Museums as restorative environments

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Acknowledgements

Abstract

Restorative environments possess a combination of attributes that facilitate recovery from mental fatigue. Most previous research in this regard has focussed on natural environments, but this paper explores the extent to which museum environments also provide access to restorative experiences. Visitors (307 tourists and 274 local residents) to a history museum, an art museum, an aquarium and a botanic garden completed a questionnaire regarding the restorative qualities and benefits of the environment they visited. The findings indicate that for some people, museums are at least as restorative as natural environments. The paper contributes to the development of a theoretical understanding of museums as restorative environments and provides insights into the factors that facilitate and enhance restorative experiences. Such experiences have the potential to contribute to visitors' well-being and satisfaction.

Keywords: visitor experiences; restorative environments; restoration; museums; botanic gardens; art galleries; well-being

INTRODUCTION

> *R&R, or 'rest and recuperation', is an acknowledged need for soldiers on the frontlines. It is not, however, uniquely the concern of the battle weary. Many people suffer from mental fatigue, decreased attention span, and irritability, and few seem to have an abundance of tranquillity, serenity, or peace of mind.*
>
> (Kaplan, Kaplan & Ryan 1998, p67)

Mental fatigue, caused by the stresses and strains of everyday life, is a common complaint in today's society, and the need to escape from the personal and interpersonal demands of life is one of the major reasons that people have for engaging in tourism and leisure experiences (Iso-Ahola, 1980). As we tire mentally over the course of a work week, or after prolonged or intense engagement in a project, our resources regularly and predictably become depleted (Hartig, 2004). Some places – restorative environments – help us recover from our efforts to meet the demands of everyday life. The desire for restorative experiences has been recognised by researchers examining tourism and leisure motivations (Pearce & Lee, 2005; Snepenger, King, Marshall & Uysal, 2006). Research focussing on environmental preference has also indicated that people actively seek out environments they believe to be restorative. Van den Berg, Koole and van der Wulp (2003) suggested that people's tendency to prefer natural over built environments may be at least partly explained in terms of variations in restorative potential between these different types of environment. Similar conclusions were also drawn by Hartig, Mang and Evans (1991) and Staats, Kieviet, and Hartig (2003).

Restoration is defined as "the process of "renewing physical, psychological and social capabilities diminished in ongoing efforts to meet adaptive demands" (Hartig, 2004, p2). Most of the existing research on the attributes and benefits of restorative environments, and the process by which they contribute to reducing mental fatigue and renewing diminished capacities, has been conducted within the framework of Attention Restoration Theory (Kaplan, 1995; Kaplan & Kaplan, 1989). According to Attention Restoration Theory, the capacity to continually focus attention on a particular activity can be reduced or lost through mental exhaustion. This state, referred to as "directed attention fatigue", can result in irritability, anxiety, anger, frustration, mental and physical fatigue, diminished ability to perform cognitive tasks, and increased likelihood of errors in performance. According to Kaplan's theory, in order to fully recover from directed attention fatigue, it is important that the individual's attention is engaged involuntarily or effortlessly, rather than intentionally. While the individual is engaged in involuntary attention or "fascination", the effort involved in inhibiting distractions can be relaxed, and directed attention can be rested (Kaplan, 1995).

Fascination (being engaged without effort) is thus one of four components that have been identified as integral to a restorative experience. The other three components are a sense of *escape* or *being away* (being physically or mentally removed from routine or demanding activities); the perception of *extent* (the environment has sufficient content and structure that it can occupy the mind for an extended period); and *compatibility* (providing a good fit with one's purposes or inclinations). Kaplan and Kaplan (1989) argue that these four attributes are most commonly found in natural environments, and research has consistently demonstrated that natural environments are generally perceived and experienced as more restorative than urban environments (Hartig & Staats, 2003). Museum environments provide rich opportunities for visitors to experience fascination, being away, extent, and compatibility, but very few studies have attempted to examine the restorative attributes and benefits of these environments.

The earliest reported study of restorative experiences outside of natural environments was conducted by Kaplan et al. (1993) in an art museum. They re-analysed focus group comments that had been collected for a different purpose, to determine whether, in talking generally about their museum experience, participants raised any of the themes theoretically related to Kaplan's restoration construct (i.e., restorative attributes such as fascination, being away, extent, compatibility; and restorative outcomes such as feeling calm or peaceful and engaging in reflection). They found that such comments were quite prevalent, especially among frequent visitors. In a follow-up questionnaire study, they confirmed that most visitors felt they had a restorative experience in the art museum, and identified two factors that appeared to contribute to the restorative potential of the setting – feeling comfortable or at ease in the setting, and being able to find one's way around.

Subsequent research has demonstrated that different types of museum environments (including art museums, history museums, gardens and zoos) have the potential to offer visitors a restorative experience that provides respite from the stresses of life and replenishes their cognitive capacity. For example, visitors to two public gardens in New York rated relaxation and stress reduction as their most important reasons for coming to the gardens, and 91% of respondents reported some level of perceived stress reduction after visiting the gardens (Bennett & Swasey, 1996). Similarly, visitors to the Brisbane Botanic Gardens rated restoration as one of their most important reasons for visiting (Ballantyne, Packer & Hughes, 2008). Rest, relaxation and recovery from stress were also among the reasons people had for visiting museums and galleries (Packer & Ballantyne, 2002). According to Scopelliti and Giuliani (2004), visiting a museum and taking a walk in a park were among a range of experiences that people considered would allow them to regain well-being and effectiveness in their everyday activities. Pals, Steg, Siero and van der Zee (2009) measured the perceived restorativeness of two different attractions in a Dutch zoo. They found that, on average, visitors agreed that the attractions possessed the four restorative components, and that measures of fascination and escape (being away) were significant predictors of both experienced pleasure and preference for the attraction. Despite the obvious differences among types of museum environments, it would appear that their common features, including the provision of free-choice or leisure learning experiences, may contribute to their effectiveness as restorative environments.
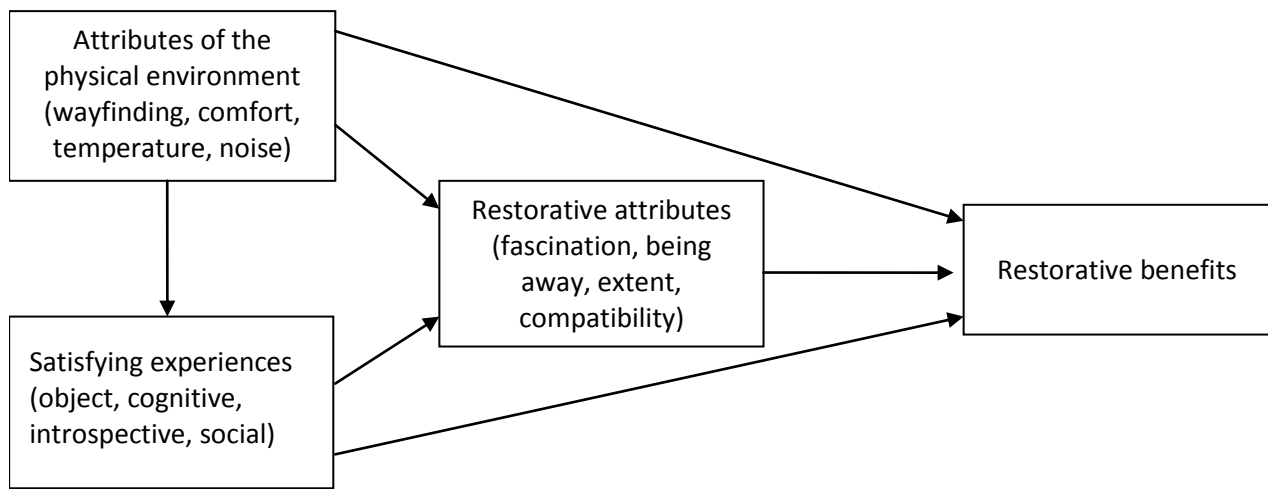
Packer (2006) noted a significant overlap between the conditions that make learning in museum settings enjoyable, and those suggested by Kaplan (1995) as being necessary for a restorative experience (in particular the presence of fascination or attention that requires no effort; an environment that is rich and coherent; and compatibility between the environment and one's purposes or inclinations). The phenomenon of restoration was further explored in Packer's (2008) study of the beneficial outcomes "beyond learning" that visitors seek and obtain from a museum visit. Interviewees in the latter study gave many examples that reflected both the restorative attributes of museum environments and the restorative benefits of a museum visit. In fact the majority of visitors reported having attained a sense of relaxation, peace and tranquility, or thoughtfulness as a result of their visit, and some reported having gained a renewed ability to deal positively with life. When Falk (2009) used the term "rechargers" to refer to the motivational segment he had previously labelled "spiritual pilgrims" (Falk, 2006), he brought a new level of attention to this small but significant group of museum visitors. Falk (2009) described rechargers as "individuals who visit in order to reflect, rejuvenate, or generally just bask in the wonder of the place" (p203-4). Given this

recent attention, it seems timely to further examine the extent to which visitors perceive museums to be restorative environments.

This paper aims to extend our understanding of museums as restorative environments by exploring visitors' perceptions of the restorative attributes and benefits of four different sites, two of which are focussed on cultural exhibits (history museum and art gallery) and two on natural exhibits (aquarium and botanic garden). Research has demonstrated that frequent or repeat visitors are more likely to seek restorative experiences than first-time visitors (Kaplan et al., 1993; Ouellette, Kaplan & Kaplan, 2005). This may indicate that familiarity with the environment is a prerequisite for a restorative experience, or that those who encounter a restorative experience are more likely to return to the environment. However, the relationship between familiarity and perceived restorativeness is not a simple one (Purcell, Peron and Berto, 2001) and may vary according to the context, or level of familiarity. This research will investigate the differences between various visitor groups (first-time and repeat visitors; frequent and occasional visitors; tourists and local visitors) in their perceptions of the restorative attributes and benefits of various environments.

This research also aims to explore the factors that make a restorative experience more likely. Previous research has identified a number of such factors, which are mostly associated with visitor comfort (Herzog, Maguire & Nebel, 2003; Packer, 2008). In extending this research from nature settings to museum environments, there is a need to incorporate new variables that may facilitate restorative experiences. To this end, the satisfying experiences framework (Doering, 1999) was employed as this framework has been found to be particularly important in understanding visitor experiences in museum environments (Packer, 2008). The framework was initially developed as an empirical list of four categories of "satisfying experiences" that visitors generally find satisfying in museums (Pekarik, Doering and Karns 1999): *object experiences* (which focus on something outside the visitor, such as seeing rare, valuable or beautiful objects); *cognitive experiences* (which focus on the interpretive or intellectual aspects of the experience, such as gaining information or understanding); *introspective experiences* (which focus on private feelings and experiences, such as imagining, reflecting, reminiscing and connecting); and *social experiences* (which focus on interactions with friends, family, other visitors or museum staff). Pekarik, Doering and Karns (1999) found that different types of museums, and different exhibitions within museums, appear to elicit these experiences to varying extents, and that different visitor groups report different types of experiences as their most satisfying. The present research explores whether measures of these satisfying experiences can contribute to the explanation of restorative benefits, beyond that explained by measures of restorative attributes, as hypothesised in Figure 1.

Figure 1. *Model of hypothesised relationships*

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┌─────────────────────┐
│   Attributes of the │
│ physical environment│────────────────────────────────────┐
│ (wayfinding, comfort,│                                    │
│ temperature, noise) │─────────┐                           │
└──────────┬──────────┘         │                           │
           │                    ▼                           ▼
           │          ┌──────────────────┐       ┌──────────────────┐
           │          │ Restorative attributes│    │                  │
           │        ┌▶│  (fascination, being │───▶│ Restorative benefits│
           ▼        │  │   away, extent,   │    │                  │
┌─────────────────────┐│  │   compatibility)  │    └──────────────────┘
│ Satisfying experiences││ └──────────────────┘           ▲
│  (object, cognitive, │┘                                 │
│ introspective, social)│──────────────────────────────────┘
└─────────────────────┘
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Specifically, this research aims to:

1. measure and compare visitors' perceptions of the restorative attributes and restorative benefits of each of four museum environments;
2. compare the extent to which different visitor groups perceive restorative attributes and experience restorative benefits; and
3. investigate the extent to which attributes of the physical environment and satisfying experiences contribute to visitors' perceptions of restorative attributes and restorative benefits.

METHOD

Research sites

The research was conducted in four different museum-type environments:

- The *Queensland Museum* is located in the cultural precinct of Brisbane, a short walk from the CBD. The museum contains a range of exhibits, in themed areas, covering both the natural environment and cultural heritage.

- The *National Gallery of Victoria* in St Kilda, Melbourne contains one of the most comprehensive collections of international art in the country, and indeed in the world.

- The *UnderWater World* aquarium is located close to a seaside resort area on Queensland's Sunshine Coast and contains a range of live aquatic displays including sharks, crocodiles, stingrays, corals, fish, sea jellies and seals.

- The *Brisbane Botanic Gardens* at Mt Coot-tha are Queensland's premier subtropical botanic gardens. The gardens are situated seven kilometres from the city centre and

include a series of distinctly different gardens arranged in themes and geographical displays.

Participants and procedure

Adult visitors to each of the four sites were approached on completion of their visit, as they exited the museum, gallery, aquarium or garden, and invited to complete a questionnaire. A non-random quota sampling technique was used to ensure adequate numbers of males and females; first-time and repeat visitors; tourists and local visitors; and under- and over-30's, with at least 40 participants in each category at each site. Data were collected on both weekdays and weekends at all of the sites. A total of 596 visitors participated in the study.

Statistical comparisons were conducted (using ANOVA) to examine differences between visitor groups, and differences among the four attractions in visitors' perceptions of the restorative attributes and benefits of each environment. Multiple regression analysis was used to examine the relationships between attributes of the environment, aspects of the experience and the attainment of restorative outcomes.

Instrument

A number of psychological scales, all of which were rated on a seven-point (0-6) scale, were included in the questionnaire in order to measure perceptions of restorative environments, restorative attributes, restorative benefits, visitor characteristics, attributes of the physical environment, and satisfying experiences. Details of these scales are provided in Appendix A.

RESULTS

Perceptions of Restorative environments

Visitors to each site were asked to rate each of nine different types of environment according to the extent to which the site helped them to relax and recover from the tension of everyday life. As expected from previous research (Hartig & Staats, 2003), natural environments were generally considered more restorative than the museum environments (Table 1). Visitors to all four of the research sites considered national parks and beaches to be the most restorative, with mean ratings of 4.6 (where 5 = "very much"). Shopping centres were considered the least restorative with a mean rating of 1.9 (where 2 = "rather little"). The four research sites were placed between these two extremes, with mean ratings between 3.5 and 4.4 (where 4 = "rather much"). Pairwise comparisons of ratings indicated that botanic gardens were considered more restorative than the other three research sites; aquariums were considered more restorative than art galleries and museums; and there was no significant difference between art galleries and museums[i].

Table 1. *Perceptions of restorative environments, as rated by visitors to the four research sites (highlighted)*

	Mean score across all respondents (n = 591)	% who indicated the environment was restorative[a]
National parks	4.6	84%
Beaches	4.6	84%
Botanic gardens	4.4	81%
Aquariums	3.9	66%
Cinemas	3.8	62%
Zoos	3.6	58%
Museums	3.6	56%
Art galleries	3.5	56%
Shopping centres	1.9	16%

[a] helped them to relax and recover "rather much", "very much", or "completely" (top three options on a 7-point scale).

There were some interesting differences, however, between visitors to the different sites. For example, art gallery visitors' ratings of art galleries were significantly higher (M = 4.5) than ratings of art galleries by visitors to the other three sites (M = 3.6, 3.0, 3.2), F [3,585] = 28.66, p<.001.   A similar pattern was found at each site.   Further analysis indicated that even amongst art gallery visitors, frequent visitors (who visit art galleries more than twice per year) rated art galleries as more restorative than did infrequent visitors (M = 4.8 and 4.0 respectively). The difference in visitors' ratings according to frequency of visitation was significant in the art gallery and the botanic garden[ii]. In other words, visitors who consider a site to be restorative are likely to be those who visit it often. It is still not clear, however, whether they visited frequently because they found it restorative, whether familiarity contributed to the restorative effect, or whether they were inclined to rate it as restorative because they had invested time and effort in visiting. For the botanic garden, aquarium and art gallery, the majority of visitors to the particular site considered that site to be at least as restorative as a national park. This was not the case for visitors to the museum, where 36% considered the museum to be at least as restorative as a national park.

Restorative attributes of the environment

The Restorative Components Scale (so-named by Herzog et al., 2003, referring to the un-named scale developed by Laumann, Gärling and Stormark, 2001) was used to compare the restorative components (i.e., Fascination, Extent, Escape, and Compatibility) of the four sites (see Table 2). Cronbach alphas[iii] for the four subscales were .85; .79; .85; and .82 respectively. On this and subsequent measures, visitors were asked to rate only the site they had just visited. Ratings on all dimensions confirmed that visitors at all of the sites considered them to have restorative qualities (mean ratings between 4 "rather much" and 5 "very much"). The botanic garden was significantly higher than all other sites in relation to "Escape".

Across sites, there were significant differences between frequent and infrequent visitors on the Fascination subscale and the Compatibility subscale[iv], frequent visitors rating both of these attributes more highly than infrequent visitors. There were no significant differences overall between tourists and local residents in their ratings of the restorative attributes of the

particular sites they had visited, and no interaction effects between the frequency of visitation and tourist-local variables.

Table 2. *Restorative attributes of the environment (0-6 scale with midpoint 3)*

	Botanic Garden	Aquarium	Art Gallery	Museum	Total
Fascination e.g., there is plenty to discover here	4.7	4.6	4.5	4.4	4.5
Extent * e.g., the elements here go together	4.6	4.3	4.1	4.3	4.3
Being Away** e.g., when I am here I feel free from work and routine	4.6	4.3	4.2	4.1	4.3
Compatibility e.g., the environment gives me the opportunity to do activities that I like	4.4	4.3	4.3	4.3	4.3

* ANOVA: $F_{(3, 584)} = 6.13$, $p = .000$
** ANOVA: $F_{(3, 583)} = 6.39$, $p < .001$

Restorative benefits of the visit

Restorative benefits were measured using the two subscales of the Attention Recovery and Reflection Scale (Staats et al., 2003), as well as the Restored Mental State Scale (developed for this study). Table 3 presents the means for these scales by site. Factor analysis confirmed the two-factor structure for the Attention Recovery and Reflection Scale and one factor for the Restored Mental State Scale. Cronbach alphas for the three scales were .94, .92, and .92 respectively.

Table 3. *Restorative benefits of the visit (0-6 scale with midpoint 3)*

	Botanic Garden	Aquarium	Art Gallery	Museum
Attention Recovery **[1] e.g., renew energy, regain the ability to concentrate	3.7	3.4	3.2	3.1
Reflection e.g., think about important issues, see things in a new perspective	3.3	3.0	3.1	3.2
Restored Mental State**[2] e.g., feel refreshed/restored; calm/relaxed	4.3	4.0	4.0	3.8

**[1] ANOVA: $F_{(3, 567)} = 6.88$, $p < .001$
**[2] ANOVA: $F_{(3, 574)} = 6.57$, $p < .001$

Visitors rated the restorative benefits of their visit in the range of 3.0 (neutral) - 4.0 (rather much) at all sites, with the exception of the botanic garden where the mean Restored Mental State score reached 4.3. The botanic garden was significantly higher than all other sites in relation to Attention Recovery and Restored Mental State.

There was a small effect of frequency of visitation on visitors' ratings on the Restored Mental State Scale[v]. The effect size increased (from 0.19 to 0.22) when considered in terms of whether or not this was the respondent's first visit to the specific site, i.e., repeat visitors felt more relaxed and restored after the visit than first-time visitors. There were no differences overall between tourists and locals, and no interaction effects between the frequency of visitation and tourist-local variables.

Visitor experiences that support restoration

Doering's satisfying experiences framework (Doering, 1999; Pekarik et al., 1999) was used in this study in order to incorporate aspects of the visitor experience that have been identified as important in museum environments, as well as those previously used to explore the restorative effects of natural environments. Respondents were asked to select one of four types of experience (Object, Cognitive, Introspective, and Social) that they believed had been the most satisfying in their visit that day. As illustrated in Figure 2, there were significant differences between the four sites in the type of experience selected as most satisfying. The Cognitive experience (gaining new knowledge) was seen as the most satisfying experience by visitors to the museum. The Object Experience (seeing rare or beautiful objects/marine life) was seen as the most satisfying experience by visitors to the aquarium. The Social Experience (spending time with friends or family) was seen as the most satisfying experience by visitors to the botanic garden. The Introspective Experience (using your mind to reflect or imagine) was second to the Object experience as most satisfying for art gallery visitors, but was chosen more often in the art gallery than at any other site. There were no significant differences between frequent and infrequent visitors in the kinds of experience they considered most satisfying, but there were between tourists and local visitors. Tourists considered the Object Experience the most satisfying, while local visitors found the Social Experience the most satisfying[vi].

Figure 2. *Most satisfying experiences at each site*

Most Satisfying Experiences
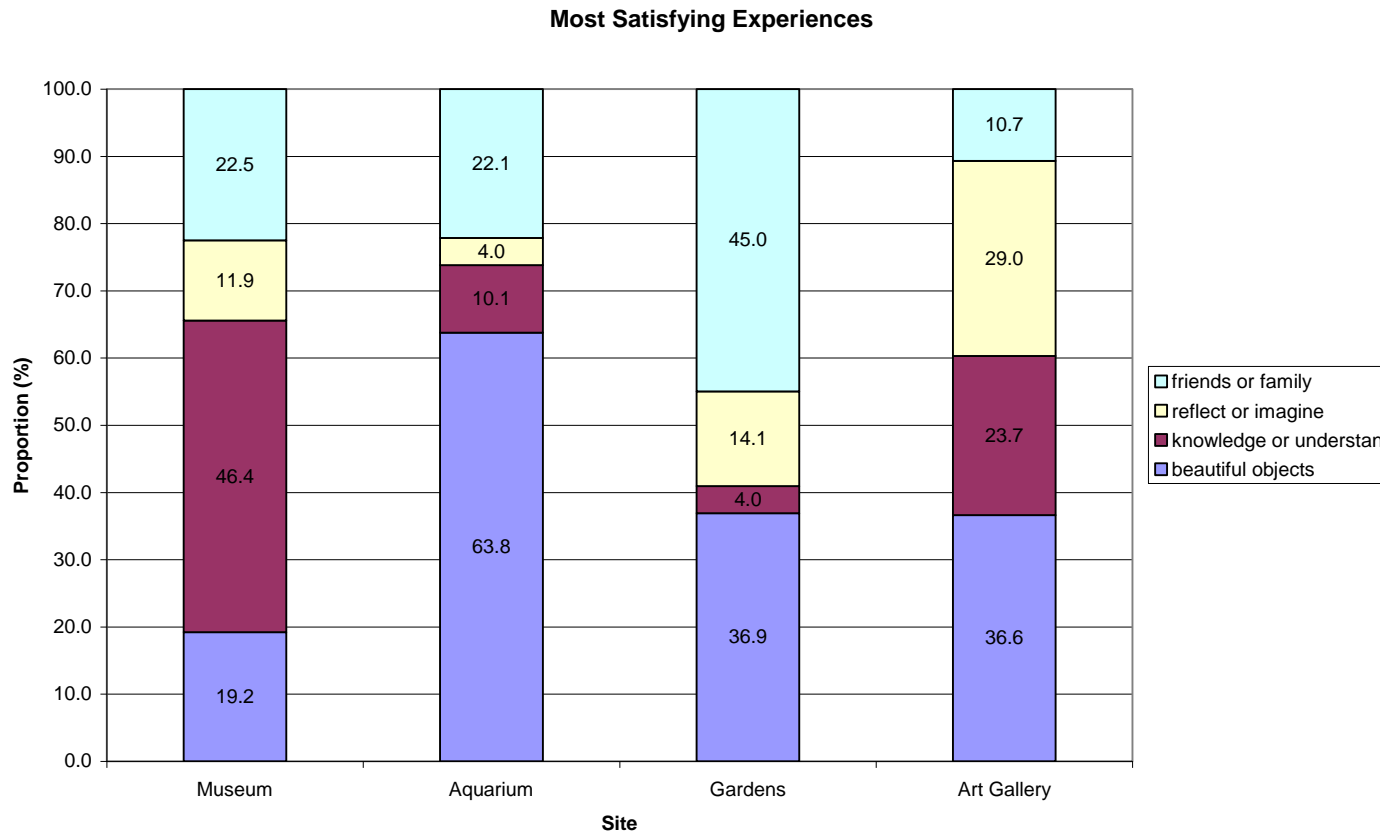
Note. Significant difference between sites in visitors' selection of most satisfying experience, χ^2 (9, $N = 580$) = 180.25, $p < .001$.

Visitors were also asked to rate various aspects of the physical environment, such as noise, temperature, lighting, physical and cognitive comfort and wayfinding. The nine items all loaded onto a single factor, and a composite measure of Attributes of the Physical Environment was formed (Cronbach's alpha = .85). The four sites varied significantly on the composite scale, F (3, 561) = 6.11, p < .001, the art gallery scoring lower than the other three sites. Art gallery gave lower ratings than the other sites on six of the nine items, including the item "I felt comfortable in the environment".

Regression analyses were conducted in order to explore the relationships depicted in Figure 1. In order to simplify the analysis of the relationships depicted in the model, average scores for Restorative Benefits, Restorative Attributes, Satisfying Experiences and Attributes of the Physical Environment were calculated by combining the relevant subscale measures of each construct (Cronbach alphas all exceeded .70). All three of the independent variables had significant direct relationships with the dependent variable (Restorative Benefits)[vii]. Because previous theory and research in other contexts has postulated the restorative attributes of the environment as the factors that best predict and explain the restorative benefits attained, the Restorative Attributes variable was entered first into a hierarchical multiple regression analysis, with Restorative Benefits as the dependent variable. Satisfying Experiences and Attributes of the Physical Environment were entered at the second step. Restorative Attributes explained 32.5% of the variance in Restorative benefits. The addition of the

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Satisfying Experiences and Attributes of the Physical Environment variables accounted for an additional 13.9% of the variance, a statistically significant difference [$F(2, 522) = 60.08$, $p < .001$]. Satisfying Experiences made a significant contribution to the model, beyond that explained by Restorative Attributes. Attributes of the Physical Environment did not explain any additional variance in Restorative Benefits, however, it did contribute to explaining both Restorative Attributes and Satisfying Experiences. These relationships are illustrated in Figure 3.

To further explore these effects, the individual subscales for Restorative Attributes and Satisfying Experiences were entered as predictors of Restorative Benefits. The best subscale predictors of Restorative Benefits were an Introspective Experience and Escape Attributes. Finally, the individual items for Attributes of the Physical Environment and Satisfying Experiences were entered as predictors of Restorative Attributes. The best predictors of Restorative Attributes were items representing the Object Experience (especially "being moved by beauty") and "I felt comfortable in the physical surroundings".

Figure 3. *Relationships between variables*
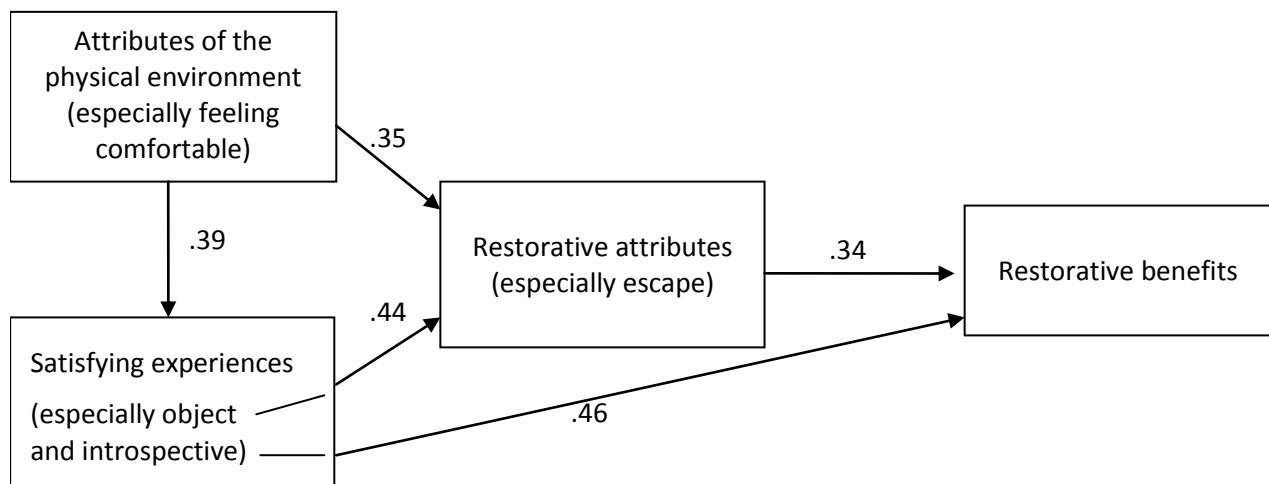
Note: The reported values are the standardised regression coefficients obtained in the following analyses: IV Attributes of the Physical Environment with DV Satisfying Experiences (beta = .39); IVs Attributes of the Physical Environment and Satisfying Experiences with DV Restorative Attributes (beta = .35, .44 respectively); IVs Attributes of the Physical Environment, Satisfying Experiences and Restorative Attributes with DV Restorative Benefits (beta = -.06, .46, .34 respectively). All tolerance levels were greater than .5 (> .2 considered acceptable).

DISCUSSION

Restoration can be defined as the renewing of physical, psychological and social capabilities that are reduced by the ongoing efforts to meet the demands of daily life. Previous research (Hartig & Staats, 2003) suggests that this is more likely to occur in natural environments, and the present study confirms this. Not only were national parks and beaches considered more restorative than urban environments, but among the research sites, those that were focussed on natural heritage (especially the botanic garden) were considered more restorative, both in attributes and benefits, than those focussed on cultural heritage (the museum and art gallery).

However, museum environments were found to offer an alternative to natural settings as a restorative experience, especially for their frequent visitors. Studies by Korpela and colleagues (Korpela & Hartig, 1996; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008) suggest that many people have "favourite places", to which they become particularly attached, and to which they go to relax, calm down, or clear their minds. These places include nature areas, waterside environments, green spaces and exercise areas, and are often perceived as being high in restorative attributes. The present research, together with interview data reported by Packer (2008) and Falk (2009), suggest that for some people, museums may act as a "favourite place" to which they frequently go for restoration.

As in previous research (Kaplan et al., 1993), frequent or repeat visitors were more likely to report having experienced restoration than occasional or first-time visitors. Assuming that frequency of visitation to a particular site can be taken as an indicator of a preference for that type of site, the findings of the research reported here support van den Berg, et al.'s (2003) conclusion that there is an association between environmental preference (based in their case on ratings of beauty) and perceived restorative potential. It is not clear, however, what the direction of this effect is. People may prefer environments they perceive to be restorative, or they may feel more restored when they visit their preferred environments, or indeed, both effects may be operating. In either case, by facilitating restorative experiences for their visitors, museums can add value to the visit and increase the likelihood that visitors will return.

Feeling comfortable in the physical surroundings of the site was identified as a factor contributing to restoration by Kaplan et al. (1993), and was confirmed here as a predictor both of visitors' perceptions of the restorative attributes of the setting, and their satisfying experiences. Bitner (1992) also found that conditions such as temperature, lighting, noise and spatial layout influenced visitors' cognitive, emotional and physiological responses to the environment. The finding that attributes of the physical environment such as comfort and wayfinding contributed to the perception of restorative attributes partly explains the restorative advantage of repeat visitation. If greater attention were given to visitors' comfort, first-time and infrequent visitors, who are less familiar with the site, may be more able to experience restorative benefits as a result of their visit. Helping visitors find their way through an unfamiliar environment, providing adequate physical facilities such as seats and rest areas, and ensuring that noise, temperature and lighting levels are pleasant, can all increase the likelihood that visitors will encounter a restorative experience.

It was found that local visitors placed more importance on social and introspective experiences, and tourists placed more importance on cognitive and object experiences. Previous research on visitor motivations (Packer, 2004) suggests that tourists are more likely to be looking for a learning and discovery experience – they want to discover new things and often try to "see as much as they can". These experiences may be incompatible with a restorative experience. Visitors who have already satisfied their initial curiosity about the site may be more open to an introspective experience, which in turn is associated with greater restoration. As the introspective experience was the best predictor of restorative outcomes in this study, it might be concluded that the restorative experience could also be enhanced by encouraging visitors to take the time to think about what they are seeing, to make personal connections with exhibits, and to exercise their imaginations.

Further research is needed to explore ways in which introspective experiences might be encouraged and supported. As these experiences were particularly evident in the art gallery,

other venues might consider the use of visual art, poetry and music as a means of stimulating reflection. Experiments along these lines have already met with considerable success, e.g., the use of poetry at the Central Park Zoo in New York (Institute of Museums and Library Services, 2006). Further research is also needed to test the findings of this study using physiological as well as self-report measures of restoration. It may be that there is a difference between the perception of restoration and the achievement of physiological effects such as reduced blood pressure or muscle tension. Although some congruence between self-report and physiological measures has been demonstrated in natural environments (Chang et al., 2008), this needs to be tested also in museum environments.

Focussing on the restorative benefits that museum environments can provide will enhance and extend their contribution to their visitors' health and well-being, and to society in general. Providing opportunities to quickly, easily and regularly access places that support restoration is especially important in today's urbanised society, where access to natural environments is limited, and where information fatigue and stress are increasingly prevalent.

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[i] BG-AQ, t [571] = 7.57, p < .001; BG-AG, t [583] = 13.57, p < .001; BG-MU, t [580] = 13.90, p < .001 : AQ-AG, t [575] = 4.15, p < .001; AQ-MU t [573] = 4.10, p < .001; AG-MU, t [584] = 0.58, p = .559.

[ii] Significant effects of frequency of visitation on visitors' ratings of restorativeness: within art gallery, F [3,133] = 6.07, p=.001; within botanic garden, F [3,147] = 7.80, p<.001.

[iii] The Cronbach alpha statistic provides a measure, ranging from 0 to 1, of the internal consistency of the items and thus the appropriateness of combining them into a single scale or subscale. Values above 0.70 are usually considered acceptable.

[iv] Significant differences between frequent and infrequent visitors on Fascination: t [584] = 3.34, p = .001; and Compatibility: t [583] = 3.04, p = .002.

[v] Significant differences between frequent and infrequent visitors on Restored Mental State: t [573] = 2.10, p = .036; Significant differences between first-time and repeat visitors on Restored Mental State: t [570] = 2.63, p = .009.

[vi] Tourist-local x most satisfying experience: χ2 (3, N = 577) = 38.00, p < .001.

[vii] Correlations between Restorative Benefits and Attributes of the Physical Environment (r 538= .284, p<.001); Satisfying Experiences (r 551= .630, p<.001); and Restorative Attributes (r 563 = .567, p<.001).

Appendix A. Details of measurement procedures

Perceptions of restorative environments
A set of nine items asked respondents to rate the extent to which each of the four research sites, as well as five other sites (national parks, beaches, zoos, cinemas and shopping centres), helped them to "relax and recover from the tension of everyday life". Each item was rated on a 7-point scale where 0 = not at all, 1 = very little, 2 = rather little, 3 = neither little nor much, 4 = rather much, 5 = very much, 6 = completely (the same scale used by Laumann, Gärling and Stormark, 2001, in their Restorative Components Scale, see below). These items were included in order to situate visitors' perceptions of the restorative nature of the research sites within a broader context of natural and urban environments.

Restorative attributes
The Restorative Components Scale (so-named by Herzog et al., 2003, referring to the un-named scale developed by Laumann, et al., 2001) was used to measure the perceived restorative attributes of the environment – fascination (6 items), extent or coherence (4 items), being away (which they labelled "escape", 4 items) and compatibility (5 items). The "Novelty" factor, which consisted of three items about doing something different or being in a different environment from usual, was not included. Each item was rated on a 7-point scale where 0 = not at all, 1 = very little, 2 = rather little, 3 = neither little nor much, 4 = rather much, 5 = very much, 6 = completely, as used by Laumann et al., 2001).

Restorative benefits
A modified version of the Attention Recovery and Reflection Scale (Staats, Kieviet and Hartig, 2003) was used to measure the restorative benefits attained from the visit. This modified scale consisted of 13 individual items, divided into two separate subscales, termed "Attention Recovery" and "Reflection".   In Staats et al.'s original version, an additional six items relating to "Social Stimulation" were also included.   These were excluded in the present study in order to avoid perceived repetition of similar items in other sections of the questionnaire (see section on the visitor experience below). The same 7-point rating was used as in the previous two scales.

A Restored Mental State Scale was also developed for use in this project, which asked participants to rate the impact of their experience using seven sets of adjectives drawn from previous work by Ouellette et al. (2005) and Packer (2008).

Visitor characteristics
Demographic information (including age, gender, education, occupation, local resident or tourist, first-time or repeat visitor to the specific site, frequency of visitation to that kind of museum environment) and an estimate of the length of the visit were collected. For the purposes of analysis, frequent visitors were defined as those who visited that particular type of museum at least twice a year.

Attributes of the physical environment
Nine items were used to rate visitors' perceptions of attributes of the environment that previous research has suggested may be important in facilitating a restorative experience: wayfinding, lighting, noise level, flow, temperature, labelling, ease, seating, and comfort (Kaplan et al., 1993; Packer, 2008). These were rated on a 7-point scale from strongly disagree to strongly agree.