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Exploring the Digital Atmosphere of Museums: Perspectives and Potential

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Abstract: This paper contributes to the field of museum and visitor experience in terms of atmosphere by discussing the “museum digital atmosphere” or MDA, a notion that has been introduced and found across museums in Greece. Research on museum atmospherics has tended to focus on physical museum spaces and exhibits. By “atmosphere”, we mean the emotional state that is a result of public response adding to the overall museum experience. The MDA is therefore studied as the specific emotional state caused by the use of digital applications and technologies. The stimulus–organism–response or SOR model is used to define the MDA, so as to confirm and reinforce the concept. To that end, a qualitative methodological approach is used; we conduct semi-structured interviews and evaluate findings via content analysis. The sample consists of 17 specialists and professionals from the field, namely museologists, museographers, museum managers, and digital application developers working in Greek museums. Ultimately, this research uses the SOR model to reveal the effect of digital tools on the digital atmosphere in Greek museums. It also enriches the SOR model with additional concepts and emotions taken from real-life situations, adding new categories of variables. This research provides the initial data and knowledge regarding the concept of the MDA, along with its importance.



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1. Introduction

Environment and atmosphere play an important role in the museum experience [1–3] and the learning process. Hooper-Greenhill [4] emphasizes that, in an informal learning environment such as that of the museum, the learning and cognitive process is determined by, among others, the space, the design, and the content of the exhibition. The museum atmosphere therefore adds to the museum experience. The museum experience is both personal and subjective given that the museum acts as a space of tangible and intangible experiences due to exogenic, e.g., service quality, and endogenic factors, e.g., visitors’ motivations, expectations, and feelings [5]. A satisfying experience is linked to cognitive and affective motives, and is affected by a number of space- and visitor-related variables, such as mood, stress, and fatigue [6].

This paper contributes to the debate on museum experience and atmospherics in the digital world by discussing the “museum digital atmosphere” (MDA), a notion currently implemented across museums in Greece by this research. Research on museum atmospherics has tended to focus on physical museum spaces and exhibits. The motivation for this study was to describe the impact of digital tools on a museum’s atmosphere as an emotional state. Addressing MDA is important for modern museums’ practices in the digital world. Learning and interpreting MDA components is a useful tool to enhance, upgrade, and optimize the museum experience. The MDA affects visitors’ experience and subsequent behavior, i.e., whether they enjoyed the experience and whether they will revisit the museum (“approach”) or reject it (“avoidance”) according to the SOR model used for this research.

The research starts with the hypothesis that atmosphere, as an intangible state, is a result of emotions caused by diverse variables. Our research uses the SOR model to reveal the effect of digital tools on the digital atmosphere across Greek museums.

The rest of this paper is organized in the following sections: A literature review is conducted on the notions of atmosphere and atmospherics, the SOR model, and the definition of emotion, mood, and feelings. We then introduce our methodology, our research questions, and findings in the next three sections. The section that follows contains a discussion of our survey results, and the final section, our concluding remarks.

2. Literature Review

In this part, we review the literature associated with the experience and use of digital applications in the museum context. We also explore the notions of atmosphere and atmospherics, the SOR model, as well as emotion, mood, and feelings in the context of the museum experience.

2.1. Experience and Use of Digital Applications in the Museum Context

The presence of digital technologies and tools reshapes and redefines the museum experience [7]. The physical experience of visiting a museum involves feeling and thinking. After the visit, the visitor acquires a cognitive gain, along with personal impressions of the emotional engagement he experienced. The presence and the use of digital applications offer visitors the opportunity to explore new ideas and feelings, and they are very likely to discover and develop previously unknown preferences and interests.

Museum technologies range from simple digital documentation and cataloging to applications in special museum information portals, online exhibits, 3D visualizations [8], haptics [9], digital museum showcases [10], museum games [11–14], augmented reality applications [15,16], and more recently to artificial intelligence [17,18].

Regarding digital technologies and tools, there are many studies evaluating their use but also their impact on the museum experience [19–24]. Research and studies have also been carried out in order to highlight the ways in which digital technologies are used to support and enhance the learning experience [25–29] or increasing the time spent in the museum [30,31] or regarding the active participation of visitors in creating their own interpretation of museum collections with the support of digital applications for iPhone, iPad, and Android [32].

2.2. Atmosphere and Atmospherics

Our study focuses on the concept of “museum atmosphere” in order to address the MDA as part of the wider framework of the exhibition environment. Although atmosphere as a natural phenomenon literally refers to the layer of air that surrounds a planet or a star, the concept of “atmosphere” has other interpretations too. In recent years, the term has been used more frequently in its metaphorical sense, specifically to describe human interaction with specific places and situations, and the resulting emotions that are evoked. However, ambiguities persist in terms of the conceptual framework [33]. Böhme [34], for example, argues that atmosphere blurs the lines between the tangible and the intangible. For him, atmosphere is “captured” somewhere in between the subjective and the objective, the subject, and the object.

“Atmospheric effects” was a term originally described by Kotler [35] (p. 50) in the context of marketing as “the conscious design of a space in order to create specific effects on the consumer-buyer”. He also pointed out that these effects were a silent language, akin to body language. Kotler is widely considered to be the first to have discussed the term “atmospherics” in 1974. However, researchers had been dealing with the concept since the 1960s [36–38]. More recently, “atmosphere” has been acknowledged as an important component for achieving a quality experience in service spaces [39]. It is now broadly used to include environmental and design elements for commercial stores, places of entertainment, and/or service areas [40].

The most widely-known models for describing and studying atmosphere are Baker’s “service environment” model [41,42] and Bitner’s [43] “servicescape” model. According to Baker’s model [4], three main dimensions describe the service environment: (a) environmental (ambient), (b) design, and (c) social. According to Bitner [43] (p. 59), for the servicescape model, the environmental dimensions are characterized as (a) ambient conditions that include non-visual sensory stimuli, (b) conditions of space and functionality (spatial layout, design, and functionality), and (c) marking elements and symbols (signs, symbols, and artifacts). Bitner’s model has been applied in a wide range of studies, including those looking at activities and spaces related to tourism, entertainment, and leisure [44–47]. Subsequently, the concept of “servicescape” was enriched and modified to provide more up-to-date and specialized terms, such as “designscape”, “landscape”, and “experiencescape” [48]. New dimensions were added to those originally introduced by Bitner, namely: (a) natural [43], (b) social [49,50], (c) social-symbolic [51], and (d) restorative [52].

2.3. The SOR Model

In the literature on atmospherics, the most widely applied theoretical framework for describing consumers’ responses to the environment has been the stimulus–organism–response or SOR model developed by Mehrabian and Russell [53] in the field of environmental psychology. According to this model, sensory inputs from the environment (Stimulus), combined with personality factors, trigger an internal, primarily emotional reaction (Organism), which results in behavioral outcomes (Response). The relationship between the environment and expressed behavior thus goes through an emotional response, which is shaped by the environment (atmosphere).

In order to characterize the emotional response, Mehrabian and Russell [51–54] specified emotion as consisting of three dimensions, referred in short as the “PAD dimensions”: (a) Pleasure, (b) degree of Arousal (extension of sensory stimulus), and (c) Dominance, as well as their conceptual opposites. Schematically, as portrayed by Forrest [54] (p. 207), who referred to Mehrabian and Russell’s figure [53] (p. 8), the model is as follows (Figure 1).

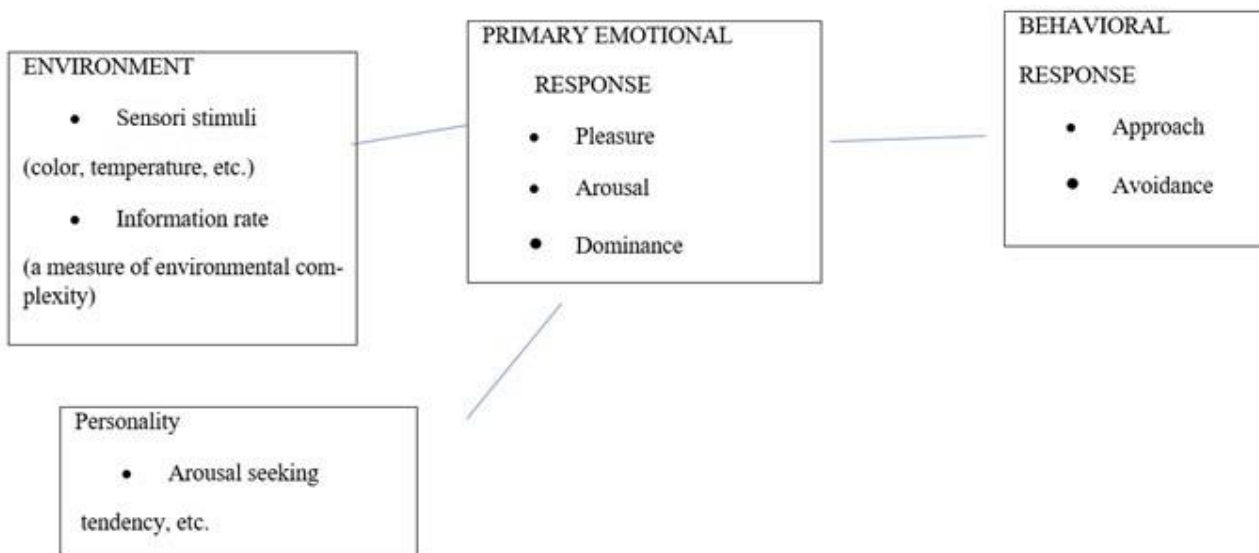


Figure 1. The SOR model.

Mehrabian and Russell’s SOR model includes ranges, which extend from despairing to hopeful regarding the pleasure variable, relaxed to stimulated regarding the arousal variable, and guided to autonomous regarding the dominance variable. Among these PAD dimensions, dominance is quite problematic and unexplored in terms of measurement [55]. According to environmental psychology, from which the SOR model is derived, the individual responds to an environment in one of two ways: approach or avoidance. The approach behavior reflects positive feelings and refers to a person’s desire to stay in a space

and explore it [56]. Avoidance behavior, meanwhile, is associated with a negative mood, namely a tendency to move away from a space and an absence of an interest in exploration [57]. Environmental psychology holds that atmosphere offers stimulus (stimuli), which is perceived by a person through the senses and emotions (forms), which result in expressed behavior (response).

Therefore, atmospheric cues are a key component, since they are the variables that determine the meaning of the stimulus (stimuli) but also trigger emotions. These variables initially fell into four categories: (a) the exterior of the store, (b) the general interior, (c) the layout and design, and (d) the point of purchase and decoration [58]. Turley and Milliman [59] added a fifth category, the human variable. This category came from research—also from the field of environmental psychology—according to which an individual’s response to the environment is not purely a product of stimuli but depends largely on personal background and expectations [60]. Such personal elements include (a) familiarity with the space, (b) involvement with and knowledge of the subject, (c) desire for exploration and discovery [4], as well as (d) the overall expectations of the visitor [43].

Forrest [54] also relied on the theories and models by Baker [41] and Bitner [43], and the SOR model by Mehrabian and Russell [53]. He modified the variables in order to make them more compatible with the museum space in terms of content and effect, which resulted in the following list: (a) external variables (e.g., architectural style, exterior decoration and signage, the museum’s location, the location of the entrance), (b) interior variables (e.g., color scheme, lighting, flooring, materials, as well as non-visual stimuli and visitors’ comfort, including sounds, aromas, and temperature), (c) layout and design (e.g., allocation of exhibition space, programs, gathering areas, catering, retail, spatial arrangement of exhibitions, visitor flow, ticketing place), (d) the point of purchase and decoration (e.g., individual exhibits and displays, display case layout, interpretive signage, and object labels), and (e) human variables (e.g., appearance of museum staff, availability and perception of museum staff, interaction with other visitors, and crowd levels).

Kottasz [61] used a customized SOR model to assess the needs of the museum environment. She argued that atmospheric variables have an effect on the visitor’s emotional state and behavioral intentions. The Kottasz model (see Figure 2) on how environmental and atmospheric cues affect the visitor’s decisions and reactions includes theories by Kaplan [62], McGoldrick and Pieros [63], Hein [64], Hooper-Greenhill [4], and Turley and Milliman [59].

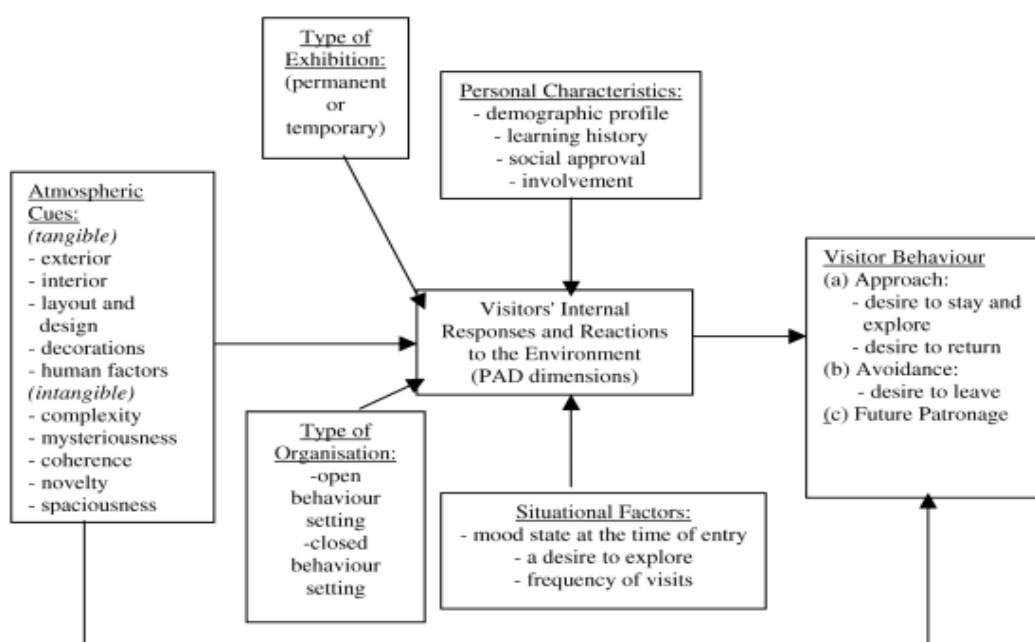


Figure 2. The Kottasz model [61] (p. 98).

2.4. Emotion, Mood, and Feelings

The words “emotion”, “mood”, and “feeling” are not synonymous, despite their frequent conflation. Nevertheless, distinguishing them is not easy [65]. As Batson et al. [66] (p. 295) pointed out: “On the psychology field the terms emotion and mood switch, without any attempt to conceptual differentiation”. However, some progress has been made in setting boundaries and a framework [67–72].

Feeling is the state that has been tested in relation to the individual’s previous experiences and is therefore identifiable. In fact, feelings are conscious states [73]. Feeling is more of a personal state, because each person has a unique set of pre-existing memories and feelings, from which they will draw information whenever they want to interpret and identify new feelings. On the other hand, emotion is the projection or expression of a feeling. In contrast to feelings, the expression of emotion may or may not be real/authentic [74]. Finally, mood is used as a term to describe emotional states that do not relate to something specific or comprehensive. For example, a person may feel depressed due to personal reasons, without anything specific being responsible for this feeling. Similarly, when a person is in an irritable mood, the cause can be anything or anyone [75]. Unlike emotions, which are closely related, even instantaneously, to their trigger, mood is not necessarily directly related to its cause or motivation. In addition, mood lasts longer than feeling. Emotions always have someone or something as their receiver [76]. That is why emotions are not static, but are constantly changing and evolving [77].

This brief breakdown of the terms “emotion”, “mood”, and “feeling” has been included to better understand our research findings (see relevant section below), due to the fact that participants’ answers indicated elements of all the above terms in relation to the presence of digital applications. However, this research does not categorize the participants’ emotional states in reference to those specific terms.

3. Methodology

This research used Mehrabian and Russell’s SOR model [54], as adopted for museum environments by Kottasz [61], in order to explore the concept of the Museum Digital Atmosphere (MDA). We also used the categories of variables as outlined above by Turley and Milliman [59] and adjusted to the museum environment by Forrest [54]. Since our aim has been to answer the “how” and “why” of a social phenomenon (i.e., MDA), we followed a qualitative approach with semi-structured interviews towards describing, interpreting, and analyzing MDA. The findings of qualitative research come from real-world situations, where phenomena under investigation take place in physical dimensions and spaces [78]. More specifically, our qualitative approach falls into the categories of explanatory and generative qualitative research [79], since it aims to examine and study connections and correlations between phenomena but also to form and develop any potential new theories, strategies, and possible actions. In particular, it deals with the parameters that shape the atmosphere during the use and presence of digital technologies. This objective is implemented with the SOR model as a tool. Moreover, the qualitative approach also falls into the explanatory category, since the sample will be measured once and the scope is to test theory and look at causality.

Our semi-structured interviews lasted an average of one hour each. The sample consisted of 17 specialists and professionals on the field, namely museologists, museographers, museum managers, and digital applications developers working in Greek museums. In total, 17 specialists may appear few as a sample, but we need to take into account that this sample (museologists and experts) represents almost the 70% of Greek museums that incorporate digital applications at their physical spaces. The interview period lasted from April to September 2018. The interviews were carried out either in situ or via online scheduled meetings. The selection of participants was based on them being representative, reliable, up to date, and with the appropriate theoretical (museological) or technological background. We applied data triangulation to enhance reliability [80].

The museums of the sample have updated, upgraded, and/or differentiated the digital tools in their exhibitions via tools included QR codes, 3D projections, virtual reality, digital exhibits, holograms, and other interactive or multimedia applications. Ten museums fully covered these criteria: (a) the Piraeus Group Cultural Foundation in Athens, (b) the Noesis Science Center & Technology Museum in Thessaloniki, (c) the Athens War Museum, (d) the Georgios Jakobides Digital Museum in Lesvos, (e) the Nikos Kazantzakis Museum in Crete, (f) Kairis' Digital Museum in Andros, and (g) the Kerkyra Annex of the National Gallery in Corfu. h) Hellenic World Foundation, i) Acropolis Museum, and j) Archaeological Museum of Tegeas. Seven of them (i.e., 70%) agreed to participate, namely: (a) the Piraeus Group Cultural Foundation in Athens, (b) the Noesis Science Center & Technology Museum in Thessaloniki, (c) the Athens War Museum, (d) the Georgios Jakobides Digital Museum in Lesvos, (e) the Nikos Kazantzakis Museum in Crete, (f) Kairis' Digital Museum in Andros, and (g) the Kerkyra Annex of the National Gallery in Corfu.

The research participants were employed at these seven museums as museologists, curators, or digital app or digital museum developers. In terms of demographics: 4 participants were men and 13 were women; 3 participants were in their thirties, 10 in their forties, and 4 in their fifties; all participants were permanent staff; in terms of length of time in the museum, 1 participant was employed for less than two years, while the rest of them had more than ten years of work experience in their positions. Interviews were recorded and transcribed, while findings were elaborated, categorized, and evaluated via content analysis taking into account the SOR model [53,61] and Forrest's [54] customized categories.

In terms of limitations and challenges, we must make crystal clear that this research has been conducted in Greece, and included Greek museums only. Also, our null hypothesis has been that MDA is a distinct form of atmosphere with its own characteristics, some of them inherited by the atmosphere caused by the museums' physical setting(s). Despite our efforts to be neutral, we understand that this hypothesis may have influenced our interpretation of findings.

4. Research Questions

Our research questions aimed mainly at exploring the characteristics of the MDA across museums in Greece. The MDA was studied as an emotional state caused by the use and presence of digital applications and technologies. With the SOR model in mind, we searched for answers to the following research questions:

1. What does atmosphere mean to you? And how about museum atmosphere? How do you understand this?
2. How would you describe the atmosphere created by digital tools? What variables evoke emotions? Which elements (variables) of a digital space or tool in particular evoke emotions?
3. What did you like or dislike? Was your mood affected by the digital environment/use of digital tools? What would make you revisit the museum?
4. How would you describe museum's digital atmosphere (MDA)? How is this atmosphere caused by or linked to the use of digital apps? Is it something definable or measurable? What shapes or causes it?

5. Research Findings

In this part, we present the responses to our survey questions.

5.1. What Does Atmosphere Mean to You? And How about Museum Atmosphere? How Do You Understand This?

In response to this question, participants described what the term "atmosphere" meant to them generally, and then "museum atmosphere" more specifically. They referred to atmosphere as something that diffuses in a space, which may encourage a person to leave or stay. A few participants first defined atmosphere in a literal way. They talked about

environmental atmosphere. Furthermore, they described it as the feeling and mood that arises from a place. They talked about warm, hospitable, and friendly feelings as part of their understanding of atmosphere. Most of the participants agreed that atmosphere is the emotional state that is evoked as soon as you enter a place or as soon as you start to deal with something in particular. One participant specified atmosphere as something that creates pleasant feelings of familiarity, that urges you to get involved with the place.

Museum atmosphere was described as an ongoing and multifaceted experience. Accordingly, the responses were multifaceted too. When participants think about museum atmosphere, they instantly think about emotions, feelings, and experiences. They highlight that museum visits are a multi-sensory experience, motivating the visitor to use all their senses. A museum's atmosphere should ideally bring up memories and feelings from childhood. One interpretive approach described the museum atmosphere as an attempt to understand the artist, i.e., the creator of the exhibit.

The participants noted that creating atmosphere is a multifaceted process having a single basic goal, that of creating emotions, with an emphasis on being immersive. Specifically, many participants pointed to the importance of the natural environment, the building, the architecture, and the spatial design. The majority of participants also stressed that the emotional impact of the museum atmosphere can be felt as one enters the building or the surrounding space, even before approaching the exhibits. Almost half referred to lighting and sound, as well as the exhibition arrangement, narrative, and storytelling as factors contributing to a museum's atmosphere. They also added scents as elements that evoke feelings and contribute to museum atmosphere, although they stressed these should be compatible with the museum space and exhibition theme. They noted the same for sounds and music. Their contribution should be in harmony with the exhibition. Two of the participants agreed that surprise—a sense of experiencing something new, unexpected, or novel—would be an emotion that would define the museum atmosphere for them. Some argued that incorporating digital tools in the museum enhances the experience, and as a result, the museum atmosphere.

Finally, the majority of participants agreed that the concept of atmosphere is holistic. It reflects the overall impression made on a visitor through their emotional or sensory immersion due to a space and/or an event.

In the words of participants:

- “I perceive it as a situation that I experience through my senses”,
- “Everything causes atmosphere: The lighting, the aromas, the space, the exhibits”,
- “I think it's the first feeling you get when you're inside”,
- “Music is always pleasant element in the museum. It calms me down”,
- “From my point of view as a developer, atmosphere is everything new and different”,
- “The building, that draws my attention. The building causes atmosphere”,
- “The layout of the exhibits largely determines the atmosphere”.

5.2. How Would You Describe the Atmosphere Created by Digital Tools? What Variables Evoke Emotions? Which Elements (Variables) of a Digital Space or Tool in Particular Evoke Emotions?

Here, participants focused on what defines and causes digital atmosphere. They were asked to talk about the triggers that may cause emotions in terms of the incorporation of digital tools in the museum.

The color settings of the digital tools seem to be very important for shaping emotions and creating atmosphere. The participants noted that their feelings of pleasure were enhanced by the compatibility of the colors with the overall museum environment. They also said that the sense of surprise, the unexpected, mystery, and discovery could all contribute to the atmosphere. In terms of the features of the digital tools used in a museum, they felt that aesthetics, functionality, usability, accessibility, interaction, user friendliness, and speed were all conducive to positive feelings such as pleasure and satisfaction. Conversely, negative feelings were associated with digital tools breaking down or being slow to use.

Some participants highlighted visitors liked being able to configure the interactivity of the digital tools to suit their requirements and preferences.

Furthermore, participants mentioned that the placement of digital tools in the museum space should take into consideration certain factors such as spatial design. The range of tools available should not overwhelm the museum experience and there should be a balance between the digital and the physical. The digital tools should be strategically placed along the visitor's path through the museum, so that visitors feel invited to use them in their journey. Tools should be impactful but also make sense in the overall exhibition narrative and message. Some participants highlighted the need for privacy when experiencing digital tools. The curators and museologists in particular mentioned that they would prefer a private room to use the technologies for a more relaxing, comfortable, and pleasant experience. In line with this suggestion, many participants argued that crowd levels can affect mood and feelings. Specifically, crowded spaces can evoke negative feelings such as distress, annoyance, and overstimulation.

All participants pointed out the importance of lighting, sound, colors, music, flooring, as well as scent and aromas. In terms of lighting and colors, they referred to these elements both in the physical museum space, as well as in the digital tools' design and interface. Intense lighting and colors are more likely to excite, while low lighting and pale colors are more likely to soothe. The choice of color and level of lighting should in any case always be considered in relation to the overall museum space and the exhibits. The participants stressed that the digital tools should be implemented in such a way so as to blend with the real and physical environment in order to respect the authenticity of the objects. Music—and sounds in general—can be used to create emotions. Loud or incongruent music can make visitors feel uncomfortable or annoyed. On the other hand, sounds that enhance the digital tool's context can be a very pleasant and interesting feature.

The human factor also came up as a component that contributes to creating emotions, especially from the digital app developers. The presence of and interaction with museum staff and other visitors are all variables contributing to a visitor's mood and feelings. Friendly and polite staff can increase visitors' comfort levels and make them more likely to stay at the museum or come back for another visit. Crowding is a parameter that also affects visitors' mood and emotions. As mentioned above, overcrowded spaces can evoke negative feelings in visitors such as anxiety and stress.

Seven of the participants discussed the importance of visitors' prior mood and expectations. They underlined that such personal factors play a crucial and decisive role regarding their overall perception of and feelings towards the museum atmosphere. This also seems to influence what the space or the digital tool itself may evoke in the visitor.

The developers mentioned that the accurate transfer of reality to the digital world, with respect to the authenticity of the exhibits, along with targeted aesthetic choices are what ultimately create a pleasant atmosphere.

In the words of participants:

“Crowding makes me feel nervous. That would prevent me from revisiting. Museum staff plays a crucial role in evoking emotions. Friendly staff makes me feel comfortable”

“I really need to experience user friendly digital apps”

“It would be nice to experience digital apps in privacy”

“I think that achieving the equilibrium: the coexistence of exhibits and digital apps would make me feel nice and make me come back again”

“Personal mood is responsible for shaping feelings when using a digital application. If I'm tired, or nervous everything will probably annoy me”

“When developing digital apps for museums Accuracy—Authenticity-Aesthetics are really important”

“Music, lighting, colors laid at the space as well as to the one selected for the digital app would make me feel nice and want to revisit the place. Speed and interaction of a digital app would evoke positive feelings”

5.3. What Did You Like or Dislike? Was Your Mood Affected by the Digital Environment/Use of Digital Tools? What Would Make You Revisit the Museum?

In this question, participants were asked to describe how their likes and dislikes about the incorporation of digital tools affected their likelihood of revisiting the museum. All of them mentioned the factor of aesthetics, specifically, that the level of digital aesthetics would be critical in making them come back for another visit. They added: well-designed tools, a smart context, clear, and comprehensible content, information accuracy, creativity, a good combination of educational and entertainment content, gamification, speed, a simplified interface, as well as scalable interactivity and other available options.

On the other hand, the majority noted that lengthy texts, bad graphics, lack of originality, a lack of respect towards the authenticity of the exhibit, including its messaging, as well as a bad fit with the physical setting of the museum would annoy them and make them tired and bored. This would mean that they would be less likely to revisit the specific museum. Three of the participants highlighted the importance of accessibility; the technology should be disability friendly, for example.

Music and sounds were emphasized by participants as a key variable for evoking positive feelings and creating a pleasant museum atmosphere in the physical and digital space alike. This finding seems to be strongly linked with whether visitors are likely to revisit the museum.

The human factor was also a distinct atmosphere variable mentioned by all of the participants. They discussed the importance of the front desk staff. Specifically, they underlined that museum employees play a crucial role regarding the evoked emotions and the overall experience. Their attitude in terms of hospitality along with their overall awareness could influence visitors' mood and feelings. In other words, participants said that staff that did not meet their expectations would probably downgrade the experience of their visit.

Personal expectations, background, and educational level are also factors responsible for evoking specific emotions in the museum, and consequently creating a specific atmosphere.

In summary, participants' intention to revisit the museum depended on several factors including the digital tools' aesthetics and design (especially when having control of the digital app), as well as the museum personnel and architectural style. Even noise and crowding could affect them and prevent them from revisiting. Another visit would also be contingent on whether the narrative of the exhibition fit well with the use of digital tools. The exhibition and the digital tools should coexist without upstaging one another. When that equilibrium is achieved, it can bring about positive emotions. Otherwise, as the museologists stressed, visitors would be annoyed and unlikely to revisit.

In the words of participants:

“Well I really like well-designed apps. That pleases me and captures my interest”

“When there are bad and long texts at digital apps makes me nervous. I really want to leave”

“What discourages me from engaging is bad graphics, low speed, unfriendly interface, I would be less likely to visit again the museum”

“Music. Music and sounds always play a crucial role, both in app's design and physical space. The presence of music would please me, especially when it is relevant to the exhibition theme”

“Digital apps should be in a specific place and in reasonable amount. They should coexist without oversubscribing the exhibits”

“The staff plays an important role, of course. Of course, because you can remember a not-pleasant moment very vividly. It can spoil your entire visit”

5.4. How Would You Describe Museum’s Digital Atmosphere (MDA)? How Is This Atmosphere Caused by or Linked to the Use of Digital Apps? Is It Something Definable or Measurable? What Shapes or Causes It?

In this final question, participants attempted to define the term “museum digital atmosphere” (MDA), to the extent it can be concretely defined. Almost 30% of participants did not answer these questions clearly. However, they all argued that MDA is a hybrid term as it borrows elements from digital curation. It is the feeling that is evoked during the transition from the physical into the digital space and interface. Many experts must therefore come together to create a digital atmosphere.

The difference between the conventional atmosphere, as an emotional mood, and the digital one was clear to the participants. They underlined that the two types of atmosphere had variables and components that diverge, even if in a broader sense certain similarities and correlations could be found. Atmosphere overall is seen as an immersive state, which is affected by the aesthetics, accuracy, speed, content quality, and interaction level of the digital tools.

One clear reply defined the MDA as the emotions that occur due to the incorporation of digital apps in addition to content, design, colors selection, sound and audio, and scents and aromas of the physical space.

In the words of participants:

“Well.. Digital Atmosphere... Digital Atmosphere I believe is the emotions that digital applications cause you, based on content, design, colors, sounds, interface, functionality”

“In digital applications the “atmosphere” is created by completely different characteristics compared to those that describe for me the “atmosphere” of a physical space”

“I consider the “digital atmosphere” as something measurable”

“What is really Digital Atmosphere? It is feelings and emotions that occur when digital apps integrate into the museum”

“I cannot tell for sure what Digital Atmosphere is, but it surely is a hybrid term”

6. Discussion

The participants’ answers confirmed the applicability of the SOR model for studying MDA in Greek museums. Clear and distinct variables of the museum space emerged when participants were asked to focus on the incorporation of digital tools. These variables mostly follow the categories uncovered through our literature review. However, some deviate from the existing conceptual framework, as this research goes beyond the (physical) museum exhibit to explore digital tools used in museums, or in the case of purely digital museums, digital exhibits.

The linear triptych, i.e., stimulus (stimuli)—primary emotional reaction (organism)—expressed behavior (response), is found to be applicable to the study of museum spaces where digital tools are used, given that correlations between stimulus–organism–response (final behavior) were ascertained. In particular, the research findings showed that stimuli, which exist in a space that hosts digital applications, are able to evoke emotions and lead to expressed action (behavior). This linear sequence documents the meaning of atmosphere and determines it through the connections of elements (stimuli), emotions, and behavior. Variables, emotions, and behaviors fill in the gaps in the equation and provide information and data about what is defined as the so-called museum digital atmosphere (MDA).

As revealed by the research findings, the MDA is an intangible state. It inherits features and variables of the conventional atmosphere. It also promotes new components that form

emotions, which arise from the incorporation of digital applications and technologies. The findings of the survey highlighted the dual function of digital tools. On the one hand, their characteristics, and properties in terms of content, functionality, and aesthetics are part of the variables that form emotions. On the other, they form the basis on which the MDA is structured and conceptually determined. They replace the exhibit and amend the classic triptych: museum–exhibit–visitor, to museum–digital tool (digital exhibit)–(digital) visitor.

The effect of digital tools on visitors' emotions and feelings is different to that of the exhibits. Specifically, unlike physical objects, digital tools are technological elements deprived of cultural, historical, and social value. The technology is a standalone element of the museum experience, but nevertheless has a strong connection to the exhibit. Given this differentiation, our research reveals that atmosphere as an emotional state is distinct depending on whether we are referring to conventional atmosphere or MDA.

Digital tools unfold in a parallel museum dimension. They coexist with the physical exhibits, but nevertheless they offer another kind of experience, enriched with intense immersion and interactivity. Depending on their type, purpose, and content, they can highlight and promote different values, goals, but also aspects of the museum exhibit. Consequently, digital applications in a museum space can define the framework of a parallel environment and, as the present study demonstrates, a "parallel" atmosphere, the MDA.

The MDA variables that shape emotions and related behaviors were highlighted by the research findings and fall into many of the categories developed by Turley & Milliman [59], Kottasz [61], and Forrest [54]. However, they display different emotional connections, given that the focus is on the digital.

Emotions such as nostalgia or memory were not reported in relation to digital applications and their use, in contrast to conventional museum spaces that tend to evoke such feelings. Then again, emotions and moods such as surprise, excitement, arousal (both in the sense of alertness and of provoking secondary emotions such as imagination) were found, as well as emotions of satisfaction and pleasure. In contrast to the positive emotions, feelings of boredom, frustration, indifference, irritability, annoyance, and general dissatisfaction emerged when referring to digital applications' malfunction and low speed. The research findings stressed that the elements of space, the features of the digital tools, and human factors (e.g., crowding, museum staff) can evoke emotions that correspond to the three dimensions of the SOR model (pleasure, arousal, and dominance).

Another considerable finding was that of the emotional dimension of dominance, i.e., control (dominance dimension), a variable on which there is a gap in the literature. The dimension of dominance is particularly difficult both in its appearance and in its correlation with elements that cause and highlight it. The present research has shown that content and design features of digital tools can trigger emotions that fall into this dominance dimension. In addition, the sense of having control over a digital tool, including management and autonomy of movement, can create positive emotions, which may encourage the visitor to visit again.

The MDA has its own peculiarities and uniqueness. It is experienced in parallel with the conventional atmosphere but also autonomously. It inherits characteristics from the atmosphere in its conventional form but at the same time presents its own dynamics and elements. The physical space may provide elements (variables) to help create the MDA, such as the building and lighting. However, it is doing so without taking away from its own atmosphere, without diminishing its own existence. The physical atmosphere, like the MDA, is a key parameter for creating positive or negative emotions and corresponding behaviors. The presence and the spatial arrangement of digital tools along with the variables that shape the atmosphere have been proven to increase the time spent in the space. They can also increase the purchase and consumption of products, as well as augmenting socialization, participation, etc. They can extend the museum visit, intensify engagement with the collections and exhibits, and enrich and upgrade the museum experience. The ultimate

feeling that the space evokes in the visitor regarding emotions, from the atmosphere point of view, is what will determine a visitor's subsequent behavior.

The variables inherited from physical space, highlighted by the participants, enriched by the presence of digital tools, and ultimately established the MDA are summarized below.

6.1. Variables That Shape the Museum Digital Atmosphere (MDA)

6.1.1. Inherited Variables from Physical Space as Categorized by Turley and Milliman [77] and as Modified by Forrest [30] (See SOR Model Part above)

- a. External variables: museum architectural style, exterior decoration and signage;
- b. General interior variables: general color schemes, lighting, flooring, material, nonvisual stimuli, and general visitor comfort—sound, aromas, temperature.
- c. Layout and design variables: space design and allocation—allocation of space to exhibitions, spatial arrangement of exhibitions—grouping of exhibits;
- d. Points of decoration variables: individual exhibits and displays, individual exhibits and images, display case layouts;
- e. Human variables: employee characteristics, crowding, interactions with other visitors.

6.1.2. New Variables Due to the Presence and Use of Digital Tools

- a. External variables: the height and the color of the building, contrast between architectural style and interior design, wall color, building size.
- b. Digital application design (design variables): content elements, digital app's aesthetics and layout, functionality, and practicality—technical issues of digital application, spatial positioning of the digital tools, number of digital apps in proportion to the museum exhibits.
- c. Spatial planning of digital tools: privacy.

6.1.3. Enriched with New Elements or Customized Inherited Variables from Physical Space

- a. External variables: garden, greenery, pathways, signs, (digital) welcome signs;
- b. General interior variables: white paint on the walls, relevance of music and sound to the museum theme and/or digital application. Sound level, rhythm, and type of music. Surrounding music, aromas, and scents relevant to the digital tools;
- c. Digital application design variables: content clarity, gamification, personal intervention and initiative, complexity (negatively mentioned), having control, multiple options, elements of mystery, cinematography, innovation, space and object's authentic depiction and rendering, being in tune with the museum space and exhibits, fonts, color contrast, options for the disabled, sound and visual quality, speed, proper functioning of technological equipment, accuracy, authenticity, and aesthetics (the 3 a's situation). Placement in a special and distinct space. Escalation of the digital app's presence in terms of immersion and interactivity options;
- d. Spatial planning: private space, lighting, sounds, aromas, smells.

While MDA is a hybrid term, it is nevertheless quantifiable. It can be measured via visitor surveys regarding the museum experience. It can also be studied through museum activities that require visitor participation. MDA contributes to the conventional atmosphere. Even though it stands alone, it also contributes to the enrichment and the enhancement of the feelings that visitors experience in the physical museum space. This new digital environment, in which the MDA is featured, is characterized as highlighted by the research findings by interaction, and strong elements of scenography.

As it can be measured, it can also be evaluated, and, therefore, it is manageable too. This assumption automatically generates connections with the field of ethics. Managing situations and decision-making are primary and structural features in the field of museum ethics. Museum ethics were developed to manage behaviors, situations, and objects. At the same time, the museum uses management to fulfil its goals. After all, museum ethics extend to all the organic elements of the museum world. Proper management leads to the improvement of both museum services and the visitor experience. There are exhibiting

ethics, collecting ethics, professional ethics, and ethics regarding visitors [81]. However, this list can no longer be considered exhaustive because of the emergence of available data in the fields of technology, society, commerce, politics, and tourism.

As already stressed, MDA is a measurable element. In addition, it is a manageable element too, because what can be measured can be managed. The new digital dimension of museums gives rise to the need for new approaches and guidelines regarding the individual organic elements that shape the digital world and community, such as digital visitors, digital exhibits, and now the MDA. The emergence of the MDA as an integral part of the digital world could give rise to new experience approaches, regarding the effect and the impact on visitor' emotions.

7. Conclusions

The findings of the present research explored the nature of museum digital atmosphere (MDA) and what elements or variables can contribute to it. The findings were backed up by the SOR model, which was supplemented by real-life components and variables. Therefore, the variables that emerged are all worthy of further research endeavors.

This research provides initial data and knowledge regarding the concept of the MDA, along with its importance. It addresses the tangible and intangible variables (stimuli), which are perceived by the visitor's senses and result in corresponding emotions. It also confirms that these emotions can lead to specific approach or avoidance behaviors. These behaviors are expressed in the visitor's choice to consequently revisit or avoid the museum in the future. The research findings, which underwent content analysis, can be a valuable resource for museum professionals and digital tool developers. They provide new information regarding the atmosphere created by the use of digital tools in the museum.

Addressing the MDA is important for modern museum practices in the digital world. Exploring and interpreting the MDA opens a new path for enhancing and optimizing the museum experience. The MDA affects visitor experiences and behavior, i.e., whether they enjoyed the experience and are likely to revisit. As atmosphere has always been a powerful medium and tool in the field of marketing, in-depth knowledge on the MDA and its variables can reinforce museum management, as well as museum marketing strategies and policies. It can also help to guide museums towards diverse communication and advertising techniques in terms of attracting visitors and much-needed funding. The latter is of great importance for museums to remain sustainable in a competitive and challenging digital era.

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