was repeated for all four conditions separately, which indicated that the overall AP of the control condition (75%) was significantly lower than the overall APs of S#1 (88%, z = -3.37, p < .001), S#4 (83%, z = -2.16, p = .03), and S#7 (92%, z = -4.71, p < .001).

Furthermore, based on the AHT values shown in Figure 24, the mean viewing times for each of the experimental and control conditions were calculated. An independent samples t-test showed that, in general, there was no significant difference between the mean time spent at the control condition (M = 5.15, SD = 6.95) and the mean time spent at the three experimental conditions altogether (M = 5.83, SD = 6.88), t (838) = -1.23, p = .22. Similarly, a one-way ANOVA

indicated nonsignificant differences between the four conditions in terms of overall AHTs, F (3, 836) = .51, MSE = 47.69, p = .67.

5.3.2.4. Trends Observed in Deviation Scores

As in Experiment P1 and D1, deviation scores of Experiment D2 involving AP and AHT values were also calculated by using the control data as baseline, which are reported in Table 16a and Table 16b, respectively. Deviation scores in Experiment D2 did not indicate a suppression trend in overall attention levels of the experimental conditions, in contrast with the trends observed in Experiment P1. In fact, none of the experimental objects yielded negative deviation scores of APs. Interestingly, both the APs and AHTs of all exhibit objects in S#1 were higher than the corresponding objects in the control condition, resulting in positive deviation scores, except for the AP of the first exhibit object, and the AHT of the second exhibit object. Here, it should be noted that, the AP of the first object in the control condition was already 100%, so it was not possible for the first object in S#1 to exceed this level and yield a positive deviation score.

Regarding the comparisons of pre- and post-salient objects, as can be seen in Table 16a, in S#4, the AP decrements (revealed in deviation scores) were equal for Exhibit Object 3 and Exhibit Object 5 [(+27) - 0) = 27]. It should also be noted that, except the first objects in each condition, the only exhibit objects with zero deviation from the control objects were those adjacent to the 2.5D object in S#4 (i.e., Exhibit Objects 3 and 5). The mean AP decrement at the pre-

salient objects in S#4 (27) and S#7 (24) was higher than the mean AP decrement at the post-salient objects in S#1 (-16) and S#4 (27); that is, the means of 26 and 22, respectively. However, this difference did not reach significance (z = .66, p = .51). Once again, due to the confounding effects resulting from large ordinal position differences (i.e., first and last) involving conditions S#1 and S#7, comparisons across those two conditions should be viewed with caution.

Table 16: Deviations in the (a) AP, and (b) AHT values of the exhibit objects (EO) in conditions with 2.5D objects (S#1, S#4, and S#7) from those of the corresponding EOs in the control condition in Experiment D2.

(a) Deviations involving AP Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**0**	+16	+13	+17	+17	+13	+14
S#4	0	+6	0	**+27**	0	+13	+14
S#7	0	+20	+13	+17	+20	+13	**+37**

(b) Deviations involving AHT Values

Condition	EO1	EO2	EO3	EO4	EO5	EO6	EO7
S#1	**+2.17**	0	+.36	+.17	+.80	+1.00	+.07
S#4	-1.53	-1.23	+.17	**+7.67**	-.20	-.33	-.13
S#7	-1.93	-1.10	-.70	-1.03	-.03	-.54	**+10.53**

Similarly, for AHTs, the difference between pre- and post-salient decrements was not significant according to a paired samples t-test, although the viewing time decrement involving the post-salient object (M = 2.67, SD = 3.43) exceeded that of the pre-salient object (M = 1.67, SD = 3.38) in S#4; t (29) = 1.98, p = .06, d = .29. Considering these findings, the deviation scores in Experiment D2 did not

support the effects of ordinal position, salience layout, and overall suppression as strongly as in Experiment P1.

5.3.2.5. Visual Summary of the Timing Results

A visual summary of the results obtained from each statistical test conducted for the timing data is presented in Figure 25. The exhibit objects that were compared through z-tests for two proportions for the AP data, and independent samples t-tests for the AHT data are illustrated via diagrams including each condition in Experiment D2. The results presented in the first two rows address the gradual decrease in the attention attracted by individual exhibit objects toward the end of the exhibitions; third, fourth, and fifth rows address the salience of the 2.5D object; fifth, sixth, seventh, and eighth rows address the overshadowing effect of the 2.5D objects on the adjacent 2D objects; and the last two rows address the effect of the 2.5D objects' presence and ordinal position on the attention to the overall exhibition.

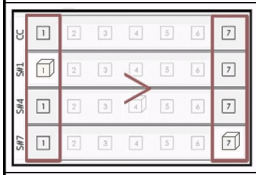
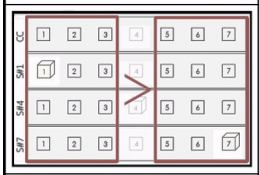
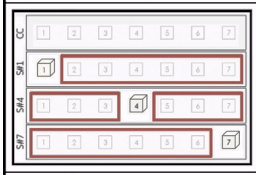
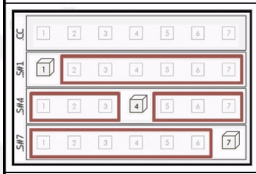
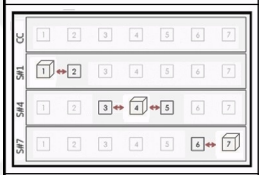
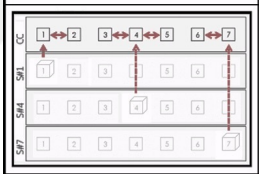
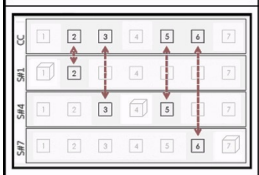
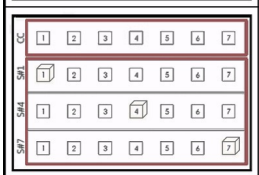
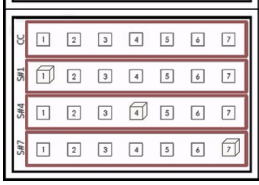
	ATTRACTING POWER (AP)	AVERAGE HOLDING TIME (AHT)
	first vs. last: → significant ($p < .001$)	first vs. last: → significant ($p < .001$)
	first three vs. last three: → significant ($p < .001$)	first three vs. last three: → significant ($p < .001$)
	three 2.5D vs. remaining eighteen: → significant ($p < .001$)	three 2.5D vs. remaining eighteen: → significant ($p < .001$)
	one 2.5D vs. remaining six: → significant ($p = .03$) → significant ($p = .03$) → not significant ($p = .08$)	
	2.5D vs. adjacent: → not significant ($p = .15$) → significant ($p = .02$; $.006$) → significant ($p = .01$)	2.5D vs. adjacent: → significant ($p < .001$)
	corresponding vs. adjacent: → significant ($p = .007$) → not significant ($p = .55$; 1) → not significant ($p = .70$)	
	adjacents vs. corresponding EOs: → not significant ($p = .17$)	adjacents vs. corresponding EOs: → not significant ($p = .84$)
	adjacents vs. non-adjacents: → significant ($p = .04$)	adjacents vs. non-adjacents: → not significant ($p = .21$)
	CC vs. experimental conditions: → significant ($p < .001$) CC : 75% ECs : 88%	CC vs. experimental conditions: → not significant ($p = .22$) CC : $M = 5.15$ ECs : $M = 5.83$
	CC vs. experimental conditions: → significant ($p < .001$) - 88% → significant ($p = .03$) - 83% → not significant ($p < .001$) - 92%	CC vs. experimental conditions: → not significant ($p = .67$)

Figure 25: Visual summary of the timing data test results for Experiment D2.

5.3.3. Behavioral Indicators

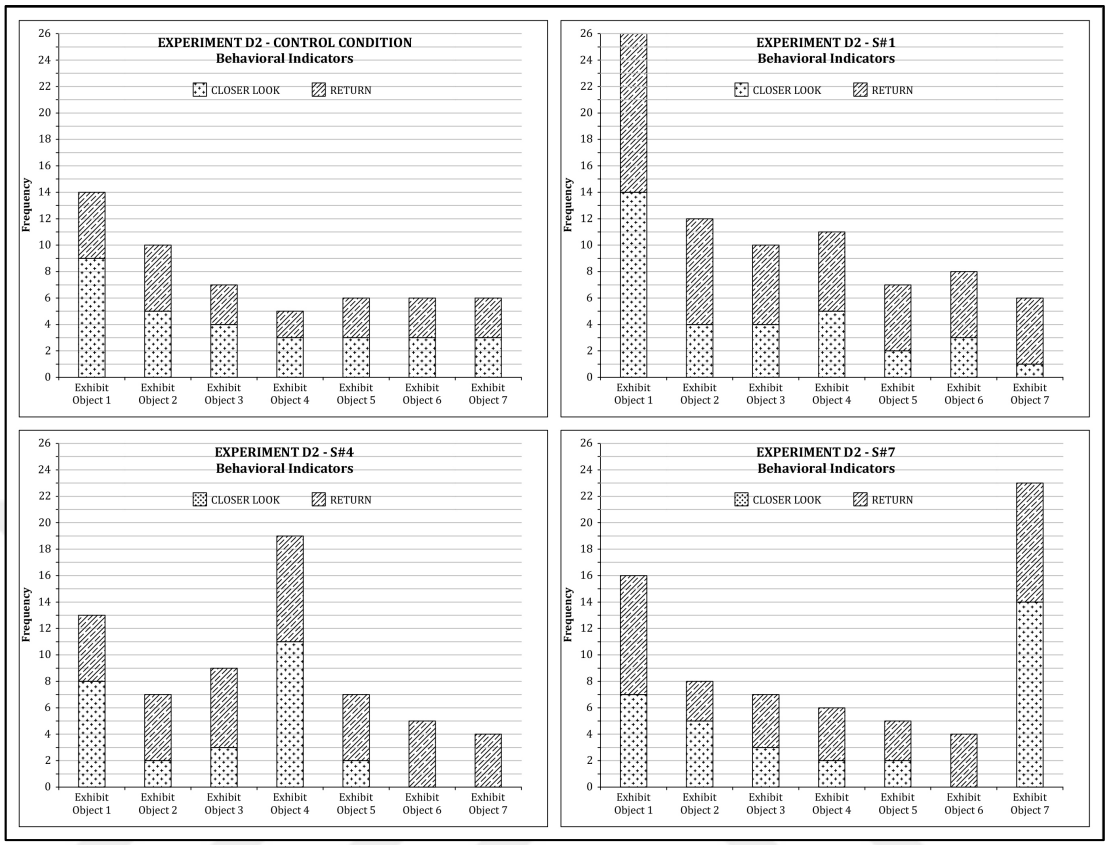


Figure 26: Frequencies of behavioral indicators observed in the four conditions of Experiment D2.

The behavioral indicators of attention and interest were identified as returning and having a closer look in Experiment D2. The frequencies of these behaviors are presented in Figure 26, which are consistent with those in Experiments P1 and D1, as well as with the timing results, as they indicate such trends as a decline towards the end, an increase at the salient object, and slight decreases at the objects adjacent to the salient one. Note that the contrasts between the frequencies at salient, non-salient, and adjacent objects are prominently larger than the contrasts observed in Experiment D1.

5.3.4. Interest Levels

Unlike those in Experiment D1, the interest ratings in Experiment D2 tended to indicate that the salient exhibit objects could arouse a higher level of interest than others, which was also the case in Experiment P1 (Figure 27). They also signified that the presence or the position of the salient exhibit object among the set could be influencing the distribution of interest to individual exhibit objects. However, the overall rating did not seem to differ between experimental conditions. Separate one-way ANOVA's for the three experimental conditions indicated significant differences between the interest ratings of the individual exhibit objects (see Table 17).

Table 17: ANOVA results involving the interest ratings of seven EOs within the experimental conditions of Experiment D2

Conditions	F-Statistics	*MSE*	Significance	Effect Size
S#1	F (6, 203) = 2.68	2.18	p = .02	η^2 = .07
S#4	F (6, 203) = 4.95	2.15	p < .001	η^2 = .13
S#7	F (6, 203) = 3.48	2.06	p = .003	η^2 = .09

An independent samples t-test indicated that the participants rated the 2.5D objects (M = 5.10, SD = 1.53) as significantly more interesting than the other 18 objects (M = 3.80, SD = 1.44) across the three experimental conditions, t (628) = 7.90, p < .001, d = .88. The mean interest rating of the adjacent objects in the three experimental conditions (M = 3.77, SD = 1.34) was significantly lower than the mean of the three 2.5D objects (M = 5.10, SD = 1.53, t (208) = 6.72, p < .001, d = .93). Analyses conducted to explore the suppression effect of adjacency to the 2.5D object on interest ratings indicated that the mean interest

rating of the adjacent objects in the three experimental conditions did not differ from both the mean of the objects corresponding to the adjacent ones in the control condition (M = 4.11, SD = 1.63), t (23) = 1.78, p = .08, d = .23 (Note that because Levene's test indicated unequal variances [F (1, 238) = 7.09, p = .008], degrees of freedom were adjusted from 238 to 230), and also from the mean interest rating of the remaining 2D objects that were not adjacent to the 2.5D objects (M = 3.80, SD = 1.46) across the three experimental conditions, t (538) = .26, p = .80, d = .02.

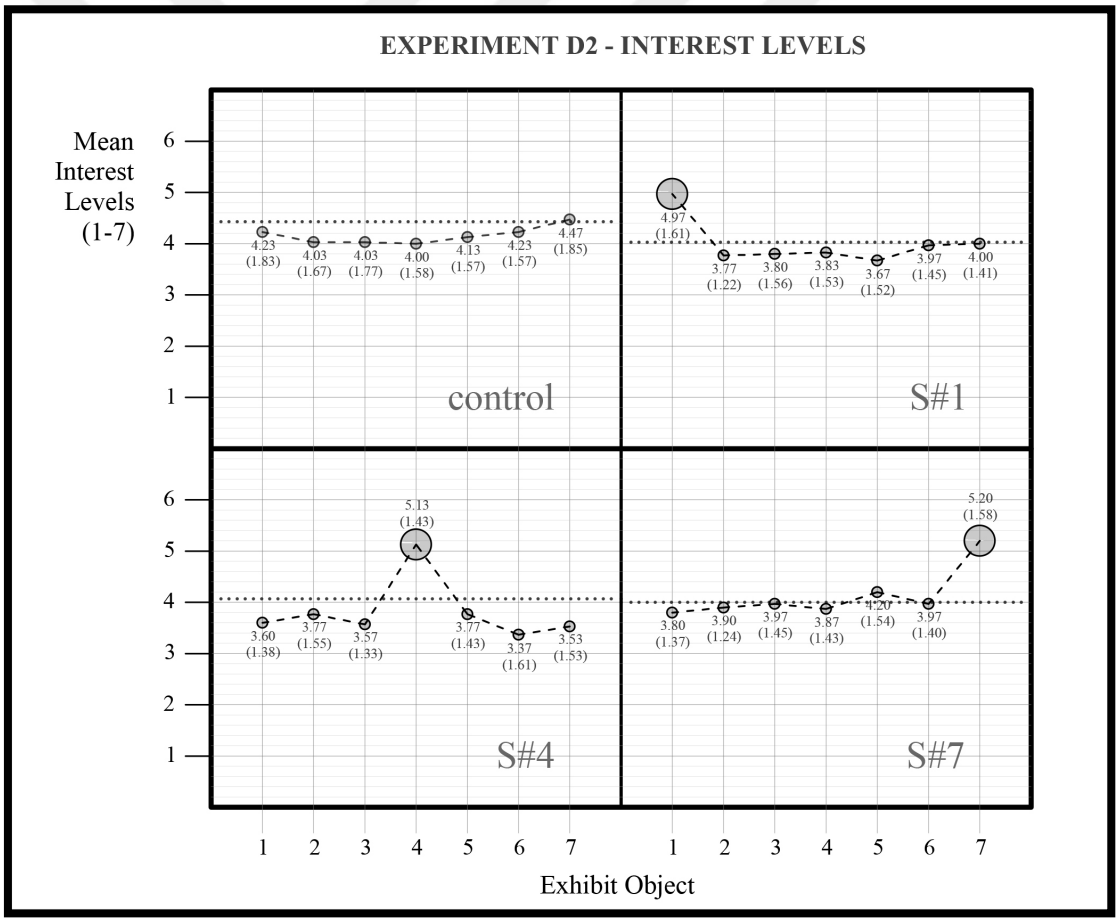


Figure 27: Mean interest levels of the exhibit objects in the four conditions of Experiment D2. The 2.5D objects are indicated with larger markers. Standard deviations are indicated within parentheses.

In addition, another independent samples t-test, conducted to explore whether the generalized suppression effect noted in the timing data would also be observed in the interest data, revealed no significant difference between the mean of the interest ratings reported for the control condition (M = 4.16, SD = 1.68) and the mean of the interest ratings reported for the three experimental conditions altogether (M = 3.98, SD = 1.52), t (838) = 1.44, p = .15, d = .11.

5.3.5. Preliminary Discussion on the Findings of Experiment D2

The AP and AHT analyses for Experiment D2 indicated that the first exhibit objects were likely to attract and hold more attention than the last ones in all the conditions, supporting the findings of Experiments P1 and D1. The attention decrements due to object satiation or exit attraction were further revealed through the comparisons of the first three and last three objects across conditions in terms of both their APs and AHTs.

Again, the steady decrease in the control condition was disrupted with the introduction of a 2.5D object in each of the experimental conditions. In line with the findings of previous research and Hypothesis 1, the 2.5D objects attracted and held visitor attention more successfully than the 2D objects, according to comparisons of the APs and AHTs of 2.5D objects with those of the 2D objects across conditions (e.g., Bitgood, 1992; Peart, 1984; Screven, 1986). However, separate tests for the experimental conditions showed that Exhibit Object 7 failed to exceed both the APs and AHTs of all the remaining objects in S#7, probably due to ordinal position effects (as is considered later on).

Adjacency to a salient object seemed to have a smaller impact in the digital environment. In this regard, although the 2D objects adjacent to the 2.5D ones had a significantly lower AP than the remaining 2D objects across conditions, the AHT comparison between these two resulted in a nonsignificant difference. Also the APs and AHTs of the 2D objects adjacent to the 2.5D ones did not differ from the APs and AHTs of the objects corresponding to those adjacent to the 2.5D objects in the control condition. Furthermore, according to the deviation scores, there was no significant difference between appearing just before or right after the 2.5D object in terms of the suppression effect on APs or AHTs. Considering the attention-value model (Bitgood, 2010, 2013), these findings indicate that salient objects might have a significant negative influence on the attention attracting capabilities of the adjacent objects, but their negative influence on the attention holding capabilities is nonsignificant. In sum, while these results only partially supported Hypothesis 3, the overshadowing effect due to adjacency is diminished in terms of their intensity in the digital environment, in line with Hypothesis 5.

The results also showed that, ordinal position, salience, and proximity effects should be considered together, since they may operate in accordance, as well as against each other. For example, although S#1, S#4 and S#7 of Experiment D2 all consisted of one 2.5D and six 2D exhibit objects, they yielded distinct schemes of attention distribution depending on the 2.5D object's position within the set. When the 2.5D object was also the first, salience and ordinal position effects were combined. As a result, the first object, also being the 2.5D one, held

visitor attention more successfully than all the other objects. On the other hand, when the 2.5D object appeared last, the salience and ordinal position effects worked against each other, so there was no significant difference between the APs and AHTs of Exhibit Objects 1 and 7 in S#7. Considering the AHT results for S#4, there were no significant differences between the first two objects and Exhibit Object 4, which was the 2.5D object, as the first two objects held more attention than others because of their ordinal position, and Exhibit Object 4 held more attention than others because of its salience level. It should also be noted that, the 2.5D objects in all three experimental conditions of Experiment D2 performed distinctly higher than all the other objects including the first ones in terms of holding visitor attention. This result implies that the influence of three-dimensionality may be stronger than such effects as object satiation or exit attraction in digital environments.

The suppression effect of the salient object on the overall exhibition, which was revealed in Experiment P1, did not seem to occur in Experiment D2. In fact, the mean AP and AHT of the three experimental conditions exceeded those of the control condition, providing support for Hypothesis 2. Although the experimental conditions were significantly better at attracting visitor attention, the difference between the attention-holding capabilities of the experimental and control conditions did not reach significance.

Finally, the interest results indicated that the 2.5D objects were superior in attracting and holding visitor attention, but did not reflect any overshadowing

effect on the adjacent objects, or attention declines toward the end of visits. Once again, they demonstrated the difference between interest levels reported by visitors as evaluative responses and their attention distribution schemes as immediate behavioral reactions.

5.4. Comparative Review of the Results

This section includes a comparative review of the three experiments in light of the results summarized in Table 18. Thus, inputs are provided for the discussion of the results regarding Hypotheses 5 and 6 (addressing the differences between physical and digital environments), and Hypotheses 7 and 8 (addressing the differences between the two salience parameters).

Table 18: Significance levels of parameters regarding ordinal position, object salience, adjacency to a salient object, and general suppression effect for the three experiments.

	EXPERIMENT P1		EXPERIMENT D1		EXPERIMENT D2	
	AP	AHT	AP	AHT	AP	AHT
#1 vs. #7	93% - 53% z = 6.94 p < .001	$M1$ = 8.72 $M2$ = 3.02 $t(161)$ = 7.24 p < .001	100% - 76% z = 5.74 p < .001	$M1$ = 11.78 $M2$ = 4.14 $t(158)$ = 8.34 p < .001	100% - 79% z = 5.28 p < .001	$M1$ = 11.21 $M2$ = 5.85 $t(229)$ = 5.45 p < .001
#1,2,3 vs. #5,6,7	76% - 51% z = 6.88 p < .001	$M1$ = 5.82 $M2$ = 3.19 $t(573)$ = 7.25 p < .001	87% - 74% z = 4.60 p < .001	$M1$ = 7.21 $M2$ = 3.68 $t(499)$ = 4.75 p < .001	90% - 78% z = 4.41 p < .001	$M1$ = 6.97 $M2$ = 4.26 $t(649)$ = 5.81 p < .001
SALIENTS vs. NON-SALIENTS	78% - 59% z = 3.32 p < .001	$M1$ = 7.30 $M2$ = 3.71 $t(96)$ = 4.10 p < .001	94% - 80% z = 3.28 p = .001	$M1$ = 8.40 $M2$ = 4.83 $t(106)$ = 4.19 p < .001	99% - 86% z = 3.51 p < .001	$M1$ = 13.01 $M2$ = 4.60 $t(96)$ =6.93 p < .001
SALIENTS vs. ADJACENTS	78% - 46% z = 4.67 p < .001	$M1$ = 7.30 $M2$ = 2.60 $t(105)$ = 5.25 p < .001	94% - 71% z = 4.31 p < .001	$M1$ = 8.40 $M2$ = 3.67 $t(131)$ = 5.22 p < .001	99% - 80% z = 4.18 p < .001	$M1$ = 13.01 $M2$ = 4.06 $t(116)$ = 7.01 p < .001
ADJACENTS vs. NON-ADJACENTS	46% - 63% z = -3.44 p < .001	$M1$ = 2.60 $M2$ = 4.03 $t(281)$ = -4.40 p < .001	71% - 83% z = -2.91 p = .003	$M1$ = 3.79 $M2$ = 5.16 $t(239)$ = -2.83 p = .005	80% - 87% z = -2.04 p = .04	$M1$ = 4.13 $M2$ = 4.75 $t(538)$ = -1.25 **p = .21**
CC vs. L#1+L#4+L#7	73% - 62% z = 2.84 p = .005	$M1$ = 5.54 $M2$ = 4.23 $t(348)$ = 3.28 p = .001	75% - 82% z = -2.36 p = .02	$M1$ = 5.15 $M2$ = 5.35 $t(838)$ = -.41 **p = .68**	75% - 88% z = -4.45 p < .001	$M1$ = 5.15 $M2$ = 5.83 $t(838)$ = -1.23 **p = .22**

5.4.1. Experiments P1 and D1

The timing and interest data in Experiments P1 and D1 showed similar trends regarding the effects of ordinal position, object salience, and adjacency to a salient object. In both experiments, there occurred a gradual decrease in AP and AHT values toward the end of exhibitions, as a consequence of such effects as object satiation or exit attraction, as seen in Figures 28 and 29. This trend was supported with the significant results of comparisons between (1) the first and last exhibit objects, and (2) the first three and last three exhibit objects.

Moreover, both experiments demonstrated the superior attention-attracting and -holding capability of the salient objects, through the comparisons between the three large and 18 small objects for the two experiments, which yielded significant results for both AP and AHT data. Also, the salient objects attracted and held more attention than the adjacent objects across conditions in both of the experiments, with a p-value smaller than .001, as seen in Table 18. Whereas the separate AP comparisons of salient and adjacent objects within conditions yielded significant results in Experiment P1, the differences between the APs of Exhibit Objects 1 (salient) and 2 (adjacent) in S#1 and Exhibit Objects 4 (salient) and 3 (adjacent) did not reach significance for Experiment D1.

Further focusing on the negative impact of adjacency to salient objects, it was found that the objects adjacent to the salient ones attracted and held significantly less attention than the remaining non-salient objects in both of the experiments. Although the APs and AHTs of the adjacent objects were

significantly smaller than those corresponding to the adjacent objects in the control condition for Experiment P1, there was no significant difference found when the same comparison was done for Experiment D1.

Considering the overall suppression effect revealed in Experiment P1, the overall APs and AHTs of the conditions in Experiment D1 were compared. Interestingly, this effect seemed to be reversed in the digital environment, such that the three experimental conditions attracted more attention than the control condition. However, there was no significant difference between the control condition and the three experimental conditions in terms of AHTs.

Last, the interest ratings reflected the effects of ordinal position in neither Experiment P1 nor D1 (Figure 30). Exhibit object salience and adjacency to salient objects seemed to be significantly influencing the interest ratings of the participants in Experiment P1, but not in Experiment D1. Again, Experiment P1 showed the overall suppression effect of the salient object on the mean interest ratings of the conditions, whereas in Experiment D1, the lowest level of attention was reported for the control condition in average, which was a significant finding.

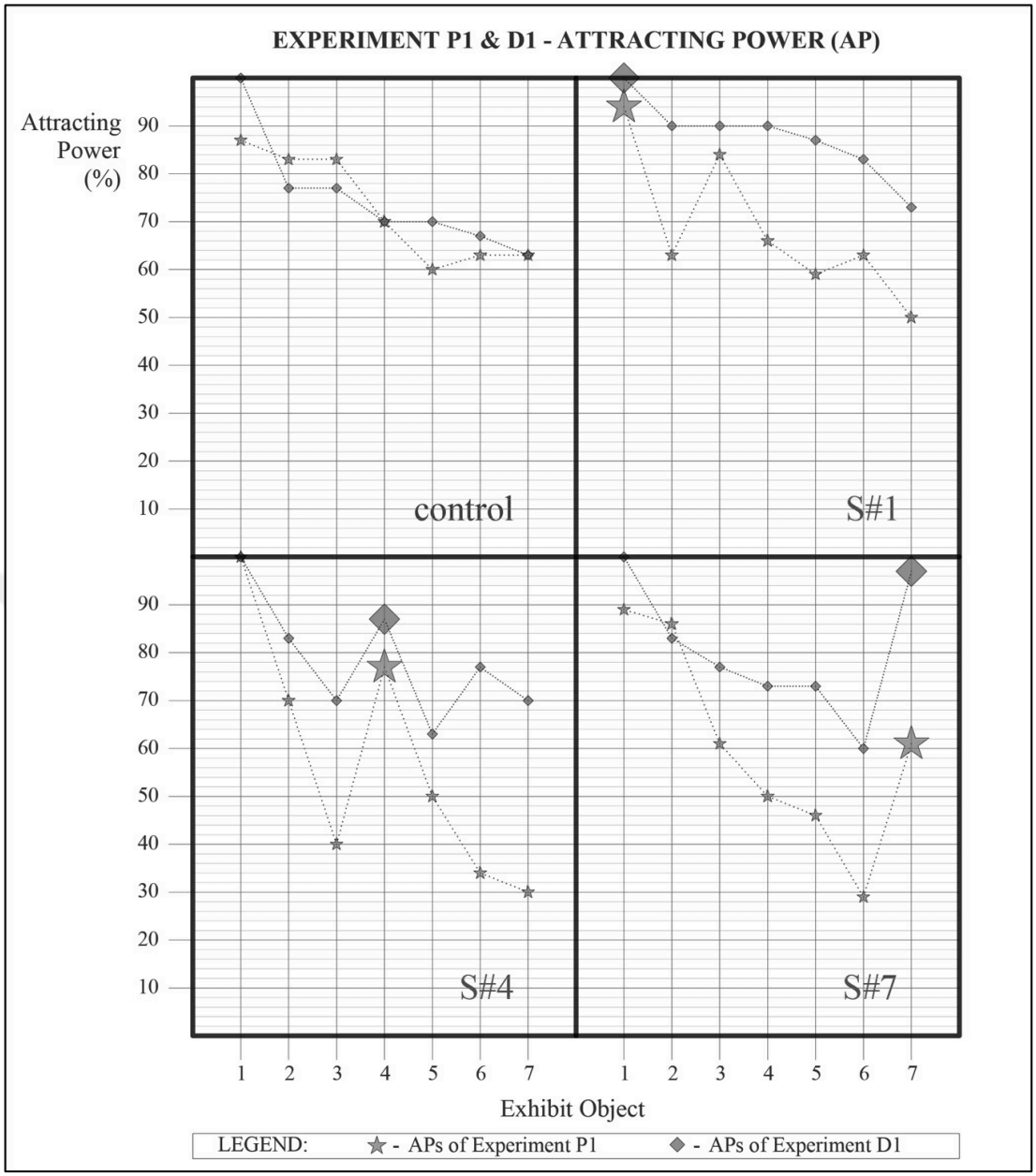


Figure 28: APs of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers.

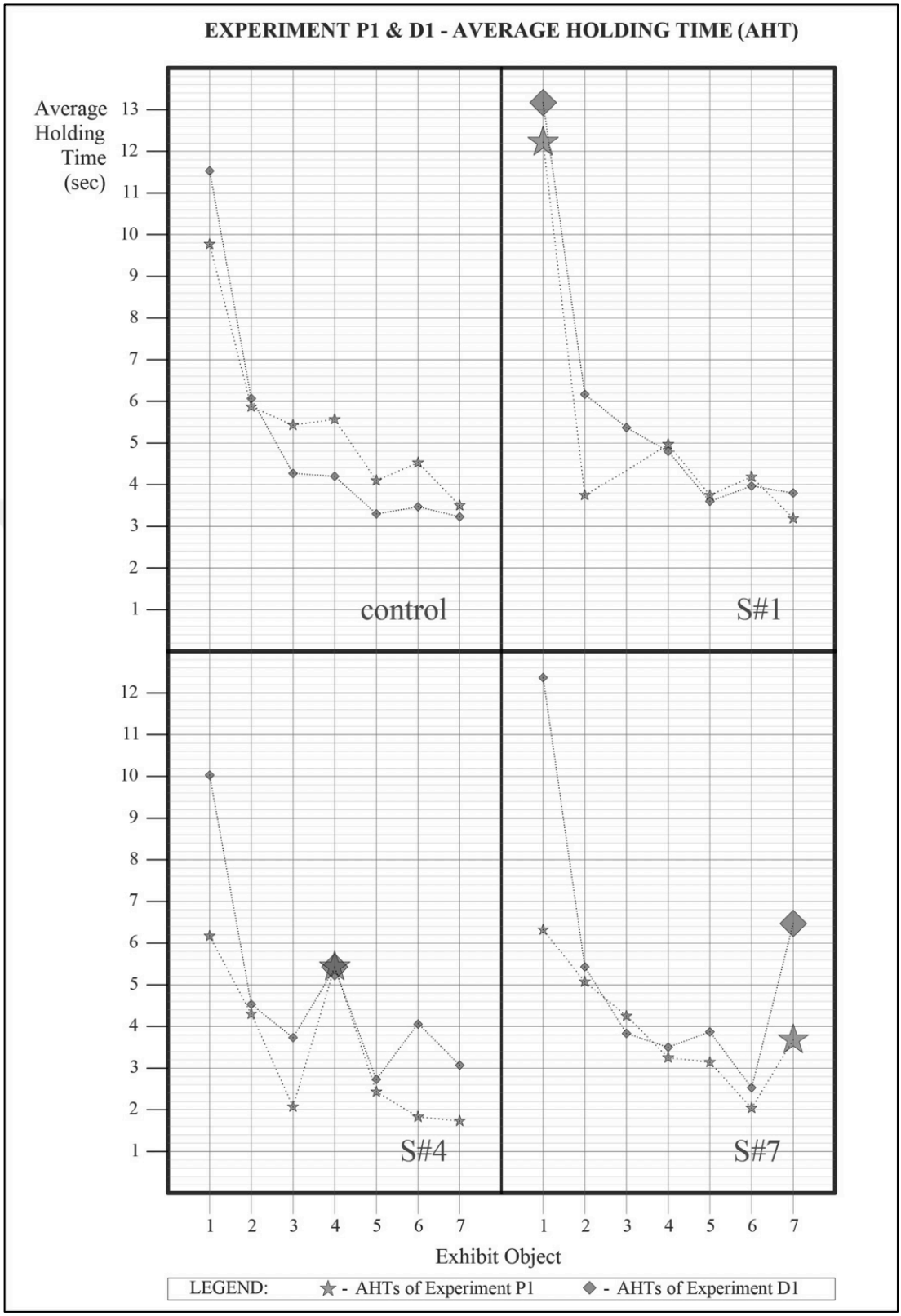


Figure 29: AHTs of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers.

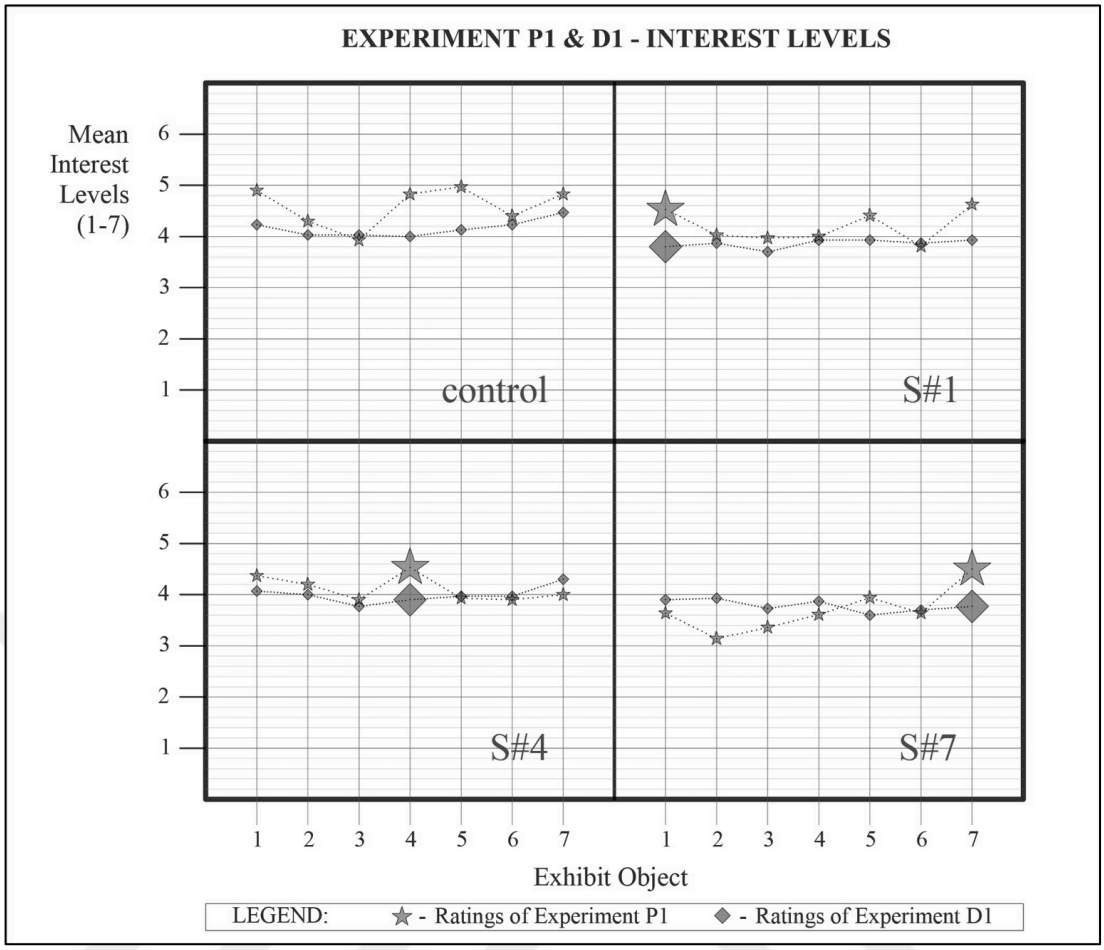


Figure 30: Interest levels of the exhibit objects in the four conditions of Experiment P1 and D1. The larger objects are indicated with larger markers.

5.4.2. Experiments D1 and D2

In general, ordinal position, exhibit object salience, and adjacency to a salient object seemed to influence the APs and AHTs of the exhibit objects in a similar way in the two digital experiments, as seen in Figures 31 and 32. The ordinal position effects were revealed through the comparisons of the APs and AHTs of (1) the first and the last objects, and (2) the first three and the last three objects across conditions for both of the experiments, which significantly showed that the objects appearing earlier attracted and held more attention from the visitors ($p < .001$ for all cases). However, considering the differences between the means of objects appearing earlier and later, the rate of the gradual decrease seemed to be lowest in Experiment D2 (see Table 18).

Second, both of the experiments indicated that object salience could be influencing the amount of attention attracted and held by the exhibits, since the mean APs and mean AHTs of the salient objects were significantly higher than those of all the non-salient objects, as well as the non-salient objects adjacent to the salient ones across conditions in both of the experiments with a maximum p-value of .001 for all cases (see Table 18).

Furthermore, in both experiments, the non-salient objects seemed to be overshadowed by the salient objects at a higher rate when they were in an adjacent position to the salient ones. For instance, the APs of the adjacent objects were significantly smaller than the remaining non-salient objects in both of the experiments. Although the AHTs of non-adjacent objects in both

experiments exceeded those of the adjacent objects, the comparison did not yield a significant result in Experiment D2, which pointed to a difference between the magnitudes of size and three-dimensionality as the two salience parameters investigated in these two experiments.

In the digital medium, the presence of the salient objects in the experimental conditions seemed to contribute to the attention-attracting capability of the overall exhibitions, in contrast with the suppression effect observed in Experiment P1. Regarding the AHTs, although the mean viewing duration of the three experimental conditions were higher than the mean viewing duration of the control condition in both Experiments D1 and D2, there was found no significant difference. It should also be noted that, there was a larger difference between the mean AHTs of the control and experimental conditions in Experiment D2 than Experiment D1, which indicates that three-dimensionality could be a stronger salience parameter in terms of generating longer viewing durations for the whole exhibition.

Finally, the findings regarding the interest levels in Experiment D1 seemed to conflict with the interest findings in Experiment D2 (see Figure 33). More specifically, exhibit object salience seemed to have no influence on the interest levels in Experiment D1, whereas the salient objects were rated as significantly more interesting than the remaining and the adjacent objects in Experiment D2 ($p < .001$ for both comparisons). Nevertheless, there was no significant difference between the mean interest ratings of the control and experimental

conditions in Experiment D2, while the objects in the control condition of Experiment P1 was rated as more interesting than the objects in the experimental conditions.

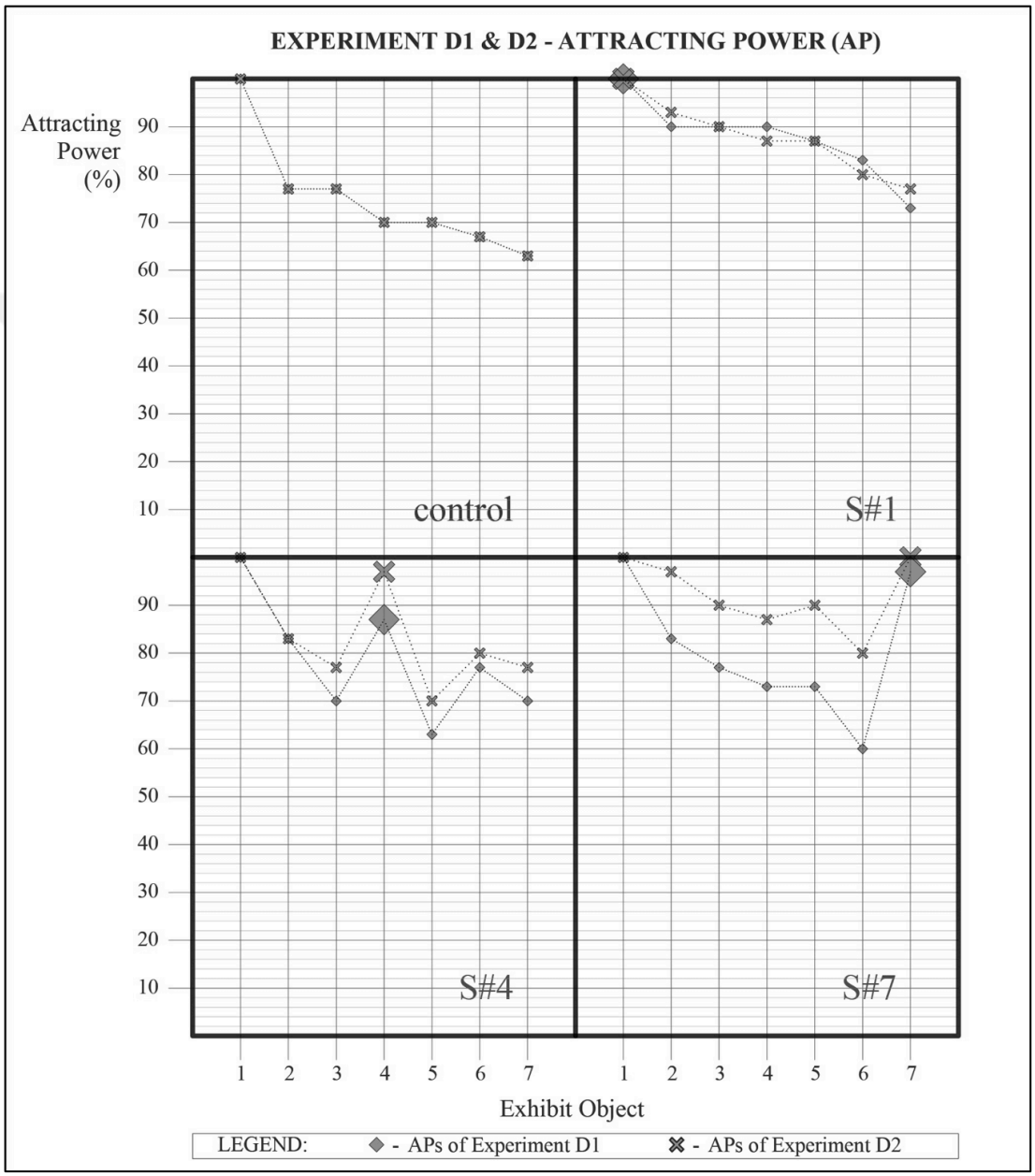


Figure 31: APs of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers.

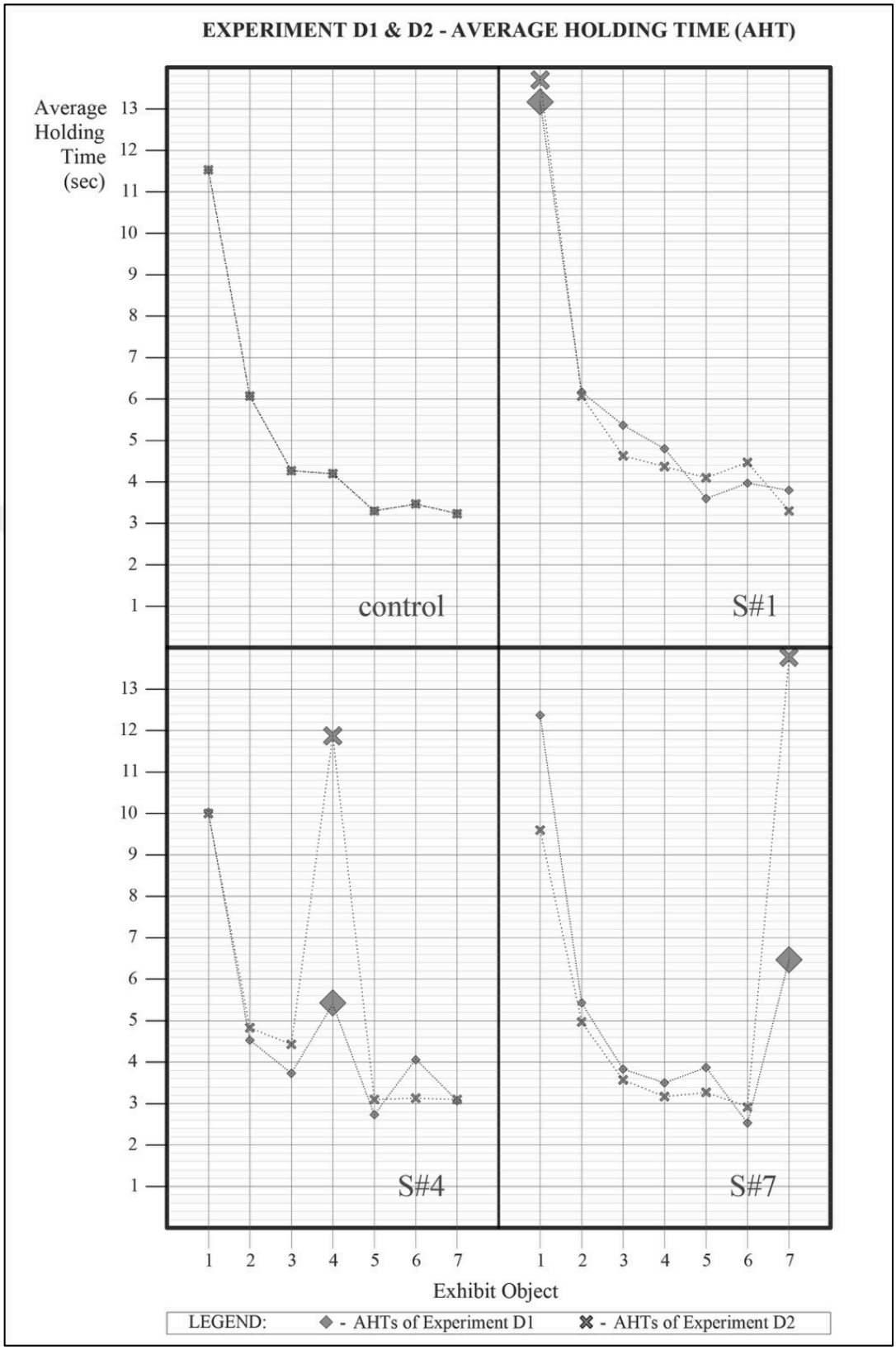


Figure 32: AHTs of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers.

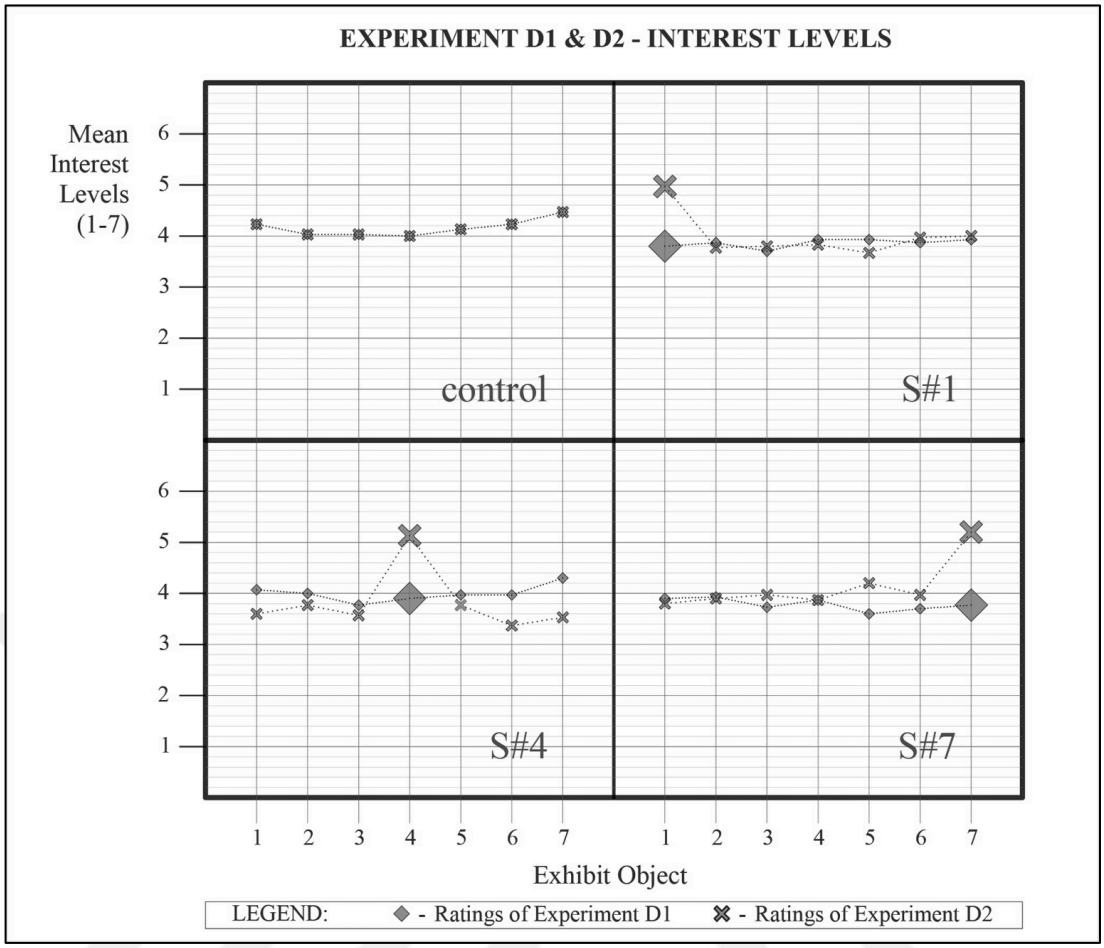


Figure 33: Interest levels of the exhibit objects in the four conditions of Experiment D1 and D2. The salient objects are indicated with larger markers.

CHAPTER 6

DISCUSSION

The findings of the empirical research provided support for the hypotheses. First, regarding Hypothesis 1, analyses of the timing data in the three experiments, represented as attracting power (AP) and average holding time (AHT), indicated that the introduction of a more salient object into a set of less salient objects altered the attention distribution schemes. As elaborately explained in the separate discussions of the three experiments, the salient objects were significantly more successful than the remaining objects in terms of attracting and holding visitor attention, in line with the findings of previous research (Bitgood, 2014; Bitgood et al., 1986; Bitgood & Patterson, 1987; Bitgood, Patterson, & Benefield, 1988; Donald, 1991; Marcellini & Jenssen, 1988; Peart, 1984). This finding is also consistent with the Gestalt principle of similarity, which states that visitors may perceive objects that share certain attributes (such as shape, size or color) as groups (Arnheim, 1974; Sternberg & Sternberg, 2012); therefore the object that does not belong to that group may be

likely to stand out. Also connected to the principle of similarity is the focal points principle, which states that attention will be drawn toward the contrasting item (Lauer & Pentak, 2008), i.e., the large objects in Experiments P1 and D1, and the 2.5D objects in Experiment D2.

Concerning the effect of a salient object's presence on the overall exhibition, the findings of Experiment P1 seemed to conflict with Hypothesis 2, as the control condition attracted and held significantly more attention than the experimental conditions (except for S#1, the overall AP of which was nonsignificantly less than that of the control condition). Nevertheless, Experiments D1 and D2 provided support for Hypothesis 2 by revealing that the overall AP and AHT values of the control condition were significantly lower than those of the experimental conditions. Therefore, the introduction of a more salient object into a set of less salient objects seemed to generate a general suppression effect in the physical exhibitions, but contribute to the overall attention attracted and held by digital exhibitions.

Second, all three experiments demonstrated the impact of the salient object's ordinal position on the distribution of visitor attention. Whether or not there was a more salient object in the set, a gradual decline in visitor attention toward the end of exhibitions was observed, which was a predicted outcome as such effects as fatigue, object satiation, or exit attraction were taken into account. In the control conditions, the gradual decline was not interrupted by "powerful sensory attractors such as large objects, loud noises or movement" (Bitgood,

2014, p. 6). Hence, the previously mentioned downtrend was most clearly apparent in the control conditions that consisted of equally salient objects. However, the introduction of the salient objects produced distinct schemes of attention distribution in the experimental conditions, since the downtrend was combined with the influence of the salient object's ordinal position. To begin with, analyses of the timing data, represented as attracting power (AP) and average holding time (AHT), indicated that the first exhibit objects were likely to attract and hold more attention than the last ones in S#1 and S#4 of the three experiments. Since the last object was also the salient one in S#7 conditions, the effects of salience and the gradual downtrend operated antagonistically, resulting in nonsignificant differences between the APs of the first and last objects in Experiments D1 and D2, and the AHTs of the first and last objects in Experiments P1 and D2 for S#7. Yet, the APs and AHTs of (1) the first objects were significantly higher than the last objects across conditions, and (2) the first three exhibit objects were significantly higher than the last three exhibit objects in all conditions of the three experiments ($p < .001$ for all cases), demonstrating the impact of gradual attention decrements. Although such decrements have been interpreted as arising either from fatigue or object satiation, in the present study, fatigue may be a less likely cause, since viewing the exhibitions did not require much physical or mental exertion (Bitgood, 2015), and none of the participants viewed the exhibitions for more than three minutes (Bitgood et al., 2013). On the other hand, object satiation appeared to be a likely cause since the exhibit involved repetitive exposure to similar objects (Melton, 1935). Also, exit attraction might be responsible for the downtrend (Melton, 1935, 1972),

which functions not only as visitors approach the exit, but also when they get further away from it. In the latter case, in line with the general value principle (Bitgood, 2006), the value of viewing the objects toward the end of the sequence seems to compete with the cost of moving away from the exit (that also functions as the entrance in our experiment), which may be even stronger than approaching the exit (Melton, 1935) because each step taken away from the exit means another step is required to get back to it. Hence, visitors seem less willing to spare time and energy as they proceed toward the end of their visits, in congruity with the general value principle, particularly if it implies getting further away from the exit as in the present study. Although almost no physical effort was required for viewing the digital exhibitions, the gradual declines in attention were observed nonetheless. In this case, the cost of viewing the exhibits involved only the invested time. Since all the objects were very similar to each other, they provided less and less benefit as the participants proceeded with their visits (i.e., there were no further aspects to explore after viewing the initial one or two objects). In view of the above, the most probable reason for the downtrend in the digital exhibitions seems to be object satiation, since [1] moving away from the exit does not require a gradually increasing cost of getting back to the exit in the digital exhibitions, which eliminates exit attraction (e.g., Melton, 1935); and [2] as in the physical exhibitions, viewing the objects required neither much time (less than three minutes), nor extensive physical and mental effort, which eliminates fatigue (e.g., Bitgood, 2009a, 2009b; Bitgood, McKerchar, & Dukes, 2013).

Regarding the impact of salient objects' ordinal position on the overall attention to the exhibitions, the AP data did not indicate a consistent effect for none of the experiments. However, the AHT results of Experiments D1 and D2 supported Hypothesis 4, by showing that there were no significant differences between the conditions in terms of AHTs. On the other hand, in Experiment P1, the control condition held significantly more attention than S#4 and S#7. Also, the overall AHT of S#1 was significantly greater than that of S#4 in Experiment P1. In this case, it can only be inferred that the salient object might suppress the overall attention solely when it is positioned in the middle or at the end of a physical exhibition.

Besides the gradual downtrend occurring due to object satiation, ordinal position of the objects also involved adjacency relationships, such that the intensity of the overshadowing effect exerted by the salient objects on the adjacent ones varied according to the ordinal position of the salient object within the exhibition. After all, "what attracts attention may also distract from attending to another exhibit element" (Bitgood, 2013, p. 191). While the adjacency effects were clearly observed in Experiment P1, the digital exhibitions revealed only nonsignificant trends that implied an overshadowing effect. For example, although the salient objects attracted and held more attention than the adjacent objects in all conditions in the digital experiments, the difference did not reach significance for #1-#2 comparison in S#1 and #3-#4 comparison in S#4 for both Experiments D1 and D2. While these nonsignificant results seem to conflict with Hypothesis 3, such declines in the

prominence of the overshadowing effect partially supported Hypothesis 5, which asserted that the effects observed in the physical experiments would be mitigated in the digital medium.

Whereas the findings demonstrated the superior attention-attracting and -holding capability of salient objects, they also showed that less salient objects could attract and hold more attention than the salient ones as well when object satiation is involved. In fact, the influence of object satiation seemed to be more powerful than the influence of salience, such that in most of the cases, the first objects surpassed the salient ones. The conflict between the effects of object salience and satiation is most clearly observed in S#7 conditions of the experiments. As previously mentioned, *the last object was also the salient one in S#7 conditions, therefore the effects of salience and the gradual downtrend operated antagonistically, resulting in nonsignificant differences between the APs of the first and last objects in Experiments D1 and D2, and the AHTs of the first and last objects in Experiments P1 and D2 for S#7.* Only in Experiment D2, the salience effects appeared to compensate for the AP and AHT decrements caused by object satiation, to the extent that the AP of the salient object was equal to the AP of the first object, and AHT of the salient object was higher than the AHT of the first object. The largest AP decrement from #1 to #7 (salient object) was observed in Experiment P1, and the largest AHT decrement from #1 to #7 (salient object) was observed in Experiment D1 (see Figure 34). In view of these findings, it can be inferred that the impacts of object satiation and salience may be different in physical and digital experiments (Hypothesis 5). However, when

considering such effects, it should also be taken into account that, digital exhibitions might be appealing for different audiences or demands, as mentioned in the literature review (Carreras & Mancini, 2014), and such technological services might "change the emphasis of many museums from educational enrichment to simply high-class amusement centers" (Screven, 1974, p. 69).

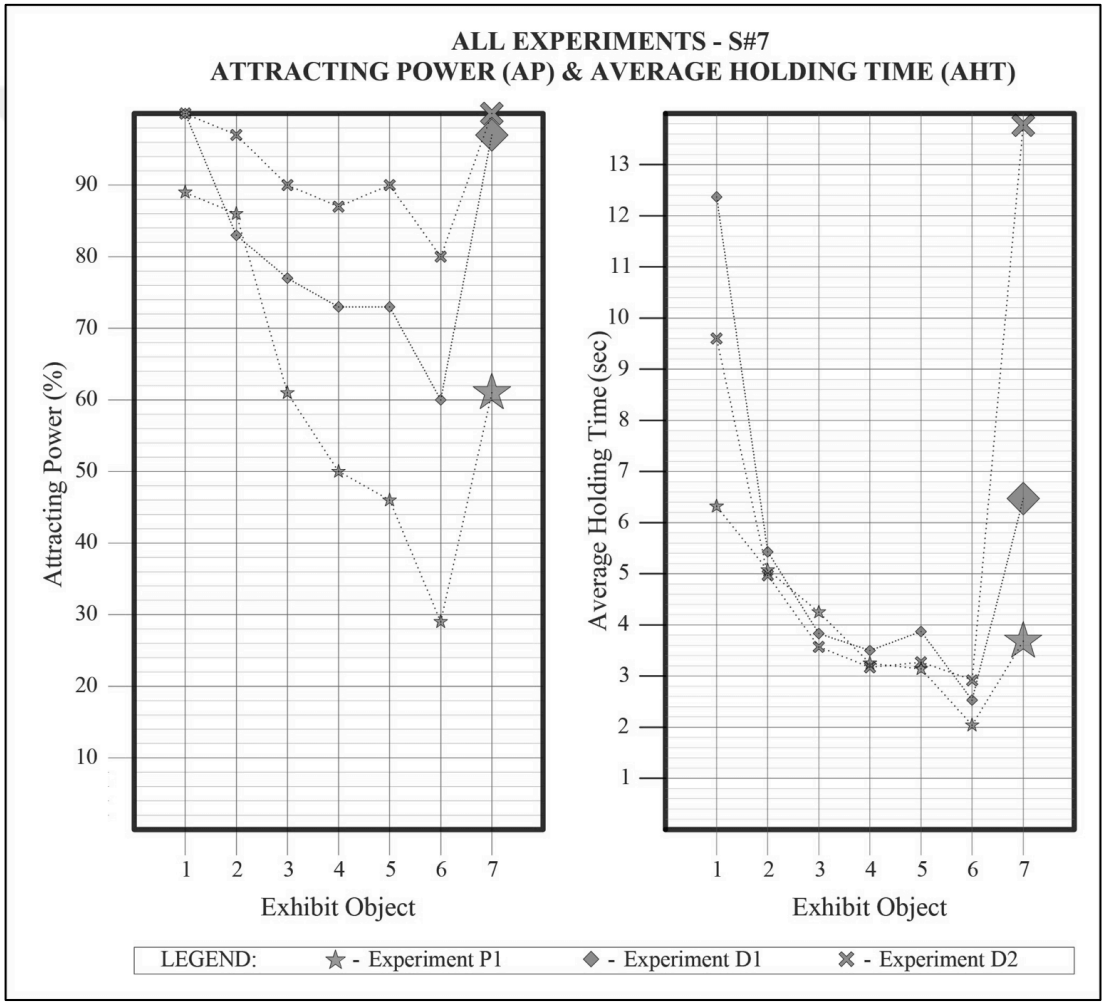


Figure 34: APs and AHTs of the exhibit objects in S#7 conditions of the three experiments.

Despite the above-mentioned effects of salience and adjacency effects revealed in the attention data, interest data did not provide consistent findings for the three experiments. While the interest ratings of the 2.5D objects were significantly higher than the 2D objects in Experiment D2, there were no significant difference found in Experiments P1 and D1. Moreover, the suppression of the adjacent objects by the salient ones was demonstrated only in Experiment P1. No such effect was detected in the interest data of the digital experiments, which might be a consequence of the presentation technique used in the digital exhibitions. The reason could also be the decreased tangibility and authenticity of the experience (Lester, 2006); "even though most archival records lend themselves more effectively to digital representation than three-dimensional museum objects, which will often appear flat, the fact remains that the viewer is looking at a representation, and the sense of personal interaction is lessened" (Lester, 2007, p. 95).

In addition, the introduction of the salient object into the exhibition seemed to create an overall suppression effect on the interest ratings in Experiments P1 and D1, but no significant difference was found between the average interest ratings of the control condition and the experimental conditions for Experiment D2. Thus, although attention and interest were addressed as equivalent concepts in earlier studies (e.g., Melton, 1935, Robinson, 1928), the present results suggest that attention levels should not be considered as directly reflecting interest ratings, hence, supporting Bitgood's (2013) outlook on the issue, as noted in the introduction. In this regard, one also needs to be cautioned

that reporting interest levels in the questionnaire did not involve an immediate behavioral reaction to the objects but an evaluative response as a consequence of the visit.

The hypotheses were further supported by the data pertaining to the frequencies of behavioral indicators by suggesting that [1] visitors seemed to engage with the salient objects more frequently than they engaged with the other objects, [2] the engagement rate seemed to decrease toward the end of the exhibitions, [3] the visitors seemed to engage with the objects in the digital exhibitions more frequently than they engaged with the objects in the physical exhibitions, and [4] a higher rate of engagement seemed to be achieved in the exhibitions involving three-dimensionality, compared to the exhibitions involving size. On the other hand, no effects were observed concerning the suppression of the adjacent objects, or the overall exhibitions by the salient objects.

Overall, the main findings of this thesis supported previous research in the field, and presented new perspectives on the spatial layout and relative salience levels of objects on display in physical and digital exhibitions. It is expected that these research results will contribute to advancing the understanding of visitor attention in both physical and digital museum settings.

CHAPTER 7

CONCLUSION

This thesis investigated the ways exhibit objects' salience levels and ordinal position would influence the distribution of visitor attention in physical and digital exhibitions by means of three field experiments. Regarding the first hypothesis, exhibit object salience seemed to have a significant influence on the distribution of visitor attention to objects exhibited in the same space. The introduction of a salient object into a set of less salient objects created a suppression effect on the attention to less salient objects in all three experiments. Interestingly, the results also indicated that the presence of the salient object affected the overall attention to the exhibition negatively in the physical medium (in conflict with Hypothesis 2), while it contributed to the overall attention to the exhibition in a digital medium (in line with Hypothesis 2).

The third hypothesis was partially supported by the findings, since adjacency to the salient object seemed to increase the magnitude of the suppression effect in the physical medium, whereas this effect was diminished to a nonsignificant level in nearly half of the cases in the digital experiments. Concerning ordinal position, the present study supported previous research by demonstrating the effects of object satiation on attention distribution (Bitgood, 2002, 2009a, 2009b, 2009c, 2013; Melton, 1935); hence such factors should be considered together with layout when designing and evaluating exhibitions (Bitgood, 2006; Melton, 1935, 1972). Furthermore, none of the experiments revealed any effects of ordinal position on the overall attention to the exhibitions since no significant difference was found between the overall attention to S#1, S#4, and S#7; except Experiment P1, in which overall AHT of S#1 was significantly greater than that of S#4. Therefore, it can be concluded that the salient object might cause a suppression effect on the overall exhibition if it is positioned in the middle or at the end of a physical exhibition, but its ordinal position would not influence the overall attention to digital exhibitions (Hypothesis 4).

Regarding the differences between the physical and digital environments in terms of the distribution of visitor attention, the results also showed that the impact of object salience changed according to whether the exhibitions were visited physically or digitally, providing partial support for Hypothesis 5. More specifically, the instant increases at the salient objects were more evident in the digital exhibitions compared to those in the physical environment. However, the overshadowing effect of the salient objects on the adjacent ones was diminished

in the digital medium in line with Hypothesis 5. Therefore, it may be inferred that, the visitors might be more generous in terms of paying attention in digital exhibitions, since the cost (i.e., tapping the screen) is lower compared to the cost of paying attention in physical exhibitions (i.e., physical effort). Moreover, the introduction of the salient object had a negative impact on the overall attention to the physical exhibitions, whereas it augmented the overall attention to the digital experiments, partially supporting Hypothesis 6.

Last, the results revealed the superiority of three-dimensionality over size in terms of its capability of attracting and holding visitor attention, in line with Hypothesis 7. In this regard, the 2.5D object seemed to attract more attention than the large object did in all conditions, and the highest APs and AHTs were observed in Experiment D2. Also, the introduction of the 2,5D object to the exhibitions resulted in a higher level of attention to the exhibitions in overall, compared to the exhibitions involving a large object, providing support for Hypothesis 8.

As is typical of experimental studies, only two salience levels were used while investigating the effect of object salience on the distribution of visitor attention (i.e., one 50 cm by 50 cm and six 35 cm by 35 cm objects, or one 2.5D and six 2D objects). This provided the control that is necessary to distinguish the effect of our independent variables. On the other hand, it is also important to understand how the magnitude of the size or depth differences between objects influences visitor behavior. In a study that have addressed this point, Bitgood et al. (1992)

found no differences between the stopping rates among the sizes that were labeled as small, medium and large, but the extra-large category yielded more stops. However, they have also suggested that the results should be replicated due to the uncontrolled circumstances of the studied exhibition. Therefore, a similar study could test more than two salience levels with appropriate controls, to explore the generalizability of our findings to a wider range of objects. Considering the Gestalt principle of similarity explained above, the study could also be repeated by introducing a less salient exhibit object in the set instead of a more salient one (e.g., a smaller object into a set of larger objects, or a 2D object into a set of 2,5D objects). In this way, one could test whether the distribution of visitor attention was indeed mainly affected by the higher salience level and not just object distinctiveness or novelty (Screven, 1986).

Furthermore, only seven objects were used in each condition of the experiments, to simplify the interpretation of the results. Also, the experiments involved sequential viewing on a single plain wall of a gallery so as to reveal the effects of ordinal position as a facet of exhibit object layout. So, other future studies could employ more than seven objects, address unstructured organizations without any implication of a viewing sequence, or explore different organizations of display surfaces (e.g., L-shaped, U-shaped or curvilinear plan schemes). It should also be noted that no interpretive texts were used in the exhibit for control purposes. However, in view of the observation that most museum exhibits tend to be accompanied by some type

of interpretation, future researchers may also need to consider the impact of the content and placement of those interpretive labels to improve the external validity of the present findings.

Additionally, since, to our knowledge, this is the first study that considers effects on salience levels of exhibit objects in experimental and control conditions, replicating the study by employing a larger and more diverse sample would be useful in determining the generalizability of the present findings. Moreover, focusing on the other two exhibit attributes emphasized in previous research (sense-modality and motion), as well as some additional variables such as color, shape, texture, opacity, illumination levels, or spatial patterns would broaden the subject in terms of object salience parameters. The symbolic meaning of the artworks, artists, or venues could also affect salience levels, which can be another issue to be investigated in future research.

Finally, the experiment was conducted in a single exhibition venue, the characteristics of which enabled us to control for possible confounding variables. However, the majority of the participants had a bachelor's degree, and most of them were frequenters of the venue, which might indicate that they belong to a specific social class. Furthermore, since the schedule of the Contemporary Arts Center was very busy, and the Z-Gallery could be reserved for the study for a limited time, participants were selected through convenience sampling. Although participants were homogeneously distributed to each condition of the three experiments in terms of gender, age group, educational

level, and such; the sampling method might have resulted in certain types of visitors (i.e., those with a bachelor's degree, frequenters, diligent visitors, etc.) to be over-represented in overall. Therefore, repeating the experiment in another venue would enrich the variety of visitors, and hence the generalizability of the results. Moreover, in the Contemporary Arts Center, neither the physical nor the digital exhibitions were viewed by more than one visitor at a time. In another venue, it may be possible to investigate how the present trends would be influenced by visual and auditory contact or conversational interaction with others (Heath Luff, vom Lehn, Hindmarsh, & Cleverly, 2002; vom Lehn, 2010; vom Lehn, Heath, & Hindmarsh, 2001; Serrell, 2002). Additionally, it may also be possible to find the extent to which certain exhibits encourage interactions with others (Bailey, Bronnenkant, Kelley, & Hein, 1998). Thus, the way visitor attention would be influenced by the rate of interactions between the visitors in the digital and physical versions of an exhibition could be investigated, using a chat tool in the digital version as proposed by Paolini et al. (2000). Besides, in the absence of interactions between the visitors in the Contemporary Arts Center, the hypotheses of the study were tested via a highly controlled, quantitative method. Further studies could approach the research problems from a qualitative perspective in another venue, by focusing on the participants' comments on the exhibits and conversations with each other.

In spite of the above-noted limitations, the study has a number of strengths. To start with, it supports previous research that investigated object salience and

visitor attention in exhibition environments by providing data from a Turkish sample, which is less often studied. Also, with the intention of stimulating similar visitor studies in Turkey, it approached the subject from an experimental perspective, which enabled the collection of quantitative field data under fairly controlled conditions to test the hypotheses. Moreover, although the attributes that make an exhibit object more salient were already addressed in several studies in the field (e.g., Bitgood & Patterson, 1987; Bitgood et al., 1988; Donald, 1991; Melton, 1972; Peart, 1984), the sequential and generalized competition effects on the other objects exhibited in the same space have not been examined previously. The present study was the first to demonstrate the negative influence of a large exhibit object's introduction into a set of smaller objects on the overall attention allocated to an exhibition in a physical environment. Besides, the differences between physical and digital exhibitions, and the differences between size and three-dimensionality were revealed, in terms of their impact on the distribution of visitor attention on individual exhibit objects.

In this thesis, visitor attention was addressed as a continuum consisting of inter-connected stages (Bitgood, 2010, 2013). APs, AHTs, and frequencies of behaviors that indicated high levels of attention involved the *capture*, *focus*, and *engage* stages of the continuum, respectively. The results concerning these three groups of data showed different tendencies, corresponding to different levels of attention. Thus, it became possible to reveal the extent of the effects, rather than merely seeking to find whether they occurred or not.

On the whole, this research has identified significant aspects of exhibit object characteristics and placement, which might influence visitor attraction and holding time. The results are expected to help exhibition designers and curators in increasing the consistencies between the planned and resulting schemes of attention distribution in both physical and digital environments by providing evidence for

- the superior attention attracting and holding capability of salient objects in both physical and digital exhibitions;
- suppression of exhibit objects with the introduction of a more salient object, which is intensified with proximity (especially in physical exhibitions);
- similarities (e.g., gradual decrease in attention toward the end of exhibitions, salience of larger or three-dimensional objects) and differences (e.g., adjacency effects are diminished in the digital medium, salient object's presence influences the amount of attention paid to the overall exhibition negatively in the physical medium, and positively in the digital medium) between the ways that certain effects occur in physical and digital exhibitions;
- the differences between the salience levels generated by diverse exhibit object parameters, such as the superiority of three-dimensionality over size.

Since the salience concept could also apply for spatial elements (e.g., plinths, seating units, partitions) besides the exhibits in museums and galleries, interior designers might also consider the effects revealed through the experiments. Although a countless number of interconnected factors influence visitor attention in physical and digital exhibition environments, the findings of this thesis are expected to form a basis for predicting the isolated effects of exhibit object salience and ordinal position on visitor attention in physical and digital exhibitions, thus contributing to more effective exhibition planning and design.

REFERENCES

2004 Survey of Visitors to Museums' Web Space and Physical Space: Survey Documentation and Findings. (2005). Retrieved December 12, 2014 from: http://www.rcip-chin.gc.ca/contenu_numerique-digital_content/2004survey-2004survey/index-eng.jsp

Andrews, J. & Schweibenz, W. (1998). The Kress Study Collection Virtual Museum Project: A new medium for old masters. *Art Documentation, 17*(1), 19-27.

Argyrous, G. (1997). *Statistics for social research.* Basingstoke: Macmillan.

Arnheim, R. (1974). *Art and visual perception: A psychology of the creative eye.* Berkeley and Los Angeles, California: University of California Press.

AutoCAD® [Computer software]. (2014). Autodesk.

Bailey, E., Bronnenkant, K., Kelley, J., & Hein, G. E. (1998). Visitor behavior at a constructivist exhibition: Evaluating investigate! at Boston's museum of science. In C. Dufresne-Tassé (Ed.), *Evaluation and museum education: New trends* (pp. 149-168). Montreal: ICOM/CECA.

Bechtel, R. B. & Churchman, A. (2002). *Handbook of environmental psychology*. New York: John Wiley & Sons.,

Benjamin, W. (2002). The work of art in the age of mechanical reproduction: Second version. In H. Eiland & M. W. Jennings (Eds.), Walter Benjamin: *Selected Writings* (Vol. 3). London: Belknap Press of Harvard University Press.

Bitgood, S. (1992). The anatomy of an exhibit. *Visitor Behavior, 7*(4), 4-14.

Bitgood, S. (1994). Knowledge gain, memory, and evaluation: Are we using appropriate measures? *Visitor Behavior, 9*(2), 10-10.

Bitgood, S. (1996). Visitor orientation and circulation: Some general principles. In G. Durbin (Ed.), *Developing Museum Exhibitions for Lifelong Learning* (pp. 149-151). London: The Stationery Office.

Bitgood, S. (2002). Environmental psychology in museums, zoos, and other exhibition centers. In R. B. Bechtel, & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 461-480). New York: John Wiley & Sons.

Bitgood, S. (2006). An analysis of visitor circulation: Movement patterns and the general value principle. *Curator: The Museum Journal, 49*(4), 463-475.

Bitgood, S. (2009a). When is "museum fatigue" not fatigue? *Curator: The Museum Journal, 52*(2), 193-202.

Bitgood, S. (2009b). Museum fatigue: A critical review. *Visitor Studies Journal, 12*(2), 93-111.

Bitgood, S. (2009c). Museum fatigue: A new look at an old problem. *Informal Learning Review, July-August Issue*, 18-22.

Bitgood, S. (2010). *An attention-value model of museum visitors.* Unpublished manuscript. Retrieved March 25, 2013 from: http://informalscience.org/images/research/VSA_Bitgood.pdf

Bitgood, S. (2013). *Attention and value: Keys to understanding museum visitors.* Walnut Creek, California: Left Coast Press, Inc.

Bitgood, S. (2014). Exhibition design that provides high value and engages visitor attention. *Exhibitionist, Spring Issue,* 6-11. Retrieved September 30, 2016 from: http://name-aam.org/uploads/downloadables/EXH.spr_14/4%20EXH%20SP%2014%20Bitgood_Exhibition%20Design%20that%20provides%20High%20Values.pdf

Bitgood, S., Hines, J., Hamberger, W., & Ford, W. (1992). Visitor circulation through a changing exhibits gallery. In A. Benefield, S. Bitgood & H. Shettel (Eds.), *Visitor studies: Theory, research, and practice* (pp. 102-111). Jacksonville, AL: Center for Social Design.

Bitgood, S., McKerchar, T. L., & Dukes, S. (2013). Looking Back at Melton: Gallery Density and Visitor Attention. *Visitor Studies, 16*(2), 217-225.

Bitgood, S., & Patterson, D. (1987). Principles of exhibit design. *Visitor Behavior, 2*(1), 4-6.

Bitgood, S. C., & Patterson, D. D. (1993). The effects of gallery changes on visitor reading and object viewing time. *Environment and Behavior, 25*(6), 761-781. doi:10.1177/0013916593256006

Bitgood, S., Patterson, D., & Benefield, A. (1988). Exhibit design and visitor behavior: Empirical relationships. *Environment and Behavior, 20*(4), 474-491. doi:10.1177/0013916588204006

Bollo, A., & Dal Pozzolo, L. (2005). Analysis of visitor behaviour inside the museum: An empirical study. *Proceedings of the 8th International Conference on Arts and Cultural Management,* Montreal.

Bonis, B., Vosinaki, S., Andreou, I., & Panayiotopoulos, T. (2013). Adaptive virtual exhibitions. *DESIDOC Journal of Library & Information Technology*, *33*(3), 183-198.

Bourdeau, L., & Chebat, J. (2001). An empirical study of the effects of the design of the display galleries of an art gallery on the movement of visitors. *Museum Management and Curatorship, 19*(1), 63-73. doi:10.1080/09647770100601901

Bowen, J. P., Bennett, J., & Johnson, J. (1998). Virtual visits to virtual museums. In D. Bearman and J. Trant (Eds.), *Museums and the Web 1998*. Pittsburgh, PA: Archives & Museum Informatics. Retrieved May 20, 2014 from: http://www.archimuse.com/mw98/papers/bowen/bowen_paper.html

Burnham, W. H. (1908). Attention and interest. *The American Journal of Psychology, 2*(1), 14-18. doi: 10.2307/1412821

Carmo, M. B., & Cláudio, A. P. (2013). 3D virtual exhibitions. *DESIDOC Journal of Library & Information Technology*, *33*(3), 222-235.

Carreras, C., & Mancini, F. (2014). A Story of Great Expectations: Past and Present of Online/Virtual Exhibitions. *DESIDOC Journal of Library & Information Technology*, *34*(2), 87-96.

Carvalho, A. P. O., Gonçalves, H. J. S., & Garcia, L. M. M. (2013). Acoustics of modern and old museums. In C. B. Burroughs, S. McGuire, & G. Maling (Ed.s), *Proceedings of Noise-Con 2013* (pp. 545-552). Indianapolis, Indiana: Institute of Noise Control Engineering.

Chiozzi, G., & Andreotti, L. (2001). Behavior vs. time: Understanding how visitors utilize the Milan natural history museum. *Curator: The Museum Journal, 44*(2), 153-165. doi:10.1111/j.2151-6952.2001.tb00038.x

Cohen, S. (1996). Children and adults. In G. Durbin (Ed.), *Developing museum exhibitions for lifelong learning* (pp. 73-76). London: The Stationary Office.

Dean, D. (1994). *Museum exhibition: Theory and practice*. London and New York: Routledge.

Desvallées, A., & Mairesse, F. (eds.) (2010). *Key concepts of museology.* Paris: Armand Colin. Retrieved December 12, 2014 from: http://icom.museum/fileadmin/user_upload/pdf/Key_Concepts_of_Museology/ Museologie_Anglais_BD.pdf

Devine-Wright, H., & Breakwell, G. (1996). Proceedings from IAPS14: *Evaluating Visitor Behaviour in a Museum Gallery.* Stockholm, Sweden: Royal Institute of Technology. 141-148.

Donald, J. G. (1991). The measurement of learning in the museum. *Canadian Journal of Education/Revue Canadienne De l'Education, 16*(3), 371-382.

Erbay, M. (2011). *Müzelerde Sergileme ve Sunum Tekniklerinin Planlanması*. İstanbul: Beta.

Exhibition. (n.d.). In *Merriam Webster online*. Retrieved April 08, 2014 from: http://www.merriam-webster.com/dictionary/exhibition

Falk, J. H. (1993). Assessing the impact of exhibit arrangement on visitor behavior and learning. *Curator: The Museum Journal, 36*(2), 133-146.

Gasperi, D. (2012). The museum space between reality and virtuality: The case of the Google Art Project. In A. Nicholls, M. Pereira, & M. Sani (Eds.), *Report 1: The Virtual Museum* (52-57). Retrieved June 01, 2016 from: http://online.ibc.regione.emilia-romagna.it/I/libri/pdf/LEM_report1_theVirtualMuseum.pdf

Gilman, B. (1916). Museum Fatigue. *The Scientific Monthly, 12*, 67–74

Heath, C., Luff, P., Vom Lehn, D., Hindmarsh, J., & Cleverly, J. (2002). Crafting participation: Designing ecologies, configuring experience. *Visual Communication, 1*(1), 9-33.

Hoshi, T., Takahashi, M., Nakatsuma, K., & Shinoda, H. (2009). Touchable holography. In *Proceedings of SIGGRAPH '09.* (Article 23). doi: 10.1145/1597956.1597979

Imamoğlu, Ç., & Yılmazsoy, A. C. (2009). Gender and locality-related differences in circulation behavior in a museum setting. *Museum Management and Curatorship, 24*(2), 123-138.

Jensen, K. A. (2006). *Effects of the artistic design of interpretive signage on attracting power, holding time and memory recall.* (Unpublished Masters Thesis). Arcata, California: Humboldt State University. Retrieved October 21, 2013 from: http://humboldt-dspace.calstate.edu/bitstream/handle/2148/141/Jensen_Thesis.pdf?sequence=1

Kakuta, T., Oishi, T., & Ikeuchi, K. (2008). Virtual Asukakyo: Real-time soft shadows in mixed reality using shadowing planes. In K. Ikeuchi, & D. Miyazaki (Eds.), *Digitally archiving cultural objects* (pp. 457-471). Berlin: Springer.

Kaynar, I. (2005). Proceedings of the 5th International Space Syntax Symposium: *Visibility, movement paths and preferences in open plan museums: An observational and descriptive study of the Ann Arbor Hands-on Museum*. Delft: the Netherlands, 189-203.

Kaynar-Rohloff, İ., Psarra, S., & Wineman, J. (2009). Proceedings of The 7th international space syntax symposium: *Experiencing Museum Gallery Layouts through Local and Global Visibility Properties in Morphology: An inquiry on the YCBA, the MoMA and the HMA*. Stockholm: KTH, 7(2) 94-108.

Kim, T., & Biocca, F. (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion. *Journal of Computer-Mediated Communication*, *3*(2). Retrieved June 01, 2016 from: http://onlinelibrary.wiley.com/doi/10.1111/j.1083-6101.1997.tb00073.x/full.

Kirchberg, V., & Tröndle, M. (2012). Experiencing exhibitions: A review of studies on visitor experiences in museums. *Curator: The Museum Journal, 55*(4), 435-452. doi:10.1111/j.2151-6952.2012.00167.x

Klein, H. (1993). Tracking visitor circulation in museum settings. *Environment and Behavior, 25*(6), 782-800. doi:10.1177/0013916593256007

Lauer, D. A., & Pentak, S. (2008). *Design basics* (7th ed.). Boston, M.A.: Thomson Wadsworth.

vom Lehn, D. (2010). Examining "response": Video-based studies in museums and galleries. *International Journal of Culture, Tourism and Hospitality Research, 4*(1), 33-43.

vom Lehn, D., Heath, C., & Hindmarsh, J. (2001). Exhibiting interaction: Conduct and collaboration in museums and galleries. *Symbolic Interaction, 24*(2), 189-216.

Lessiter, J., Freeman, J., Keogh, E., & Davidoff, J. (2001). A cross-media presence questionnaire: The ITC-Sense of Presence Inventory. *Presence*, *10*(3), 282-297. doi:10.1162/105474601300343612

Lester, P. (2006). Is the virtual exhibition the natural successor to the physical? 1. *Journal of the Society of Archivists*, *27*(1), 85-101. doi:10.1080/00039810600691304

Loomis, R. J., Elias, S. M., & Wells, M. (2003). Website availability and visitor motivation: An evaluation study for the Colorado Digitization Project. *Unpublished Report. Fort Collins, CO: Colorado.* Retrieved December 11, 2014 from:

http://web.archive.org/web/20071007110835/http://www.cdpheritage.org/cdp/documents/loomis_report.pdf

Mania, K., & Robinson, A. (2005). An experimental exploration of the relationship between subjective impressions of illumination and physical fidelity. *Computers & Graphics*, *29*(1), 49-56. doi:10.1016/j.cag.2004.11.007

Matthew, M. (1996). Adult learners. In G. Durbin (Ed.), *Developing museum exhibitions for lifelong learning* (pp. 70-2). London: The Stationary Office.

McManus, P. M. (1994). "Families in museums". R. S. Miles and L. Zavala (Eds.), *Towards the Museum of the Future: New European Perspectives.* London: Routledge, pp. 81-97.

McKim, J. (2017). Speculative Animation: Digital Projections of Urban Past and Future. *Animation: An Interdisciplinary Journal, 12*(3). 287-305. doi: 10.1177/1746847717729581

Melton, A. W. (1935). *Problems of installation in museums of art.* Washington, D.C.: American Association of Museums.

Melton, A. W. (1972). Visitor behavior in museums: Some early research in environmental design. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *14*(5), 393-403.

Negrini, M., Paolini, P., & Rubegni, E. (2012). Museums' Visitors or Internet Users? In A. Nicholls, M. Pereira, and M. Sani (Eds.), *Report 1: The Virtual Museum,* 69-82.

Paolini, P., Barbieri, T., Loiudice, P., Alonzo, F., Zanti, M., & Gaia, G. (2000). Visiting a museum together: How to share a visit to a virtual world. *Journal of the American Society for Information Science*, *51*(1), 33-38.

Packer, J., & Ballantyne, R. (2005). Solitary vs. shared: Exploring the social dimension of museum learning. *Curator: The Museum Journal, 48*(2), 177-192. doi:10.1111/j.2151-6952.2005.tb00165.x

Peart, B. (1984). Impact of exhibit type on knowledge gain, attitudes, and behavior. *Curator: The Museum Journal*, *27*(3), 220-237.

Pekarik, A. J., & Schreiber, J. B. (2012). The power of expectation. *Curator: The Museum Journal, 55*(4), 487-496. doi:10.1111/j.2151-6952.2012.00171.x

Pekarik, A. J., Schreiber, J. B., Hanemann, N., Richmond, K., & Mogel, B. (2014). IPOP: A theory of experience preference. *Curator: The Museum Journal, 57*(1), 5-27. doi:10.1111/cura.12048

Robinson, E. S. (1928). *The behavior of the museum visitor.* Washington, DC: American Association of Museums.

Rogers, W. A. & Fisk, A. D. (2003). Technology Design, Usability and Aging: Human Factors Techniques and Considerations. In N. Charness and K. W. Schaie (Eds.), *Impact of Technology on Successful Aging* (pp. 1-14). New York: Springer.

Ross, S. R., & Gillespie, K. L. (2008). Influences on visitor behavior at a modern immersive zoo exhibit. *Zoo Biology, 28*(5), 462-472.

Rothman, L. (2014, April 21). Ghosts in the machine. Canada builds a new city that brings old Vancouver back to life. *Time.* Retrieved December 12, 2014 from: http://time.com/57177/canadas-ghosts-in-the-machine/

Rounds, J. (2004). Strategies for the curiosity-driven museum visitor. *Curator: The Museum Journal, 47*(4), 389-412.

Screven, C. G. (1974). *The measurement and facilitation of learning in the museum environment: An experimental analysis.* Washington D. C.: Smithsonian Institution Press.

Screven, C. G. (1986). Exhibitions and information centers: Some principles and approaches. *Curator: The Museum Journal, 29*(2), 109-137.

Serrell, B. (1997a). Paying attention: The duration and allocation of visitors' time in museum exhibitions. *Curator: The Museum Journal, 40*(2), 108-125. doi:10.1111/j.2151-6952.1997.tb01310.x

Serrell, B. (1997b). Time is indeed of the essence. *Curator: The Museum Journal, 40*(4), 253-255. doi:10.1111/j.2151-6952.1997.tb01310.x

Serrell, B. (2002). *Are they watching? visitors and videos in exhibitions. Curator: The Museum Journal, 45*(1), 50-64. doi:10.1111/j.2151-6952.2002.tb00049.x

Shettel, H. (1976). *An evaluation of visitor response to "Man in his environment"* (Report No. AIR-43200-7/76-FR). Washington, DC: American Institutes for Research.

Shettel, H. H. (1997). Time - Is it really of the essence? *Curator: The Museum Journal, 40*(4), 246-249. doi:10.1111/j.2151-6952.1997.tb01308.x

Slater, M. (1999). Measuring presence: A response to the Witmer and Singer presence questionnaire. *Presence: Teleoperators and Virtual Environments*, *8*(5), 560-565. doi:10.1162/105474699566477

Sookhanaphibarn, K., & Thawonmas, R. (2009). A framework for design and evaluation of digital museums in Second Life as learning institutions. In *Intelligent Information Hiding and Multimedia Signal Processing, 2009. IIH-MSP'09. Fifth International Conference on* (pp. 1130-1133). doi: 10.1109/IIH-MSP.2009.194

Sternberg, R. J., & Sternberg, K. (2012). *Cognitive psychology* (6th ed.). Belmont: Wadsworth, Cengage Learning.

Styliani, S., Fotis, L., Kostas, K., & Petros, P. (2009). Virtual museums, a survey and some issues for consideration. *Journal of Cultural Heritage, 10*(4), 520-528. doi: 10.1016/j.culher.2009.03.003

Sylaiou, S., Mania, K., Karoulis, A., & White, M. (2010). Exploring the relationship between presence and enjoyment in a virtual museum. *International Journal of Human-Computer Studies*, *68*(5), 243-253. doi:10.1016/j.ijhcs.2009.11.002

Taveira, A. & Choi, S. D. (2009). Review Study of Computer Input Devices and Older Users. *International Journal of Human-Computer Interaction, 25*(5), 455-474. doi: 10.1080/10447310902865040

Tröndle, M., Greenwood, S., Kirchberg, V., & Tschacher, W. (2012). An integrative and comprehensive methodology for studying aesthetic experience in the field: Merging movement tracking, physiology, and psychological data. *Environment and Behavior, 6*(1), 102-135. doi:10.1177/0013916512453839

Tröndle, M. (2014). Space, movement and attention: Affordances of the museum environment. *International Journal of Arts Management*, *17*(1), 4-17.

Tzortzi, K. (2007). Proceedings of the 6th International Space Syntax Symposium: *Museum building design and exhibition layout*, İstanbul: İstanbul Technical University.

Usoh, M., Catena, E., Arman, S., & Slater, M. (2000). Using presence questionnaires in reality. *Presence: Teleoperators and Virtual Environments*, *9*(5), 497-503. doi:10.1162/105474600566989

Walczak, K., Cellary, W., & White, M. (2006). Virtual museum exhibitions. *IEEE Computer*, *39*(3), 93-95.

Washburne, R. F., Wagar, J. A. (1972). Evaluating visitor response to exhibit content. *Curator: The Museum Journal*, *15*(3), 248-256.

Wineman, J. D., & Peponis, J. (2010). Constructing spatial meaning spatial affordances in museum design. *Environment and Behavior, 42*(1), 86-109.

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence: Teleoperators and virtual environments*, *7*(3), 225-240. doi:10.1162/105474698565686

Wojciechowski, R., Walczak, K., White, M., & Cellary, W. (2004). Building virtual and augmented reality museum exhibitions. In *Proceedings of the Ninth International Conference on 3D Web Technology* (pp. 135-144).

Wood, E., Willoughby, T., Rushing, A., Bechtel, L., & Gilbert, J. (2005). Use of computer input devices by older adults. *Journal of Applied Gerontology, 24*(5), 419-438. doi: 10.1177/0733464805278378

Yalowitz, S. S., & Bronnenkant, K. (2009). Timing and tracking: Unlocking visitor behavior. *Visitor Studies, 12*(1), 47-64. doi:10.1080/10645570902769134

APPENDICES

APPENDIX A: Questionnaire of Experiment P1

Bu anket, Bilkent Üniversitesi, İç Mimarlık ve Çevre Tasarımı Bölümü Doktora öğrencilerinden Ayça Turgay'ın tez çalışmasına bilimsel veri sağlamak amacıyla hazırlanmıştır. Verdiğiniz bilgiler başkalarıyla paylaşılmayacak ve başka hiçbir amaçla kullanılmayacaktır.
Sorularınız için: ayca.turgay@bilkent.edu.tr

KİŞİSEL SORULAR:

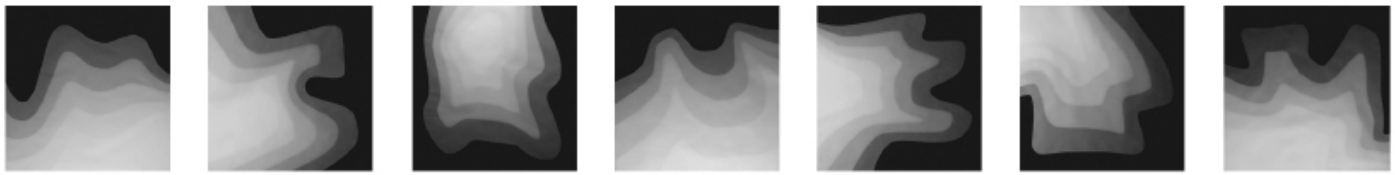
1. Kişisel bilgileriniz:
   Yaş: ..... Meslek: ..... Cinsiyet: ☐K ☐E
2. Eğitim durumunuz:
   - ☐ İlkokul
   - ☐ Ortaokul
   - ☐ Lise
   - ☐ Üniversite
   - ☐ Yüksek Lisans / Doktora
3. Sanatsal sergileri yılda kaç kez ziyaret edersiniz?
   ☐ Hiç ☐ 1-5 ☐ 5'ten çok
4. Daha önce bu mekânda bulundunuz mu? Evetse sebebini belirtiniz.
   ☐Evet: ..... ☐Hayır

Bu çalışmanın devamında yer almak isterseniz lütfen iletişim bilgilerinizi paylaşınız.
Ad-Soyad: .....
Telefon: ..... E-posta adresi : .....@.....

Lütfen arkayı çeviriniz.

SERGİ İLE İLGİLİ SORULAR:

1. Aşağıda eserler sergide gördüğünüz sıra ile yer almaktadır. Her bir esere ilginizi çekme derecelerine göre 1 ila 7 arası bir puan veriniz.



①	②	③	④	⑤	⑥	⑦
Hiç ilgimi çekmedi						Çok ilgimi çekti

2. Sergide gördüğünüz eserleri herhangi bir başka eser/form/nesneye benzetiyor musunuz? Cevabınız evetse açıklayınız.

☐Evet: .....

☐Hayır

3. Genel olarak sergiyi ne kadar ilgi çekici buldunuz?

Hiç ilgimi çekmedi ①②③④⑤⑥⑦ Çok ilgimi çekti

4. Sergideki deneyiminiz hakkında ek olarak belirtmek istediklerinizi lütfen yazınız.

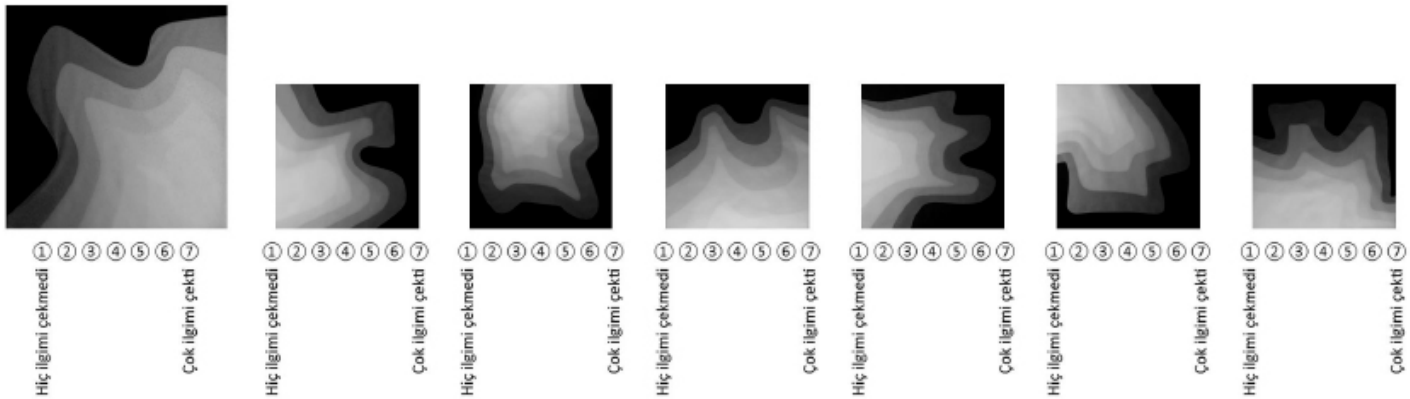
.....

.....

.....

SERGİ İLE İLGİLİ SORULAR:

1. **Aşağıda eserler sergide gördüğünüz sıra ile yer almaktadır. Her bir esere ilginizi çekme derecelerine göre 1 ila 7 arası bir puan veriniz.**



2. **Sergide gördüğünüz eserleri herhangi bir başka eser/form/nesneye benzetiyor musunuz? Cevabınız evetse açıklayınız.**

☐Evet: .....

☐Hayır

3. **Genel olarak sergiyi ne kadar ilgi çekici buldunuz?**

Hiç ilgimi çekmedi ①②③④⑤⑥⑦ Çok ilgimi çekti

4. **Sergideki deneyiminiz hakkında ek olarak belirtmek istediklerinizi lütfen yazınız.**

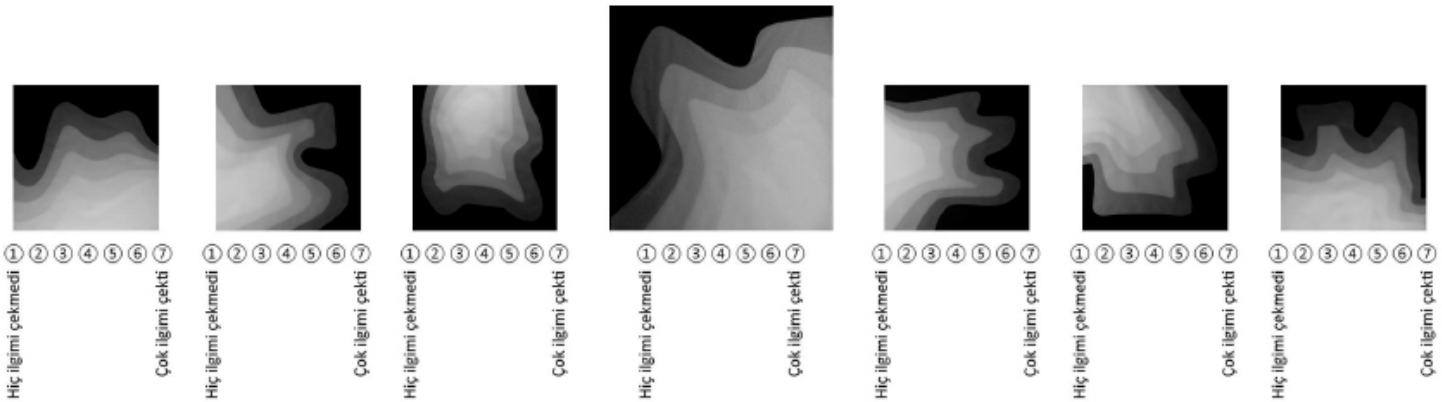
.....

.....

.....

SERGİ İLE İLGİLİ SORULAR:

1. **Aşağıda eserler sergide gördüğünüz sıra ile yer almaktadır. Her bir esere ilginizi çekme derecelerine göre 1 ila 7 arası bir puan veriniz.**



2. **Sergide gördüğünüz eserleri herhangi bir başka eser/form/nesneye benzetiyor musunuz? Cevabınız evetse açıklayınız.**

   ☐Evet: .....

   ☐Hayır

3. **Genel olarak sergiyi ne kadar ilgi çekici buldunuz?**

   Hiç ilgimi çekmedi ①②③④⑤⑥⑦ Çok ilgimi çekti

4. **Sergideki deneyiminiz hakkında ek olarak belirtmek istediklerinizi lütfen yazınız.**

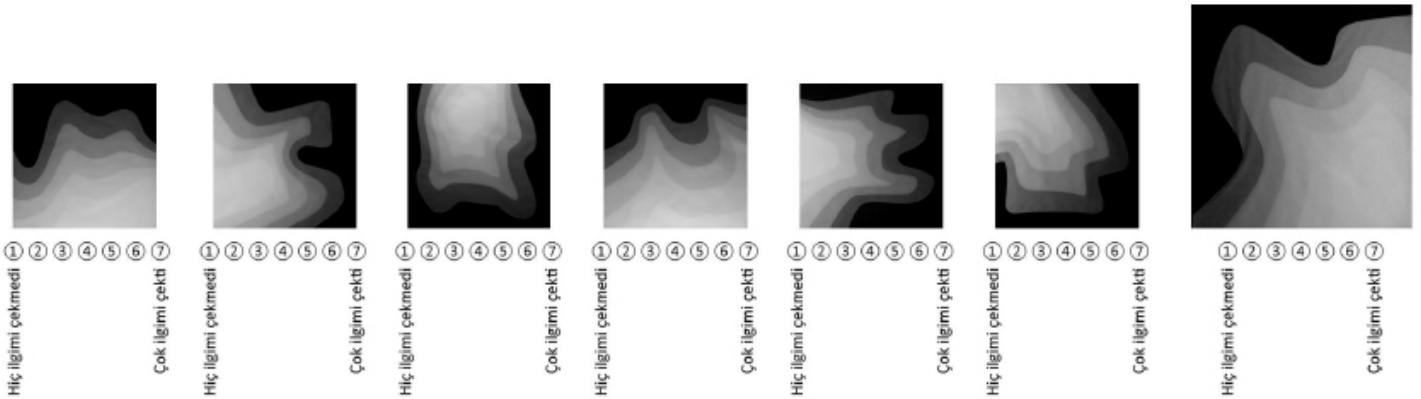
   .....

   .....

   .....

SERGİ İLE İLGİLİ SORULAR:

1. **Aşağıda eserler sergide gördüğünüz sıra ile yer almaktadır. Her bir esere ilginizi çekme derecelerine göre 1 ila 7 arası bir puan veriniz.**



2. **Sergide gördüğünüz eserleri herhangi bir başka eser/form/nesneye benzetiyor musunuz? Cevabınız evetse açıklayınız.**

☐Evet: .....

☐Hayır

3. **Genel olarak sergiyi ne kadar ilgi çekici buldunuz?**

Hiç ilgimi çekmedi ①②③④⑤⑥⑦ Çok ilgimi çekti

4. **Sergideki deneyiminiz hakkında ek olarak belirtmek istediklerinizi lütfen yazınız.**

.....

.....

.....

APPENDIX B: SUS Presence Questionnaire[1]

1. Please rate your sense of being in the exhibition space, on the following scale from 1 to 7, where 7 represents your normal experience of being in a place. I had a sense of ''being there'' in the exhibition space:
   (1) Not at all. (7) Very much.

2. To what extent were there times during the experience when the exhibition space was the reality for you? There were times during the experience when the exhibition space was the reality for me...
   (1) At no time. (7) Almost all the time.

3. When you think back about your experience, do you think of the exhibition space more as images that you saw, or more as somewhere that you visited? The exhibition space seems to me to be more like...
   (1) Images that I saw. (7) Somewhere that I visited.

4. During the time of the experience, which was strongest on the whole, your sense of being in the exhibition space, or of being elsewhere? I had a stronger sense of...
   (1) Being elsewhere. (7) Being in the exhibition space.

5. Consider your memory of being in the exhibition space. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today? By ''structure of the memory,'' consider things like the extent to which you have a visual memory of the exhibition space, whether that memory is in color, the extent to which the memory seems vivid or realistic, its size, location in your imagination, the extent to which it is panoramic in your imagination, and other such structural elements. I think of the exhibition space as a place in a way similar to other places that I've been today...
   (1) Not at all. (7) Very much so.

6. During the time of the experience, did you often think to yourself that you were actually in the exhibition space? During the experience I often thought that I was really standing in the exhibition space...
   (1) Not very often. (7) Very much so.

[1] Adapted from: Usoh, M., Catena, E., Arman, S., & Slater, M. (2000). Using presence questionnaires in reality. *Presence, 9*(5), 497-503. doi:10.1162/105474600566989

APPENDIX C: Statistical Test Results on Participants' Personal Information – Experiment P1

GROUP STATISTICS - GENDER

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	Women	65	4.57	3.11	.39
	Men	55	4.53	3.50	.47
MEAN INTEREST	Women	65	4.25	1.26	.16
	Men	55	4.05	1.32	.18

INDEPENDENT SAMPLES TEST - GENDER

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	.40	.53	.06	118	.95	.04	.60	-1.16	1.23
	Equal variances not assumed			.06	109.19	.95	.04	.61	-1.17	1.25
MEAN INTEREST	Equal variances assumed	.10	.75	.83	118	.41	.20	.24	-.27	.66
	Equal variances not assumed			.83	112.47	.41	.20	.24	-.27	.67

GROUP STATISTICS - AGE

	AGE GROUP	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	18-44	76	4.47	2.99	.34
	45-65	44	4.70	3.77	.57
MEAN INTEREST	18-44	76	4.05	1.31	.15
	45-65	44	4.35	1.23	.19

INDEPENDENT SAMPLES TEST - AGE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	.15	.70	-.38	118	.71	-.24	.62	-1.47	1.00
	Equal variances not assumed			-.35	74.23	.72	-.24	.66	-1.56	1.09
MEAN INTEREST	Equal variances assumed	.49	.48	-1.23	118	.22	-.30	.24	-.78	.18
	Equal variances not assumed			-1.25	94.85	.21	-.30	.24	-.77	.18

ANOVA – EDUCATION

(High-School / Bachelor's / Postgraduate)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	7.84	2	3.92	.36	.70
	Within Groups	1274.14	117	10.89		
	Total	1281.99	119			
MEAN INTEREST	Between Groups	1.75	2	.88	.53	.59
	Within Groups	194.89	117	1.67		
	Total	196.64	119			

GROUP STATISTICS – PREVIOUS EXPERIENCE IN THE VENUE

	PREVIOUS EXPERIENCE	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	VISITED BEFORE	92	4.47	3.19	.33
	FIRST-TIME	28	4.84	3.61	.68
MEAN INTEREST	VISITED BEFORE	92	4.11	1.13	.12
	FIRST-TIME	28	4.31	1.72	.32

INDEPENDENT SAMPLES TEST - PREVIOUS EXPERIENCE IN THE VENUE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	1.08	.30	-.52	118	.60	-.37	.71	-1.78	1.04
	Equal variances not assumed			-.49	40.66	.63	-.37	.76	-1.91	1.16
MEAN INTEREST	Equal variances assumed	6.43	.01	-.72	118	.48	-.20	.28	-.75	.35
	Equal variances not assumed			-.58	34.44	.57	-.20	.35	-.90	.50

ANOVA – EXHIBITION VISITING FREQUENCIES
(Never / 1-5 Times a Year/ More than 5 Times a Year)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	8.91	2	4.46	.41	.67
	Within Groups	1273.08	117	10.88		
	Total	1281.99	119			
MEAN INTEREST	Between Groups	8.57	2	4.29	2.67	.07
	Within Groups	188.07	117	1.61		
	Total	196.64	119			

APPENDIX D: One-Way ANOVA Results for Mean Viewing Durations in Experiment P1

ANOVA – TIMING – Control Condition

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	756.962	6	126.160	5.549	.000
Within Groups	4615.233	203	22.735		
Total	5372.195	209			

SCHEFFE - TIMING – Control Condition

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	3.90000	1.23113	.129	-.5151	8.3151
	3	4.33333	1.23113	.059	-.0817	8.7484
	4	4.20000	1.23113	.076	-.2151	8.6151
	5	5.66667*	1.23113	.002	1.2516	10.0817
	6	5.23333*	1.23113	.008	.8183	9.6484
	7	6.26667*	1.23113	.000	1.8516	10.6817
2	1	-3.90000	1.23113	.129	-8.3151	.5151
	3	.43333	1.23113	1.000	-3.9817	4.8484
	4	.30000	1.23113	1.000	-4.1151	4.7151
	5	1.76667	1.23113	.913	-2.6484	6.1817
	6	1.33333	1.23113	.978	-3.0817	5.7484
	7	2.36667	1.23113	.717	-2.0484	6.7817
3	1	-4.33333	1.23113	.059	-8.7484	.0817
	2	-.43333	1.23113	1.000	-4.8484	3.9817
	4	-.13333	1.23113	1.000	-4.5484	4.2817
	5	1.33333	1.23113	.978	-3.0817	5.7484
	6	.90000	1.23113	.997	-3.5151	5.3151
	7	1.93333	1.23113	.871	-2.4817	6.3484
4	1	-4.20000	1.23113	.076	-8.6151	.2151
	2	-.30000	1.23113	1.000	-4.7151	4.1151
	3	.13333	1.23113	1.000	-4.2817	4.5484
	5	1.46667	1.23113	.964	-2.9484	5.8817
	6	1.03333	1.23113	.994	-3.3817	5.4484
	7	2.06667	1.23113	.830	-2.3484	6.4817
5	1	-5.66667*	1.23113	.002	-10.0817	-1.2516
	2	-1.76667	1.23113	.913	-6.1817	2.6484
	3	-1.33333	1.23113	.978	-5.7484	3.0817
	4	-1.46667	1.23113	.964	-5.8817	2.9484
	6	-.43333	1.23113	1.000	-4.8484	3.9817
	7	.60000	1.23113	1.000	-3.8151	5.0151
6	1	-5.23333*	1.23113	.008	-9.6484	-.8183
	2	-1.33333	1.23113	.978	-5.7484	3.0817
	3	-.90000	1.23113	.997	-5.3151	3.5151
	4	-1.03333	1.23113	.994	-5.4484	3.3817
	5	.43333	1.23113	1.000	-3.9817	4.8484
	7	1.03333	1.23113	.994	-3.3817	5.4484
7	1	-6.26667*	1.23113	.000	-10.6817	-1.8516
	2	-2.36667	1.23113	.717	-6.7817	2.0484
	3	-1.93333	1.23113	.871	-6.3484	2.4817
	4	-2.06667	1.23113	.830	-6.4817	2.3484
	5	-.60000	1.23113	1.000	-5.0151	3.8151
	6	-1.03333	1.23113	.994	-5.4484	3.3817

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	3.5000	
5.00	30	4.1000	
6.00	30	4.5333	
4.00	30	5.4333	5.4333
3.00	30	5.5667	5.5667
2.00	30	5.8667	5.8667
1.00	30		9.7667
Sig.		.717	.059

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1898.554	6	316.426	10.152	.000
Within Groups	6763.406	217	31.168		
Total	8661.960	223			

SCHEFFE - TIMING – S#1

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	8.46875*	1.39570	.000	3.4669	13.4706
	3	7.87500*	1.39570	.000	2.8732	12.8768
	4	7.25000*	1.39570	.000	2.2482	12.2518
	5	8.46875*	1.39570	.000	3.4669	13.4706
	6	8.03125*	1.39570	.000	3.0294	13.0331
	7	9.03125*	1.39570	.000	4.0294	14.0331
2	1	-8.46875*	1.39570	.000	-13.4706	-3.4669
	3	-.59375	1.39570	1.000	-5.5956	4.4081
	4	-1.21875	1.39570	.993	-6.2206	3.7831
	5	.00000	1.39570	1.000	-5.0018	5.0018
	6	-.43750	1.39570	1.000	-5.4393	4.5643
	7	.56250	1.39570	1.000	-4.4393	5.5643
3	1	-7.87500*	1.39570	.000	-12.8768	-2.8732
	2	.59375	1.39570	1.000	-4.4081	5.5956
	4	-.62500	1.39570	1.000	-5.6268	4.3768
	5	.59375	1.39570	1.000	-4.4081	5.5956
	6	.15625	1.39570	1.000	-4.8456	5.1581
	7	1.15625	1.39570	.995	-3.8456	6.1581
4	1	-7.25000*	1.39570	.000	-12.2518	-2.2482
	2	1.21875	1.39570	.993	-3.7831	6.2206
	3	.62500	1.39570	1.000	-4.3768	5.6268
	5	1.21875	1.39570	.993	-3.7831	6.2206
	6	.78125	1.39570	.999	-4.2206	5.7831
	7	1.78125	1.39570	.950	-3.2206	6.7831
5	1	-8.46875*	1.39570	.000	-13.4706	-3.4669
	2	.00000	1.39570	1.000	-5.0018	5.0018
	3	-.59375	1.39570	1.000	-5.5956	4.4081
	4	-1.21875	1.39570	.993	-6.2206	3.7831
	6	-.43750	1.39570	1.000	-5.4393	4.5643
	7	.56250	1.39570	1.000	-4.4393	5.5643
6	1	-8.03125*	1.39570	.000	-13.0331	-3.0294
	2	.43750	1.39570	1.000	-4.5643	5.4393
	3	-.15625	1.39570	1.000	-5.1581	4.8456
	4	-.78125	1.39570	.999	-5.7831	4.2206
	5	.43750	1.39570	1.000	-4.5643	5.4393
	7	1.00000	1.39570	.998	-4.0018	6.0018
7	1	-9.03125*	1.39570	.000	-14.0331	-4.0294
	2	-.56250	1.39570	1.000	-5.5643	4.4393
	3	-1.15625	1.39570	.995	-6.1581	3.8456
	4	-1.78125	1.39570	.950	-6.7831	3.2206
	5	-.56250	1.39570	1.000	-5.5643	4.4393
	6	-1.00000	1.39570	.998	-6.0018	4.0018

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	3.1875	
5.00	30	3.7500	
6.00	30	3.7500	
4.00	30	4.1875	
3.00	30	4.3438	
2.00	30	4.9688	
1.00	30		12.2188
Sig.		.950	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	616.181	6	102.697	10.144	.000
Within Groups	2055.100	203	10.124		
Total	2671.281	209			

SCHEFFE - TIMING – S#4

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	1.86667	.82153	.525	-1.0795	4.8128
	3	4.10000*	.82153	.001	1.1538	7.0462
	4	.73333	.82153	.992	-2.2128	3.6795
	5	3.73333*	.82153	.003	.7872	6.6795
	6	4.33333*	.82153	.000	1.3872	7.2795
	7	4.43333*	.82153	.000	1.4872	7.3795
2	1	-1.86667	.82153	.525	-4.8128	1.0795
	3	2.23333	.82153	.291	-.7128	5.1795
	4	-1.13333	.82153	.928	-4.0795	1.8128
	5	1.86667	.82153	.525	-1.0795	4.8128
	6	2.46667	.82153	.179	-.4795	5.4128
	7	2.56667	.82153	.141	-.3795	5.5128
3	1	-4.10000*	.82153	.001	-7.0462	-1.1538
	2	-2.23333	.82153	.291	-5.1795	.7128
	4	-3.36667*	.82153	.012	-6.3128	-.4205
	5	-.36667	.82153	1.000	-3.3128	2.5795
	6	.23333	.82153	1.000	-2.7128	3.1795
	7	.33333	.82153	1.000	-2.6128	3.2795
4	1	-.73333	.82153	.992	-3.6795	2.2128
	2	1.13333	.82153	.928	-1.8128	4.0795
	3	3.36667*	.82153	.012	.4205	6.3128
	5	3.00000*	.82153	.042	.0538	5.9462
	6	3.60000*	.82153	.005	.6538	6.5462
	7	3.70000*	.82153	.003	.7538	6.6462
5	1	-3.73333*	.82153	.003	-6.6795	-.7872
	2	-1.86667	.82153	.525	-4.8128	1.0795
	3	.36667	.82153	1.000	-2.5795	3.3128
	4	-3.00000*	.82153	.042	-5.9462	-.0538
	6	.60000	.82153	.997	-2.3462	3.5462
	7	.70000	.82153	.994	-2.2462	3.6462
6	1	-4.33333*	.82153	.000	-7.2795	-1.3872
	2	-2.46667	.82153	.179	-5.4128	.4795
	3	-.23333	.82153	1.000	-3.1795	2.7128
	4	-3.60000*	.82153	.005	-6.5462	-.6538
	5	-.60000	.82153	.997	-3.5462	2.3462
	7	.10000	.82153	1.000	-2.8462	3.0462
7	1	-4.43333*	.82153	.000	-7.3795	-1.4872
	2	-2.56667	.82153	.141	-5.5128	.3795
	3	-.33333	.82153	1.000	-3.2795	2.6128
	4	-3.70000*	.82153	.003	-6.6462	-.7538
	5	-.70000	.82153	.994	-3.6462	2.2462
	6	-.10000	.82153	1.000	-3.0462	2.8462

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	1.7333	
5.00	30	1.8333	
6.00	30	2.0667	
4.00	30	2.4333	
3.00	30	4.3000	4.3000
2.00	30		5.4333
1.00	30		6.1667
Sig.		.141	.525

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#7

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	331.786	6	55.298	3.399	.003
Within Groups	3074.964	189	16.270		
Total	3406.750	195			

SCHEFFE - TIMING – S#7

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	1.25000	1.07802	.969	-2.6190	5.1190
	3	2.07143	1.07802	.718	-1.7976	5.9404
	4	3.07143	1.07802	.236	-.7976	6.9404
	5	3.17857	1.07802	.198	-.6904	7.0476
	6	4.28571*	1.07802	.018	.4167	8.1547
	7	2.64286	1.07802	.426	-1.2261	6.5118
2	1	-1.25000	1.07802	.969	-5.1190	2.6190
	3	.82143	1.07802	.997	-3.0476	4.6904
	4	1.82143	1.07802	.826	-2.0476	5.6904
	5	1.92857	1.07802	.782	-1.9404	5.7976
	6	3.03571	1.07802	.249	-.8333	6.9047
	7	1.39286	1.07802	.947	-2.4761	5.2618
3	1	-2.07143	1.07802	.718	-5.9404	1.7976
	2	-.82143	1.07802	.997	-4.6904	3.0476
	4	1.00000	1.07802	.990	-2.8690	4.8690
	5	1.10714	1.07802	.983	-2.7618	4.9761
	6	2.21429	1.07802	.647	-1.6547	6.0833
	7	.57143	1.07802	1.000	-3.2976	4.4404
4	1	-3.07143	1.07802	.236	-6.9404	.7976
	2	-1.82143	1.07802	.826	-5.6904	2.0476
	3	-1.00000	1.07802	.990	-4.8690	2.8690
	5	.10714	1.07802	1.000	-3.7618	3.9761
	6	1.21429	1.07802	.973	-2.6547	5.0833
	7	-.42857	1.07802	1.000	-4.2976	3.4404
5	1	-3.17857	1.07802	.198	-7.0476	.6904
	2	-1.92857	1.07802	.782	-5.7976	1.9404
	3	-1.10714	1.07802	.983	-4.9761	2.7618
	4	-.10714	1.07802	1.000	-3.9761	3.7618
	6	1.10714	1.07802	.983	-2.7618	4.9761
	7	-.53571	1.07802	1.000	-4.4047	3.3333
6	1	-4.28571*	1.07802	.018	-8.1547	-.4167
	2	-3.03571	1.07802	.249	-6.9047	.8333
	3	-2.21429	1.07802	.647	-6.0833	1.6547
	4	-1.21429	1.07802	.973	-5.0833	2.6547
	5	-1.10714	1.07802	.983	-4.9761	2.7618
	7	-1.64286	1.07802	.887	-5.5118	2.2261
7	1	-2.64286	1.07802	.426	-6.5118	1.2261
	2	-1.39286	1.07802	.947	-5.2618	2.4761
	3	-.57143	1.07802	1.000	-4.4404	3.2976
	4	.42857	1.07802	1.000	-3.4404	4.2976
	5	.53571	1.07802	1.000	-3.3333	4.4047
	6	1.64286	1.07802	.887	-2.2261	5.5118

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	2.0357	
5.00	30	3.1429	3.1429
6.00	30	3.2500	3.2500
4.00	30	3.6786	3.6786
3.00	30	4.2500	4.2500
2.00	30	5.0714	5.0714
1.00	30		6.3214
Sig.		.249	.198

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

APPENDIX E: Statistical Test Results on Participants' Personal Information – Experiment D1

GROUP STATISTICS - GENDER

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	Women	61	5.38	4.35	.56
	Men	59	5.23	4.00	.52
MEAN INTEREST	Women	61	3.98	1.31	.17
	Men	59	3.95	1.31	.17

INDEPENDENT SAMPLES TEST - GENDER

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	.03	.87	.20	118	.84	.16	.76	-1.36	1.67
	Equal variances not assumed			.20	117.71	.84	.16	.76	-1.35	1.66
MEAN INTEREST	Equal variances assumed	.10	.76	.09	118	.93	.02	.24	-.45	.50
	Equal variances not assumed			.09	117.87	.93	.02	.24	-.45	.50

GROUP STATISTICS - AGE

	AGE GROUP	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	18-44	93	4.87	3.68	.38
	45-65	27	6.78	5.34	1.03
MEAN INTEREST	18-44	93	3.97	1.35	.14
	45-65	27	3.95	1.15	.22

INDEPENDENT SAMPLES TEST - AGE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	3.53	.06	-2.13	118	.04	-1.91	.90	-3.69	-.13
	Equal variances not assumed			-1.74	33.48	.09	-1.91	1.10	-4.14	.32
MEAN INTEREST	Equal variances assumed	2.12	.15	.06	118	.95	.02	.29	-.55	.58
	Equal variances not assumed			.06	48.76	.95	.02	.26	-.51	.54

ANOVA – EDUCATION

(High-School / Bachelor's / Postgraduate)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	50.46	2	25.23	1.47	.24
	Within Groups	2010.76	117	17.19		
	Total	2061.21	119			
MEAN INTEREST	Between Groups	5.15	2	2.58	1.53	.22
	Within Groups	196.35	117	1.68		
	Total	201.50	119			

GROUP STATISTICS – PREVIOUS EXPERIENCE IN THE VENUE

	PREVIOUS EXPERIENCE	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	VISITED BEFORE	100	5.40	4.46	.45
	FIRST-TIME	20	4.81	2.09	.47
MEAN INTEREST	VISITED BEFORE	100	4.00	1.29	.13
	FIRST-TIME	20	3.81	1.39	.31

INDEPENDENT SAMPLES TEST - PREVIOUS EXPERIENCE IN THE VENUE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	1.87	.17	.58	118	.56	.60	1.02	-1.43	2.62
	Equal variances not assumed			.92	60.10	.36	.60	.65	-.69	1.89
MEAN INTEREST	Equal variances assumed	.60	.44	.57	118	.57	.18	.32	-.45	.81
	Equal variances not assumed			.54	25.97	.59	.18	.34	-.51	.87

ANOVA – EXHIBITION VISITING FREQUENCIES
(Never / 1-5 Times a Year/ More than 5 Times a Year)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	7.34	2	3.67	.209	.81
	Within Groups	2053.87	117	17.55		
	Total	2061.21	119			
MEAN INTEREST	Between Groups	6.96	2	3.48	2.09	.13
	Within Groups	194.54	117	1.66		
	Total	201.50	119			

APPENDIX F: One-Way ANOVA Results for Mean Viewing Durations in Experiment D1

ANOVA – TIMING – Control Condition

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1595.990	6	265.998	6.362	.000
Within Groups	8487.133	203	41.809		
Total	10083.124	209			

SCHEFFE - TIMING – Control Condition

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	5.46667	1.66950	.103	-.5205	11.4538
	3	7.26667*	1.66950	.006	1.2795	13.2538
	4	7.33333*	1.66950	.005	1.3462	13.3205
	5	8.23333*	1.66950	.001	2.2462	14.2205
	6	8.06667*	1.66950	.001	2.0795	14.0538
	7	8.30000*	1.66950	.001	2.3129	14.2871
2	1	-5.46667	1.66950	.103	-11.4538	.5205
	3	1.80000	1.66950	.978	-4.1871	7.7871
	4	1.86667	1.66950	.974	-4.1205	7.8538
	5	2.76667	1.66950	.839	-3.2205	8.7538
	6	2.60000	1.66950	.876	-3.3871	8.5871
	7	2.83333	1.66950	.823	-3.1538	8.8205
3	1	-7.26667*	1.66950	.006	-13.2538	-1.2795
	2	-1.80000	1.66950	.978	-7.7871	4.1871
	4	.06667	1.66950	1.000	-5.9205	6.0538
	5	.96667	1.66950	.999	-5.0205	6.9538
	6	.80000	1.66950	1.000	-5.1871	6.7871
	7	1.03333	1.66950	.999	-4.9538	7.0205
4	1	-7.33333*	1.66950	.005	-13.3205	-1.3462
	2	-1.86667	1.66950	.974	-7.8538	4.1205
	3	-.06667	1.66950	1.000	-6.0538	5.9205
	5	.90000	1.66950	1.000	-5.0871	6.8871
	6	.73333	1.66950	1.000	-5.2538	6.7205
	7	.96667	1.66950	.999	-5.0205	6.9538
5	1	-8.23333*	1.66950	.001	-14.2205	-2.2462
	2	-2.76667	1.66950	.839	-8.7538	3.2205
	3	-.96667	1.66950	.999	-6.9538	5.0205
	4	-.90000	1.66950	1.000	-6.8871	5.0871
	6	-.16667	1.66950	1.000	-6.1538	5.8205
	7	.06667	1.66950	1.000	-5.9205	6.0538
6	1	-8.06667*	1.66950	.001	-14.0538	-2.0795
	2	-2.60000	1.66950	.876	-8.5871	3.3871
	3	-.80000	1.66950	1.000	-6.7871	5.1871
	4	-.73333	1.66950	1.000	-6.7205	5.2538
	5	.16667	1.66950	1.000	-5.8205	6.1538
	7	.23333	1.66950	1.000	-5.7538	6.2205
7	1	-8.30000*	1.66950	.001	-14.2871	-2.3129
	2	-2.83333	1.66950	.823	-8.8205	3.1538
	3	-1.03333	1.66950	.999	-7.0205	4.9538
	4	-.96667	1.66950	.999	-6.9538	5.0205
	5	-.06667	1.66950	1.000	-6.0538	5.9205
	6	-.23333	1.66950	1.000	-6.2205	5.7538

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	3.2333	
5.00	30	3.3000	
6.00	30	3.4667	
4.00	30	4.2000	
3.00	30	4.2667	
2.00	30	6.0667	6.0667
1.00	30		11.5333
Sig.		.823	.103

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2033.429	6	338.905	9.140	.000
Within Groups	7527.067	203	37.079		
Total	9560.495	209			

SCHEFFE - TIMING – S#1

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	7.00000*	1.57224	.004	1.3617	12.6383
	3	7.80000*	1.57224	.001	2.1617	13.4383
	4	8.36667*	1.57224	.000	2.7283	14.0050
	5	9.56667*	1.57224	.000	3.9283	15.2050
	6	9.20000*	1.57224	.000	3.5617	14.8383
	7	9.36667*	1.57224	.000	3.7283	15.0050
2	1	-7.00000*	1.57224	.004	-12.6383	-1.3617
	3	.80000	1.57224	1.000	-4.8383	6.4383
	4	1.36667	1.57224	.993	-4.2717	7.0050
	5	2.56667	1.57224	.849	-3.0717	8.2050
	6	2.20000	1.57224	.923	-3.4383	7.8383
	7	2.36667	1.57224	.893	-3.2717	8.0050
3	1	-7.80000*	1.57224	.001	-13.4383	-2.1617
	2	-.80000	1.57224	1.000	-6.4383	4.8383
	4	.56667	1.57224	1.000	-5.0717	6.2050
	5	1.76667	1.57224	.973	-3.8717	7.4050
	6	1.40000	1.57224	.992	-4.2383	7.0383
	7	1.56667	1.57224	.986	-4.0717	7.2050
4	1	-8.36667*	1.57224	.000	-14.0050	-2.7283
	2	-1.36667	1.57224	.993	-7.0050	4.2717
	3	-.56667	1.57224	1.000	-6.2050	5.0717
	5	1.20000	1.57224	.997	-4.4383	6.8383
	6	.83333	1.57224	1.000	-4.8050	6.4717
	7	1.00000	1.57224	.999	-4.6383	6.6383
5	1	-9.56667*	1.57224	.000	-15.2050	-3.9283
	2	-2.56667	1.57224	.849	-8.2050	3.0717
	3	-1.76667	1.57224	.973	-7.4050	3.8717
	4	-1.20000	1.57224	.997	-6.8383	4.4383
	6	-.36667	1.57224	1.000	-6.0050	5.2717
	7	-.20000	1.57224	1.000	-5.8383	5.4383
6	1	-9.20000*	1.57224	.000	-14.8383	-3.5617
	2	-2.20000	1.57224	.923	-7.8383	3.4383
	3	-1.40000	1.57224	.992	-7.0383	4.2383
	4	-.83333	1.57224	1.000	-6.4717	4.8050
	5	.36667	1.57224	1.000	-5.2717	6.0050
	7	.16667	1.57224	1.000	-5.4717	5.8050
7	1	-9.36667*	1.57224	.000	-15.0050	-3.7283
	2	-2.36667	1.57224	.893	-8.0050	3.2717
	3	-1.56667	1.57224	.986	-7.2050	4.0717
	4	-1.00000	1.57224	.999	-6.6383	4.6383
	5	.20000	1.57224	1.000	-5.4383	5.8383
	6	-.16667	1.57224	1.000	-5.8050	5.4717

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
5.00	30	3.6000	
7.00	30	3.8000	
6.00	30	3.9667	
4.00	30	4.8000	
3.00	30	5.3667	
2.00	30	6.1667	
1.00	30		13.1667
Sig.		.849	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1227.457	6	204.576	7.580	.000
Within Groups	5478.467	203	26.988		
Total	6705.924	209			

SCHEFFE - TIMING – S#4

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	5.500*	1.382	.017	.54	10.46
	3	6.300*	1.382	.003	1.34	11.26
	4	4.633	1.382	.087	-.32	9.59
	5	7.300*	1.382	.000	2.34	12.26
	6	5.967*	1.382	.006	1.01	10.92
	7	6.967*	1.382	.000	2.01	11.92
2	1	-5.500*	1.382	.017	-10.46	-.54
	3	.800	1.382	.999	-4.16	5.76
	4	-.867	1.382	.999	-5.82	4.09
	5	1.800	1.382	.945	-3.16	6.76
	6	.467	1.382	1.000	-4.49	5.42
	7	1.467	1.382	.980	-3.49	6.42
3	1	-6.300*	1.382	.003	-11.26	-1.34
	2	-.800	1.382	.999	-5.76	4.16
	4	-1.667	1.382	.962	-6.62	3.29
	5	1.000	1.382	.997	-3.96	5.96
	6	-.333	1.382	1.000	-5.29	4.62
	7	.667	1.382	1.000	-4.29	5.62
4	1	-4.633	1.382	.087	-9.59	.32
	2	.867	1.382	.999	-4.09	5.82
	3	1.667	1.382	.962	-3.29	6.62
	5	2.667	1.382	.714	-2.29	7.62
	6	1.333	1.382	.988	-3.62	6.29
	7	2.333	1.382	.827	-2.62	7.29
5	1	-7.300*	1.382	.000	-12.26	-2.34
	2	-1.800	1.382	.945	-6.76	3.16
	3	-1.000	1.382	.997	-5.96	3.96
	4	-2.667	1.382	.714	-7.62	2.29
	6	-1.333	1.382	.988	-6.29	3.62
	7	-.333	1.382	1.000	-5.29	4.62
6	1	-5.967*	1.382	.006	-10.92	-1.01
	2	-.467	1.382	1.000	-5.42	4.49
	3	.333	1.382	1.000	-4.62	5.29
	4	-1.333	1.382	.988	-6.29	3.62
	5	1.333	1.382	.988	-3.62	6.29
	7	1.000	1.382	.997	-3.96	5.96
7	1	-6.967*	1.382	.000	-11.92	-2.01
	2	-1.467	1.382	.980	-6.42	3.49
	3	-.667	1.382	1.000	-5.62	4.29
	4	-2.333	1.382	.827	-7.29	2.62
	5	.333	1.382	1.000	-4.62	5.29
	6	-1.000	1.382	.997	-5.96	3.96

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
5	30	2.73	
7	30	3.07	
3	30	3.73	
6	30	4.07	
2	30	4.53	
4	30	5.40	5.40
1	30		10.03
Sig.		.714	.087

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#7

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1989.029	6	331.505	20.845	.000
Within Groups	3228.400	203	15.903		
Total	5217.429	209			

SCHEFFE - TIMING – S#7

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	6.93333*	1.02967	.000	3.2407	10.6259
	3	8.53333*	1.02967	.000	4.8407	12.2259
	4	8.86667*	1.02967	.000	5.1741	12.5593
	5	8.50000*	1.02967	.000	4.8074	12.1926
	6	9.83333*	1.02967	.000	6.1407	13.5259
	7	5.90000*	1.02967	.000	2.2074	9.5926
2	1	-6.93333*	1.02967	.000	-10.6259	-3.2407
	3	1.60000	1.02967	.877	-2.0926	5.2926
	4	1.93333	1.02967	.740	-1.7593	5.6259
	5	1.56667	1.02967	.888	-2.1259	5.2593
	6	2.90000	1.02967	.249	-.7926	6.5926
	7	-1.03333	1.02967	.985	-4.7259	2.6593
3	1	-8.53333*	1.02967	.000	-12.2259	-4.8407
	2	-1.60000	1.02967	.877	-5.2926	2.0926
	4	.33333	1.02967	1.000	-3.3593	4.0259
	5	-.03333	1.02967	1.000	-3.7259	3.6593
	6	1.30000	1.02967	.952	-2.3926	4.9926
	7	-2.63333	1.02967	.370	-6.3259	1.0593
4	1	-8.86667*	1.02967	.000	-12.5593	-5.1741
	2	-1.93333	1.02967	.740	-5.6259	1.7593
	3	-.33333	1.02967	1.000	-4.0259	3.3593
	5	-.36667	1.02967	1.000	-4.0593	3.3259
	6	.96667	1.02967	.990	-2.7259	4.6593
	7	-2.96667	1.02967	.223	-6.6593	.7259
5	1	-8.50000*	1.02967	.000	-12.1926	-4.8074
	2	-1.56667	1.02967	.888	-5.2593	2.1259
	3	.03333	1.02967	1.000	-3.6593	3.7259
	4	.36667	1.02967	1.000	-3.3259	4.0593
	6	1.33333	1.02967	.946	-2.3593	5.0259
	7	-2.60000	1.02967	.386	-6.2926	1.0926
6	1	-9.83333*	1.02967	.000	-13.5259	-6.1407
	2	-2.90000	1.02967	.249	-6.5926	.7926
	3	-1.30000	1.02967	.952	-4.9926	2.3926
	4	-.96667	1.02967	.990	-4.6593	2.7259
	5	-1.33333	1.02967	.946	-5.0259	2.3593
	7	-3.93333*	1.02967	.027	-7.6259	-.2407
7	1	-5.90000*	1.02967	.000	-9.5926	-2.2074
	2	1.03333	1.02967	.985	-2.6593	4.7259
	3	2.63333	1.02967	.370	-1.0593	6.3259
	4	2.96667	1.02967	.223	-.7259	6.6593
	5	2.60000	1.02967	.386	-1.0926	6.2926
	6	3.93333*	1.02967	.027	.2407	7.6259

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
6.00	30	2.5333	
4.00	30	3.5000	3.5000
3.00	30	3.8333	3.8333
5.00	30	3.8667	3.8667
2.00	30	5.4333	5.4333
7.00	30		6.4667
1.00	30		
Sig.		.249	.223

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

APPENDIX G: Statistical Test Results on Participants' Personal Information – Experiment D2

GROUP STATISTICS - GENDER

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	Women	62	5.58	3.96	.50
	Men	58	5.74	4.58	.60
MEAN INTEREST	Women	62	3.97	1.16	.15
	Men	58	4.09	1.13	.15

INDEPENDENT SAMPLES TEST - GENDER

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	.14	.71	-.21	118	.83	-.17	.78	-1.71	1.38
	Equal variances not assumed			-.21	112.96	.83	-.17	.78	-1.72	1.39
MEAN INTEREST	Equal variances assumed	.26	.61	-.57	118	.57	-.12	.21	.53	.30
	Equal variances not assumed			-.57	117.79	.57	-.12	.21	.53	.30

GROUP STATISTICS - AGE

	AGE GROUP	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	18-44	89	5.85	4.64	.49
	45-65	31	5.10	2.85	.51
MEAN INTEREST	18-44	89	3.97	1.24	.13
	45-65	31	4.19	.78	.14

INDEPENDENT SAMPLES TEST - AGE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	3.35	.07	.85	118	.40	.76	.89	-1.00	2.52
	Equal variances not assumed			1.07	86.14	.29	.76	.71	-.65	2.17
MEAN INTEREST	Equal variances assumed	4.94	.03	-.94	118	.35	-.22	.24	-.70	.25
	Equal variances not assumed			-1.17	84.13	.25	-.22	.19	-.61	.16

ANOVA – EDUCATION

(High-School / Bachelor's / Postgraduate)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	90.46	2	45.23	2.56	.08
	Within Groups	2063.47	117	17.64		
	Total	2153.92	119			
MEAN INTEREST	Between Groups	.205	2	.103	.08	.93
	Within Groups	155.11	117	1.33		
	Total	155.311	119			

GROUP STATISTICS – PREVIOUS EXPERIENCE IN THE VENUE

	PREVIOUS EXPERIENCE	N	Mean	Std. Deviation	Std. Error Mean
MEAN AHT	VISITED BEFORE	101	5.86	4.49	.45
	FIRST-TIME	19	4.59	2.53	.58
MEAN INTEREST	VISITED BEFORE	101	4.08	1.11	.11
	FIRST-TIME	19	3.77	1.28	.29

INDEPENDENT SAMPLES TEST - PREVIOUS EXPERIENCE IN THE VENUE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MEAN AHT	Equal variances assumed	.95	.33	1.91	118	.24	1.26	1.06	-.84	3.37
	Equal variances not assumed			1.73	42.98	.09	.73	.73	-.21	2.74
MEAN INTEREST	Equal variances assumed	.30	.59	1.09	118	.28	.29	.29	-.26	.88
	Equal variances not assumed			.99	23.43	.33	.31	.31	-.34	.96

ANOVA – EXHIBITION VISITING FREQUENCIES
(Never / 1-5 Times a Year/ More than 5 Times a Year)

		Sum of Squares	df	Mean Square	F	Sig.
MEAN AHT	Between Groups	11.48	2	5.74	.31	.73
	Within Groups	2142.44	117	18.31		
	Total	2.153.92	119			
MEAN INTEREST	Between Groups	6.45	2	3.22	2.53	.08
	Within Groups	148.87	117	1.27		
	Total	155.31	119			

APPENDIX H: One-Way ANOVA Results for Mean Viewing Durations in Experiment D2

ANOVA – TIMING – Control Condition

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1595.990	6	265.998	6.362	.000
Within Groups	8487.133	203	41.809		
Total	10083.124	209			

SCHEFFE - TIMING – Control Condition

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	5.46667	1.66950	.103	-.5205	11.4538
	3	7.26667*	1.66950	.006	1.2795	13.2538
	4	7.33333*	1.66950	.005	1.3462	13.3205
	5	8.23333*	1.66950	.001	2.2462	14.2205
	6	8.06667*	1.66950	.001	2.0795	14.0538
	7	8.30000*	1.66950	.001	2.3129	14.2871
2	1	-5.46667	1.66950	.103	-11.4538	.5205
	3	1.80000	1.66950	.978	-4.1871	7.7871
	4	1.86667	1.66950	.974	-4.1205	7.8538
	5	2.76667	1.66950	.839	-3.2205	8.7538
	6	2.60000	1.66950	.876	-3.3871	8.5871
	7	2.83333	1.66950	.823	-3.1538	8.8205
3	1	-7.26667*	1.66950	.006	-13.2538	-1.2795
	2	-1.80000	1.66950	.978	-7.7871	4.1871
	4	.06667	1.66950	1.000	-5.9205	6.0538
	5	.96667	1.66950	.999	-5.0205	6.9538
	6	.80000	1.66950	1.000	-5.1871	6.7871
	7	1.03333	1.66950	.999	-4.9538	7.0205
4	1	-7.33333*	1.66950	.005	-13.3205	-1.3462
	2	-1.86667	1.66950	.974	-7.8538	4.1205
	3	-.06667	1.66950	1.000	-6.0538	5.9205
	5	.90000	1.66950	1.000	-5.0871	6.8871
	6	.73333	1.66950	1.000	-5.2538	6.7205
	7	.96667	1.66950	.999	-5.0205	6.9538
5	1	-8.23333*	1.66950	.001	-14.2205	-2.2462
	2	-2.76667	1.66950	.839	-8.7538	3.2205
	3	-.96667	1.66950	.999	-6.9538	5.0205
	4	-.90000	1.66950	1.000	-6.8871	5.0871
	6	-.16667	1.66950	1.000	-6.1538	5.8205
	7	.06667	1.66950	1.000	-5.9205	6.0538
6	1	-8.06667*	1.66950	.001	-14.0538	-2.0795
	2	-2.60000	1.66950	.876	-8.5871	3.3871
	3	-.80000	1.66950	1.000	-6.7871	5.1871
	4	-.73333	1.66950	1.000	-6.7205	5.2538
	5	.16667	1.66950	1.000	-5.8205	6.1538
	7	.23333	1.66950	1.000	-5.7538	6.2205
7	1	-8.30000*	1.66950	.001	-14.2871	-2.3129
	2	-2.83333	1.66950	.823	-8.8205	3.1538
	3	-1.03333	1.66950	.999	-7.0205	4.9538
	4	-.96667	1.66950	.999	-6.9538	5.0205
	5	-.06667	1.66950	1.000	-6.0538	5.9205
	6	-.23333	1.66950	1.000	-6.2205	5.7538

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
7.00	30	3.2333	
5.00	30	3.3000	
6.00	30	3.4667	
4.00	30	4.2000	
3.00	30	4.2667	
2.00	30	6.0667	6.0667
1.00	30		11.5333
Sig.		.823	.103

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2304.429	6	384.071	15.774	.000
Within Groups	4942.567	203	24.348		
Total	7246.995	209			

SCHEFFE - TIMING – S#1

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	7.63333*	1.27404	.000	3.0644	12.2023
	3	9.06667*	1.27404	.000	4.4977	13.6356
	4	9.33333*	1.27404	.000	4.7644	13.9023
	5	9.60000*	1.27404	.000	5.0311	14.1689
	6	9.23333*	1.27404	.000	4.6644	13.8023
	7	10.40000*	1.27404	.000	5.8311	14.9689
2	1	-7.63333*	1.27404	.000	-12.2023	-3.0644
	3	1.43333	1.27404	.973	-3.1356	6.0023
	4	1.70000	1.27404	.938	-2.8689	6.2689
	5	1.96667	1.27404	.880	-2.6023	6.5356
	6	1.60000	1.27404	.954	-2.9689	6.1689
	7	2.76667	1.27404	.582	-1.8023	7.3356
3	1	-9.06667*	1.27404	.000	-13.6356	-4.4977
	2	-1.43333	1.27404	.973	-6.0023	3.1356
	4	.26667	1.27404	1.000	-4.3023	4.8356
	5	.53333	1.27404	1.000	-4.0356	5.1023
	6	.16667	1.27404	1.000	-4.4023	4.7356
	7	1.33333	1.27404	.981	-3.2356	5.9023
4	1	-9.33333*	1.27404	.000	-13.9023	-4.7644
	2	-1.70000	1.27404	.938	-6.2689	2.8689
	3	-.26667	1.27404	1.000	-4.8356	4.3023
	5	.26667	1.27404	1.000	-4.3023	4.8356
	6	-.10000	1.27404	1.000	-4.6689	4.4689
	7	1.06667	1.27404	.994	-3.5023	5.6356
5	1	-9.60000*	1.27404	.000	-14.1689	-5.0311
	2	-1.96667	1.27404	.880	-6.5356	2.6023
	3	-.53333	1.27404	1.000	-5.1023	4.0356
	4	-.26667	1.27404	1.000	-4.8356	4.3023
	6	-.36667	1.27404	1.000	-4.9356	4.2023
	7	.80000	1.27404	.999	-3.7689	5.3689
6	1	-9.23333*	1.27404	.000	-13.8023	-4.6644
	2	-1.60000	1.27404	.954	-6.1689	2.9689
	3	-.16667	1.27404	1.000	-4.7356	4.4023
	4	.10000	1.27404	1.000	-4.4689	4.6689
	5	.36667	1.27404	1.000	-4.2023	4.9356
	7	1.16667	1.27404	.991	-3.4023	5.7356
7	1	-10.40000*	1.27404	.000	-14.9689	-5.8311
	2	-2.76667	1.27404	.582	-7.3356	1.8023
	3	-1.33333	1.27404	.981	-5.9023	3.2356
	4	-1.06667	1.27404	.994	-5.6356	3.5023
	5	-.80000	1.27404	.999	-5.3689	3.7689
	6	-1.16667	1.27404	.991	-5.7356	3.4023

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
6.00	30	3.3000	
4.00	30	4.1000	
3.00	30	4.3667	
5.00	30	4.4667	
2.00	30	4.6333	
7.00	30	6.0667	
1.00	30		13.7000
Sig.		.582	1.000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2368.057	6	394.676	6.608	.000
Within Groups	12123.867	203	59.723		
Total	14491.924	209			

SCHEFFE - TIMING – S#4

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	5.16667	1.99539	.353	-1.9892	12.3225
	3	5.56667	1.99539	.260	-1.5892	12.7225
	4	-1.86667	1.99539	.990	-9.0225	5.2892
	5	6.90000	1.99539	.068	-.2558	14.0558
	6	6.86667	1.99539	.071	-.2892	14.0225
	7	6.90000	1.99539	.068	-.2558	14.0558
2	1	-5.16667	1.99539	.353	-12.3225	1.9892
	3	.40000	1.99539	1.000	-6.7558	7.5558
	4	-7.03333	1.99539	.058	-14.1892	.1225
	5	1.73333	1.99539	.993	-5.4225	8.8892
	6	1.70000	1.99539	.994	-5.4558	8.8558
	7	1.73333	1.99539	.993	-5.4225	8.8892
3	1	-5.56667	1.99539	.260	-12.7225	1.5892
	2	-.40000	1.99539	1.000	-7.5558	6.7558
	4	-7.43333*	1.99539	.035	-14.5892	-.2775
	5	1.33333	1.99539	.998	-5.8225	8.4892
	6	1.30000	1.99539	.999	-5.8558	8.4558
	7	1.33333	1.99539	.998	-5.8225	8.4892
4	1	1.86667	1.99539	.990	-5.2892	9.0225
	2	7.03333	1.99539	.058	-.1225	14.1892
	3	7.43333*	1.99539	.035	.2775	14.5892
	5	8.76667*	1.99539	.005	1.6108	15.9225
	6	8.73333*	1.99539	.005	1.5775	15.8892
	7	8.76667*	1.99539	.005	1.6108	15.9225
5	1	-6.90000	1.99539	.068	-14.0558	.2558
	2	-1.73333	1.99539	.993	-8.8892	5.4225
	3	-1.33333	1.99539	.998	-8.4892	5.8225
	4	-8.76667*	1.99539	.005	-15.9225	-1.6108
	6	-.03333	1.99539	1.000	-7.1892	7.1225
	7	.00000	1.99539	1.000	-7.1558	7.1558
6	1	-6.86667	1.99539	.071	-14.0225	.2892
	2	-1.70000	1.99539	.994	-8.8558	5.4558
	3	-1.30000	1.99539	.999	-8.4558	5.8558
	4	-8.73333*	1.99539	.005	-15.8892	-1.5775
	5	.03333	1.99539	1.000	-7.1225	7.1892
	7	.03333	1.99539	1.000	-7.1225	7.1892
7	1	-6.90000	1.99539	.068	-14.0558	.2558
	2	-1.73333	1.99539	.993	-8.8892	5.4225
	3	-1.33333	1.99539	.998	-8.4892	5.8225
	4	-8.76667*	1.99539	.005	-15.9225	-1.6108
	5	.00000	1.99539	1.000	-7.1558	7.1558
	6	-.03333	1.99539	1.000	-7.1892	7.1225

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
6.00	30	3.1000	
4.00	30	3.1000	
3.00	30	3.1333	
5.00	30	4.4333	
2.00	30	4.8333	4.8333
7.00	30	10.0000	10.0000
1.00	30		11.8667
Sig.		.068	.058

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.

ANOVA – TIMING – S#7

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3152.895	6	525.483	21.802	.000
Within Groups	4892.800	203	24.102		
Total	8045.695	209			

SCHEFFE - TIMING – S#7

(I) order	(J) order	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	4.63333*	1.26761	.042	.0875	9.1792
	3	6.03333*	1.26761	.001	1.4875	10.5792
	4	6.43333*	1.26761	.000	1.8875	10.9792
	5	6.33333*	1.26761	.001	1.7875	10.8792
	6	6.66667*	1.26761	.000	2.1208	11.2125
	7	-4.16667	1.26761	.101	-8.7125	.3792
2	1	-4.63333*	1.26761	.042	-9.1792	-.0875
	3	1.40000	1.26761	.975	-3.1459	5.9459
	4	1.80000	1.26761	.917	-2.7459	6.3459
	5	1.70000	1.26761	.936	-2.8459	6.2459
	6	2.03333	1.26761	.859	-2.5125	6.5792
	7	-8.80000*	1.26761	.000	-13.3459	-4.2541
3	1	-6.03333*	1.26761	.001	-10.5792	-1.4875
	2	-1.40000	1.26761	.975	-5.9459	3.1459
	4	.40000	1.26761	1.000	-4.1459	4.9459
	5	.30000	1.26761	1.000	-4.2459	4.8459
	6	.63333	1.26761	1.000	-3.9125	5.1792
	7	-10.20000*	1.26761	.000	-14.7459	-5.6541
4	1	-6.43333*	1.26761	.000	-10.9792	-1.8875
	2	-1.80000	1.26761	.917	-6.3459	2.7459
	3	-.40000	1.26761	1.000	-4.9459	4.1459
	5	-.10000	1.26761	1.000	-4.6459	4.4459
	6	.23333	1.26761	1.000	-4.3125	4.7792
	7	-10.60000*	1.26761	.000	-15.1459	-6.0541
5	1	-6.33333*	1.26761	.001	-10.8792	-1.7875
	2	-1.70000	1.26761	.936	-6.2459	2.8459
	3	-.30000	1.26761	1.000	-4.8459	4.2459
	4	.10000	1.26761	1.000	-4.4459	4.6459
	6	.33333	1.26761	1.000	-4.2125	4.8792
	7	-10.50000*	1.26761	.000	-15.0459	-5.9541
6	1	-6.66667*	1.26761	.000	-11.2125	-2.1208
	2	-2.03333	1.26761	.859	-6.5792	2.5125
	3	-.63333	1.26761	1.000	-5.1792	3.9125
	4	-.23333	1.26761	1.000	-4.7792	4.3125
	5	-.33333	1.26761	1.000	-4.8792	4.2125
	7	-10.83333*	1.26761	.000	-15.3792	-6.2875
7	1	4.16667	1.26761	.101	-.3792	8.7125
	2	8.80000*	1.26761	.000	4.2541	13.3459
	3	10.20000*	1.26761	.000	5.6541	14.7459
	4	10.60000*	1.26761	.000	6.0541	15.1459
	5	10.50000*	1.26761	.000	5.9541	15.0459
	6	10.83333*	1.26761	.000	6.2875	15.3792

*. The mean difference is significant at the 0.05 level.

HOMOGENEOUS SUBSETS

EO	N	Subset for alpha = 0.05	
		1	2
6.00	30	2.9333	
4.00	30	3.1667	
3.00	30	3.2667	
5.00	30	3.5667	
2.00	30	4.9667	
7.00	30		9.6000
1.00	30		13.7667
Sig.		.859	.101

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 30.000.