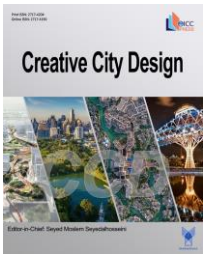

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How the Enigmatic Architectural Components of Museums Affect the Perception of Audiences in Different Age Groups

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Abstract:

Aims: Museums communicate cultural evolution through spatial experience, yet contemporary museum architecture often underplays audience engagement. This study examines how enigmatic architectural components (lighting, color, message flow, signs, navigation, text/scripts, labels/panels, display cases, and graphics) affect audience perception across age groups at the Tehran Museum of Contemporary Art (TMoCA).

Methodology: A structured questionnaire using a 5-point Likert scale was administered to 373 visitors, sampled by age clusters (20-40, 40-60, 60-80). Internal consistency was verified (Cronbach's $\alpha = 0.726$, 9 variables). Data were analyzed in SPSS using descriptive indices and fit/contribution indicators reported as R^2, β, t, and F.

Findings: For ages 20-40, the highest contribution relates to message flow ; for 40-60, text/scripts contribute most; and for 60–80, graphics dominate. Navigation consistently shows lower contributions relative to other components.

Conclusion: Audience sensitivity to architectural-environmental cues is age-dependent at TMoCA. Designers should prioritize narrative flow for younger adults, plain and legible texts for middle-aged visitors, and strong, accessible graphics for older adults; wayfinding requires targeted improvement across cohorts.

Keywords: Enigmatic Architecture; Audience Perception; Message Flow; Wayfinding; Exhibition Design.

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1. Introduction

Museums operate as communicative environments where spatial configurations, signage, lighting, color, texts, and graphics collectively shape how visitors perceive and make sense of cultural content. Architecture therefore does not merely "house" exhibitions; it mediates audience experience and frames the interpretive work that visitors perform while moving through galleries. Within this broad view, enigmatic—or mystery-evoking—architectural components (e.g., subdued lighting contrasts, layered sightlines, narrative sequencing of galleries, and evocative graphics) are frequently employed to spark curiosity and sustain engagement. Theoretically, such cues can heighten anticipation, focus attention, and scaffold meaning-making; practically, however, sensitivity to these cues may vary with age due to differences in visual acuity, reading preferences, cognitive load, and wayfinding strategies. Despite abundant design guidance, comparatively little empirical evidence profiles how these components operate across distinct age cohorts. Related research in Creative City Design underscores that architectural and visual elements measurably influence audience perception and visual experience, but does not

disaggregate effects by age in a single-site museum context [31,32]. this study addresses that gap by examining nine components—lighting, color, message flow, signs, navigation, text/scripts, labels/panels, display cases, and graphics—at the Tehran Museum of Contemporary Art (TMoCA) across three age groups (20–40, 40–60, 60–80). To the best of our knowledge, prior work has not jointly profiled these components by age cohort within one museum. Our contribution is twofold: (i) an age-stratified model that estimates the relative effects of the nine components on perceived "mystery," and (ii) actionable, age-aware design guidelines for exhibition making and wayfinding.

Research question: How do enigmatic architectural components influence audience perception across different age groups at TMoCA?

Objectives: (1) estimate the relative effects of the nine components within each cohort; (2) compare effect patterns across cohorts; and (3) derive practical recommendations to optimize narrative flow, legibility, and navigation for diverse visitors.

2. Literature Review

2.1. Theoretical Framework

2.1.1. The dictionary definition of a museum

The word museum is adapted from the Greek word "mozin", which means the abode of "mouse", the goddess of arts and crafts in ancient Greek mythology, which is pronounced museum in English and museum in French around the decade of 1261 A.H. [2] The French pronunciation of "Museum" also found its way into the Persian language. The International Council of Museums affiliated with the Organization, Cultural, Scientific and Educational Organization of the United Nations, in paragraphs 3 and 4 of its statutes, which is the most comprehensive definition of a museum, says that a museum is a permanent institution without a material purpose whose doors It is open to everyone and works to serve society and its progress [3]. the purpose of museums is to research the works and evidence left by man and the environment, to collect, preserve, and create connections between these works, especially to display them to examine spiritual productivity [4]. The definition of a museum from the Omid dictionary is a collection of antiquities, a building where antiquities are kept or exhibited. In ancient Greece, it was the name of a place where they studied crafts and sciences, and it was also the name of a hill in Athens, where they built a place of worship and a special place for several of your gods that came into being and the muses were the daughters of Jupiter, who were considered the gods who inspired science, literature, art, music, and sculpture [5].

2.2. Duties of museums

Every museum has three basic tasks - preservation and maintenance - 2 research and search; 3- communication [6]. preservation includes selecting and collecting cultural works and taking care of them. Research and search are the preparation of documents, which is considered a necessary platform for research and search. are taken, and among them, we can mention educational programs intended for different age groups, holding exhibitions, launching publications, creating websites, multimedia programs, etc [7].

2.3. Effect of architectural factors in museums affecting perceptions of audiences

2.3.1. Lighting

Another element that can help in facilitating better understanding on the museum message is lighting. Lighting can also provide an aesthetic experience which can affect the visitor in creating different moods and highlight objects and bring them out of dark, mysterious voids and enable the objects to glow and sparkle. Furthermore, lighting can provide such a bright and happy environment [8]. Maximea said that most museums use low light levels due to the people that prefer warmth. On the other hand, lighting should be at moderate levels, spotting the cases and pieces in them so that the visitors can see clearly the objects and labels [9]. Referring to the standards by Museum & Galleries Commission (1995) directional lighting can enhance the visitors' perception and help them in understanding the exhibition because lighting can emphasize form or surface texture of the objects. In addition of that, light which is an element of design can also contribute to the message where it can be used to set a mood or give drama to the exhibition [5]. On the other hand, dramatic lighting with strong contrasts and areas of semi-darkness between exhibits can cause problems to people with visual impairments, therefore, brighter lighter and closer access from the current practice is required for them [6]. complexity in an environment can affect arousal and performance in that environment. Excessive stimuli cause distraction and increase the fatigue of students, just as excessive simplicity is boring and destructive. Classrooms have more goals than just learning, so maintaining a balance of complexity will be the best approach [8,9].

2.3.2. Signs

One of the most familiar problems in museum design is the pattern used for interior spaces [10]. some of the principles of sign design include the following:

Using signs in prominent and important places throughout the building

Using specific colors to provide orientation information

Use some sort of tokenization system that gives visitors a sense of control over the environment, rather than relying on employees to answer their questions [11].

2.3.3. Navigation in the museum

The complexity of museum environments is one of its inherent characteristics because they aim to display as many galleries as possible. one of the ways to overcome this complexity is inherent in creating signs for navigation in the museum because most people prefer to use signs rather than asking employees [12]. examples of routing maps and decision-point signage are illustrated in Figure 1.

2.3.4. Color

Besides display case and lighting, colors also play an important role in any exhibition design. Colors can help

the exhibition room, objects or artifacts looks fascinating. In addition to this, colors enable to create an intimate and relaxing environment [8].

Figure 1. Examples of signs and routing maps [20,21]

Temporary exhibitions require more basic color or neutral color because it can last through for the next exhibition. Thematic exhibition on the other hand, can be adopted in order to have the 'black box' effect which use black or another dark color in matte tones. Those colors can be used on walls and ceilings to render the large portions of gallery background so that it can be invisible to eye and therefore encourage the visitors to give attention to the exhibit components or modules which have been highlighted with special lighting and color [13]. For an instance, a gallery at the University of British Columbia Museum of Anthropology is one of the good examples in using a good combination color for their exhibition. The gallery is colored with calm and thought-enhancing pale grey-green which matched by blond wood fittings. Furthermore, the color chosen works effectively which help the visitors engage to the exhibition and restful to the eye. A similar selection of colors within the gallery will encourage the visitors to contemplate and discover their thoughts. Choosing white for the ceiling will not only make the exhibition room looks brightly but it will reflect the color of the displays in the room and make it outstanding. Tone color is also important because it can help the lightness or darkness of any chosen colors. Tone can create the overall effect of the exhibition, create specific displays and the shape of the objects can be appreciated when it is seen against a background of a contrasting tone.

2.3.5. Text or Scripts

Text or scripts is important as it will deliver the message. Lord & Lord (2002) [13], found out that texts or scripts should be brief and simple in order to provide the information at multiple levels of complexity for visitors. As to make the message clearly legible, the exhibition designer should know which level of speech can be used and which specific jargon can be used to achieve high level of communication competencies [14]. Visitors like the short lines as they might go for further reading to complete their understanding and they do enjoy the informal and rhythmic quality of the text. Texts with simple wording might be appreciated by the visitors in order to read the information displayed [15]. In addition of that, a brief text should be relevant to the interest and motivations of visitors. Text placement also plays an important role in order to have a strong conceptual context. The text at the wall panels shall be in higher orders in the labeling hierarchy because those texts are concerned with ideas.

2.3.6. Display Case

According to Kim & Yeoh (2010), the main factors that can satisfy visitors' experiences are largely derived from the physical environment and personal experiential from the objects displayed at the museum. As an example, display cases. As suggested by Kaplan (2001), each case should be placed with attention to the shape, size and detail to increase its readability and labels stressed the function [9]. Similar to this, Durbin did mention in his study that the display cases should be readable which are not higher than 0.9 meters to suit for short or seated people. In addition of that, all display cases must have enough space beside them in order for the visitors to move comfortably especially people who are using wheelchairs [16]. Display case can also be designed in order to attract the visitors. Belcher (1992) suggested that display case be design either open or closed concept. Open concept can allow all-round viewing of the objects whereas enclosed design is where it have backings and stand. Motifs enable to catch the eye of the visitor although they are several meters away [8].

2.3.7. Graphics

To increase motivations among visitors, graphics need to be attractive and lively. These elements helped to focus the attention on the displays. The gallery design should be simple but impressive. In 1981, "Images of Power: Art of the Royal Court of Benin, Nigeria" exhibition in New York had addressed the inclusion of the audience. Sheldon Cotler, the graphic designer had successfully conveyed a feeling of the rainforest environment in the exhibition. The cases were wrapped with natural linen that gave texture and a neutral background to the rich darkling shades of bronze, brass, ivory, and wood and terracotta objects. The blown-up and mounted black and white photographs on the grey gallery walls to provide some depth and the grey carpeting completed the neutral shell [18].

2.3.8. Labels and Panels

Labels and panels should be placed with sightlines that most people can see it. Therefore, they can read the labels comfortably [13]. Wall panels as stated by Kaplan (2001) said that panels which incorporate with other graphic elements such as photographs, maps, charts and drawings can enhance viewing and enclose exhibition space and grab the attention of the visitors. Ciolfi & Bannan in their study in 2002 found out that the information available to the visitors in the proximity of the displays should be minimal. Labels which are simple will allow for mediation of information. It is sufficient if the labels to indicate the nature, the provenance and the period and placed it near to the object or a group of objects. Kelly (2006) suggesting in her study few guidelines in writing panels and labels. Labels should be placed near to the objects they are describing in order for the visitors to not get confused. The design of the labels can be designed in question form so that it will encourage participation and to grab their attention [15].

2.3.9. Message flow

The organization of the message flow can help the visitors

more understand on the subject matter. In order to have contextual or thematic exhibitions, the artefacts, specimens or other objects must be related to each other. It can be in room settings or dioramas or simply grouped in thematic within a display cases. Graphics may be multi layered and a combination of words and images can help visitor's comprehension and they can experience the transformative of the message [19]. The message flow needs to be planned like a storyline. Story line means that we need to presents the key element which related to visitor experience and this will refine the subject of the exhibition and key topics can be identified [20]. Thus, it is important to have such a good message flow, so that the visitors will engage to the exhibit and understand the intended message. another important topic is the way visitors explore and tour the museum. Visitors are biased towards the right side and as soon as they enter the gallery, they start looking and moving around from the right side [21]. at first, visitors see all the galleries, but as time passes, they become more selective and stop to visit fewer galleries [22]. people tend to use the first output they see, so people only see part of each gallery. Researchers call this pull of exits "exit stimulus" [20,21]
A high-level overview of exhibition components is summarized in Figure 2.

3. Research background

Ghobishavi, Kabuli in 1401 in the article on designing the interior architecture of the Abadan Museum with the approach of identity and inspiration from traditional architecture reached the following results: This study was carried out to design the interior architecture of the Abadan Museum with the approach of identity and inspiration from traditional architecture. In this research, it has been collected both by field method (questionnaire and library method). The measures of this research are questionnaire - field studies - documentary and library studies and experimental observations. To analyze the information, the methods (diagram-table-statistical, descriptive, and inferential) related to the topic of data have been used. The analysis shows that some of the original concepts of Iranian traditional culture and architecture have directly and indirectly influenced the design of the contemporary art museum in a way that these concepts overlap with the concepts of building formation [24].
Taheri, Rahimi Mehr in 2023 in the article "Museum design criteria with traditional architecture approach" said: Museums display some of the components of material culture and the objects in museums may not belong to that city only, so choosing a city to create A museum can have different reasons, but in general, the variety of works and objects in museums can indicate the growth of the civilization of that country. The main goal of the current research is to provide museum design criteria with a traditional architecture approach. The method of this descriptive-analytical research and the type of data collection is the library. In this way, to examine the concept, characteristics, definitions, type, and style of museum design, as well as studies in the field of research approach, i.e. traditional architectural concepts, information was collected in the form of a documentary and field library, and this information was collected from various sources such as related books, research articles, Databases, etc. were extracted. According to the objectives of the research and investigations, based on the research findings for each of the principles of traditional Iranian architecture, including moderation in decorations, use of functional decorations, moderation in the size of the building, creation of multi-functional spaces, prohibition of aristocracy, etc. [25].
In 2018, Pir Zadi, Alaei, in his article investigating the role of ambiguity in architecture, reached the following results: since the late 1980s, when postmodern and deconstruction topics were developed, postmodern architecture this time by accepting fundamental changes and new horizons from the perspective of visual stimuli such as; He found ambiguity and complexity. Thus, now in the 21st century, a new end has been opened. A new beauty is emerging in this world. Replacing the complex buildings instead of the silent and static buildings of the classical era, the architecture of the world, like this world itself, is becoming creative, self-changing, and unpredictable. Ambiguity in architecture in the modern and postmodern era was seen in the works of Peter Eisenman and Frank Gehry. In today's architecture, architects should not use visual stimuli in design. In this case, the ambiguity feature of the stimulus can be effective, which makes it impossible to get a superficial impression of the design or building in question; Which causes a kind of persuasion in the interpretation of today's critics, a kind of participation of the viewer with the said architecture to create new meanings. This ability in architecture is considered an attraction for the work and an important part of the building depends on it. On this basis, this research is investigated clearly and ambiguously. The method of conducting this research is library and internet research and analysis and interpretation of related materials [26].
Pir Babaei, Anuri in 2012 in his article "Mystery and Ambiguity in Islamic Architecture" stated: "The journey through the beauty created in Islamic architecture requires a spiritual journey to its mysterious valley." Where every pattern and color are a solid code of existential truth. A code that the audience reflects in the mirror of their existence, and the perceiver and the perceived seek unity. To understand the architectural concepts of this land, one must know and understand the cultural perspectives in which these concepts were created. In this regard, it is necessary to pay attention to the stability of essential concepts hidden in phenomena over time and to be inspired by them. The purpose of writing this article is to get familiar with the concept of mystery and ambiguity in literature, philosophy, and architecture, as well as to examine its relationship with human nature and its manifestations in Islamic architecture so that designers and perceivers can get closer to truth high values [27].
McLeod, Suzanne in 2012 in the book Making the Museum concluded that: In recent decades, many museums, galleries, and historical sites around the world have made an unprecedented large-scale investment in the infrastructure of their cultural sites, especially museums in terms of building renovation. And they have done the interior. The creation of numerous purpose-built new museums shows that there has been a fundamental re-

evaluation of the processes of designing and shaping the museum space. The interior space of the museum and its interior architecture need to examine the formation of its architectural infrastructure to organize them in the museum through the examination of the elements of the interior space and direct its potential to connect to the deepest level of communication with human perception and imagination [28].

Klonk, Charlotte in 2009 in the book Spaces of Experience: Interesting Studies on Art Gallery Interiors explores the changing ideals and design practices of museum gallery interiors in Europe and North America from the 18th century to the end of the 21st century, provides detailed information on the display methods in these spaces, which include: background wall color, light, furniture, height, and space creation to display artworks. The researcher shows that scientists such as Hermann von Helmholtz and Wilhelm Wundt, according to the theories of perception, consider the new ways of creating spaces for exhibitions and museums as important as the changing ways of exhibiting in art galleries and museums. As Michael Bazandal called one way of seeing elements in the space, due to the effect of this new method in interior decoration, information display showcase [22].

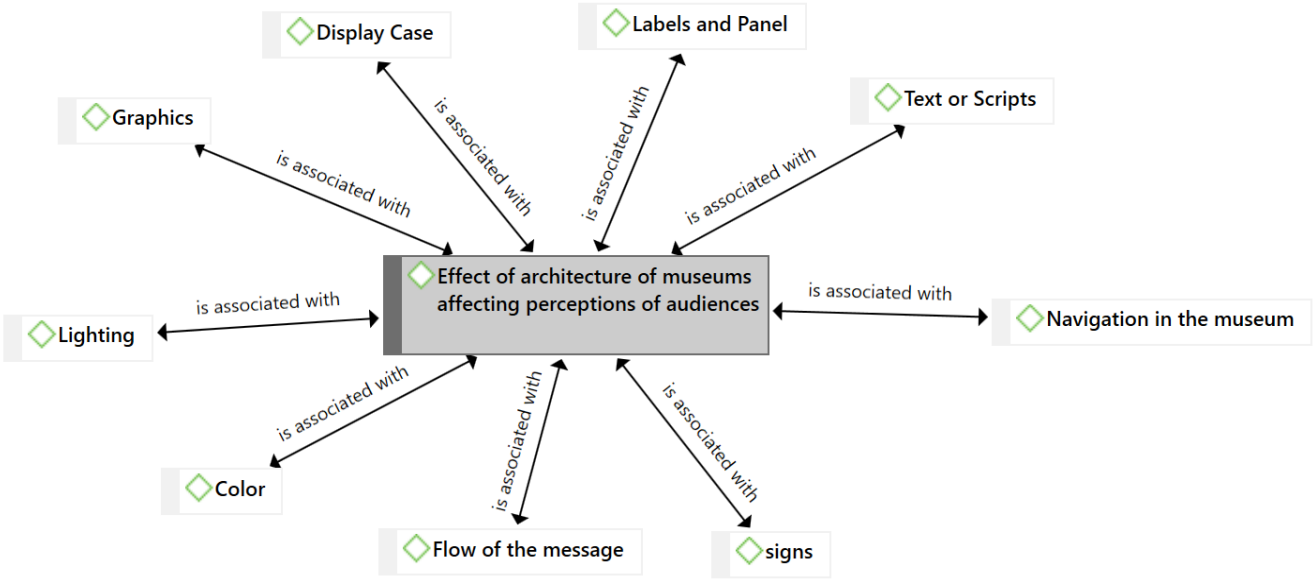


Figure 2. Summary of factors and components in museums

4. Methodology

Significance level was set at $p < 0.05$. We report questionnaire reliability (Cronbach's α) and, where applicable, model-fit and contribution indicators (R^2, β, t, F). In the present version—so as to avoid over-interpretation while diagnostics are re-estimated—age-cohort differences are summarized conservatively as rank-order salience (Table 4); full multivariate estimates will be provided upon re-estimation. a cross-sectional survey was administered to visitors of the Tehran Museum of Contemporary Art (TMoCA). Data were analyzed in SPSS.

The instrument comprised three parts: Part A (demographics and age cohort), Part B (items on exhibition architecture/components), and Part C (perceived impacts). Part A contained multiple-choice items. All attitudinal responses used a 5-point Likert scale. (1 = strongly disagree; 5 = strongly agree)

Drawing on emic/etic perspectives, perception is treated as a mental process formed by the audience. Because typical visitors are not expected to be familiar with technical theoretical constructs, a structured (closed) questionnaire was preferred [28]. Items targeted the main research question—how enigmatic architectural components (lighting, color, message flow, signs, navigation, text/scripts, labels/panels, display cases, graphics) influence audience perception across age cohorts. reliability of the instrument was evaluated using Cronbach's alpha across the nine constructs. internal consistency was acceptable. (α = 0.726; see Table 1)

Table 1. Internal consistency of the questionnaire across nine constructs (Cronbach's α = 0.726)

(Cronbach's alpha)	Number of variables (N)
0.726	9

Note. α = Cronbach's alpha; values ≥ 0.70 indicate acceptable internal consistency for exploratory studies.

Sampling and sample size. To minimize cost and time, questionnaires were distributed to a random sample of the museum's visitors (space users). The sample size (n = 373) was determined using the Krejcie & Morgan table and was distributed across the three age cohorts with gender balance by clusters.

5. Study area

Tehran Museum of Contemporary Arts is located on the north side of Keshavarz Boulevard and west of Laleh Park, and it started its cultural and artistic activity in 1977. In a land of 2000 square meters and surrounded by a green and beautiful space known as the sculpture park with valuable statues of famous contemporary artists of Iran and the world, the museum building is a combination of modern and traditional architecture inspired by the windbreaks of the desert regions of Iran. it was made. The

museum is a systemized collection of various administrative departments, an audio-visual library, exhibition services, etc. The design and architecture of this building was done by Kamran Diba. The vestibule, square, passage, and passage are among the eye-catching elements that make the art-loving visitors think about the art and culture of Iran. The contemporary art museum is the center of important activities and events. Iran's art is considered in the field of visual arts. The museum gallery is the venue for various art exhibitions. During the establishment of each exhibition, one or two galleries are also dedicated to displaying the treasures of the great artists of the world. beautiful and valuable statues of contemporary artists such as Henry Moore, Alberto Giacometti, and Parviz Tanavoli have turned the surrounding greenery into a sculpture park. The viewer takes a circular path around the main space of the museum and after viewing the galleries, he reaches the vestibule. In the vestibule, a beautiful and innovative work of material and thought made of oil and steel by the Japanese artist Noriyuki Haraguchi is displayed. The permanent collection of the Tehran Museum of Contemporary Arts consists of nearly 3000 valuable and unique works that belong to the elites of the visual arts of Iran and the world yesterday and today and are owned by the museum. Works of renowned artists such as Renoir Lautrec, Gauguin, Picasso, Max Ernst, and Magritte are among them. A spectacular collection of English and American pop and photorealist artists, as well as spectacular abstract works by Jackson Pollock, Klein, and Swayze, are included in the more modern works group. Tehran Museum of Contemporary Art also has works by Bacon, Hockney, Kitaj, Du Bofe, and Jansen. the case-study site is shown in Figure 3.

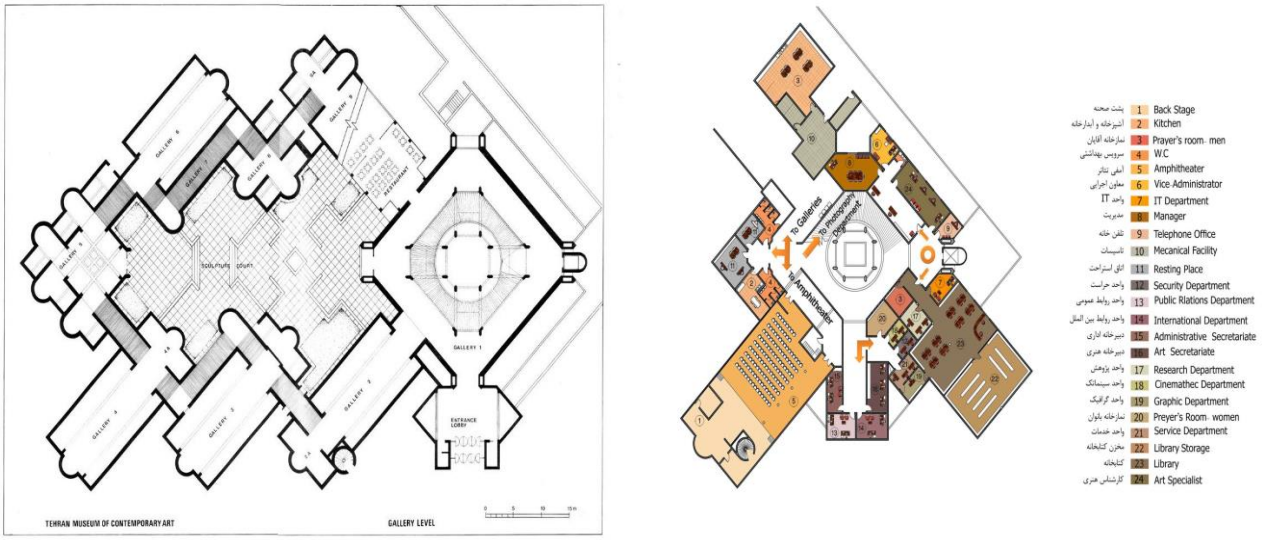


Figure 3. Study area

6. Results

Results are reported by age cohort, with explicit cross-references to Tables 2–4 and Figures 1–4. a qualitative visual audit of interior features is summarized in Table 2. A scoping visual audit provided the qualitative baseline for interpreting interior features and signage (Tables 2–3), while age-specific patterns were summarized using a conservative rank-order approach (Table 4).

Relying on the principles of space creation and basic knowledge to understand the interior space in museums, the researcher has examined the visual examples of the interior space of the Tehran Museum of Contemporary Art and, while enumerating the general characteristics of the interior environment of this museum, has explained the visual characteristics in it.

These indicators are based on McQuail's ideas about the quality and quality of the interior spaces of museums, as well as the field investigation of the interior spaces of the sample research museum, and they are descriptive in nature.

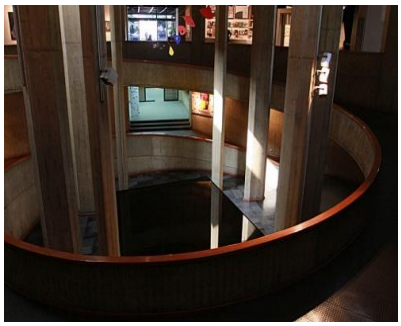
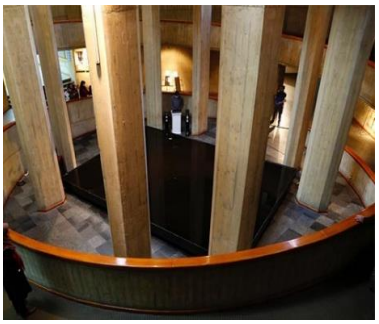
The interior of the Tehran Museum of Contemporary Art has been examined in terms of interior graphics. In the following, based on the analytical review of the background of the research as well as its compilation and development by the researcher, from the examination of the signs and images of the audience guide used in the Museum of Contemporary Arts, the findings of the following table were obtained and the quality of the effect of different types of internal guides of the museum on Different age groups of visitors of this museum were counted. Age-specific issues in signage and guide maps are detailed in Table 3.

6.1. Investigating and analyzing the level of mystery in the interior of Tehran Museum of Contemporary Arts

To check the analysis of how and the degree of enigmatic interior space in the Tehran Museum of Contemporary Arts, the different spaces of this museum can be studied independently and separately for each space. However, the present research considers only the spaces of the museum where the audience spends more time in those spaces.

Therefore, spaces such as administrative departments, warehouses, tanks, etc. have not been investigated.

Table2. Visual audit of architectural features at TMoCA (qualitative observations)

• More attention to space geometry in combining architecture with environmental graphics • Not paying attention to the user and displaying the information of the departments, minimal use of environmental graphics	• More attention to space geometry in combining architecture with environmental graphics • Not paying attention to the user and displaying the information of the departments • Minimal use of environmental graphics	• Excessive simplicity and lack of attention • Necessary for visual beauty • Failure to place 3D works in a specific and appropriate place • Improper arrangement of two-dimensional works in the horizontal direction
		
• Excessive simplicity; limited visual appealImproper arrangement of two-dimensional works in the horizontal direction • Artificial and spot lighting suitable for the space	• Excessive simplicity and lack of attention to visual beauty • Failure to place 3D works, stands and furniture in a specific and appropriate place • Improper arrangement of two-dimensional works in the horizontal direction	• Paying more attention to the geometry of space in combining architecture with the environmental graphics of the departments' information • Lack of attention to the user and display • Minimal use of environmental graphics
		
• Excessive simplicity and lack of attention to visual beauty • Failure to place 3D works, stands and furniture in a specific and appropriate place • Improper arrangement of two-dimensional works in the horizontal direction • More attention to space geometry in combining architecture with environmental graphics	• Excessive simplicity and lack of attention to visual beauty • Improper arrangement of two-dimensional works in the horizontal direction • Lack of lighting suitable for the space • Excessive simplicity and lack of attention to visual beauty • Improper arrangement of two-dimensional works in the horizontal direction	• Excessive simplicity and lack of attention to visual beauty • Failure to place 3D works in a specific and appropriate place • Improper arrangement of two-dimensional works in the horizontal direction • Artificial and spot lighting suitable for the space • Choosing and arranging the right color of the artificial light source

Note. Bulleted items summarize field observations of display arrangement, lighting, environmental graphics, and user information presentation within galleries.

Table 3. Signage and guide-map evaluation by age group at TMoCA

Age category	Guide maps	Directional signs	Visual signs	written signs
20-40 Years Old	• Lack of appeal to the age group • Lack of visual guide maps • Not paying attention to the user and displaying the information of the departments	• Not consistently located at decision points • Human scale mostly observed • Insufficient youth-oriented cues	• Unclear/vague iconography • Not aligned with vision/ergonomic standards • Unpredictable placement across rooms • Less attraction for young people •	• Overly simple; low aesthetic appeal • Low attraction to younger visitors • Lack of legibility • Having an acceptable standard for reading • Pay less attention to punctuation
40-60 Years Old	• Absence and installation of necessary maps • Absence of separate guide maps • Not paying attention to the user and displaying the information of the departments	• Not being placed in a certain and appropriate place • Relative observance of proportions and scale • Failure to create enough attraction for middle-aged people	• The unpredictability of the sign installation location • Less attraction for middle aged people • Failure to pay attention to the observer's vision standards	• Necessary attention to written signs • Having an acceptable standard for reading • Excessive simplicity and lack of attention to beauty
60-80 Years Old	• Absence and installation of necessary maps • Absence of separate guide maps • Not paying attention to the user and displaying the information of the departments	• Not being placed in a certain and appropriate place • Relative observance of proportions and scale • Lack of attraction for the elderly	• The unpredictability of the sign installation location • Less attraction for the elderly • Failure to pay attention to the observer's vision standards	• Adequate attention to written signs • Having an acceptable standard for reading • Excessive simplicity and lack of attention to beauty

Note. Age groups are 20–40, 40–60, and 60–80 years. Each column reports salient issues for the respective signage type in terms of legibility, placement, and attractiveness.

Table 4. Provisional rank-order of component salience by age (based on observed response patterns at TMoCA)

Rank level	20–40 Years	40–60 Years	60–80 Years
Highest	Message flow	Text/scripts	Graphics
Next	Text/scripts; Lighting; Graphics	Lighting; Message flow; Labels/panels	Lighting; Signs; Message flow
Lower	Signs; Labels/panels; Display cases	Signs; Graphics; Display cases	Text/scripts; Labels/panels
Lowest	Navigation	Navigation	Display cases

Note. Cells list the relative salience of components within each cohort. This provisional table prioritizes conservative rank-order reporting; formal multivariate estimates (standardized β, t, p, model R^2, and VIF) can be provided after re-estimation.

For ages 20–40, message flow emerges as the most salient component, with navigation trailing other factors (see

Table 4). For ages 40–60, text/scripts stand out as the strongest feature, while navigation remains comparatively weaker (see Table 4). For ages 60–80, graphics dominate, whereas display cases show the lowest salience for this cohort (see Table 4). After determining the coefficients for each age group, pairwise fit diagrams were derived for 20–40 vs. 40–60, 20–40 vs. 60–80, and 40–60 vs. 60–80 (see Figure 4). Responses from the 20–40 and 40–60 cohorts show a relatively high correlation and can inform similar design choices, whereas both cohorts correlate weakly with responses from the 60–80 cohort.

Contrast graphics are the primary age-contingent drivers of perceived mystery at TMoCA, whereas navigation and display cases play comparatively smaller roles depending on cohort (Table 4). Prior work likewise shows that clear narrative structure improves comprehension and engagement [29], readable text segments sustain attention [30], and combined word–image graphics aid understanding [19]. Our provisional, rank-order reporting purposefully avoids over-precise statistics while model diagnostics are re-estimated, yet it aligns with the broader literature and with the two CCD studies we cite [31,32].

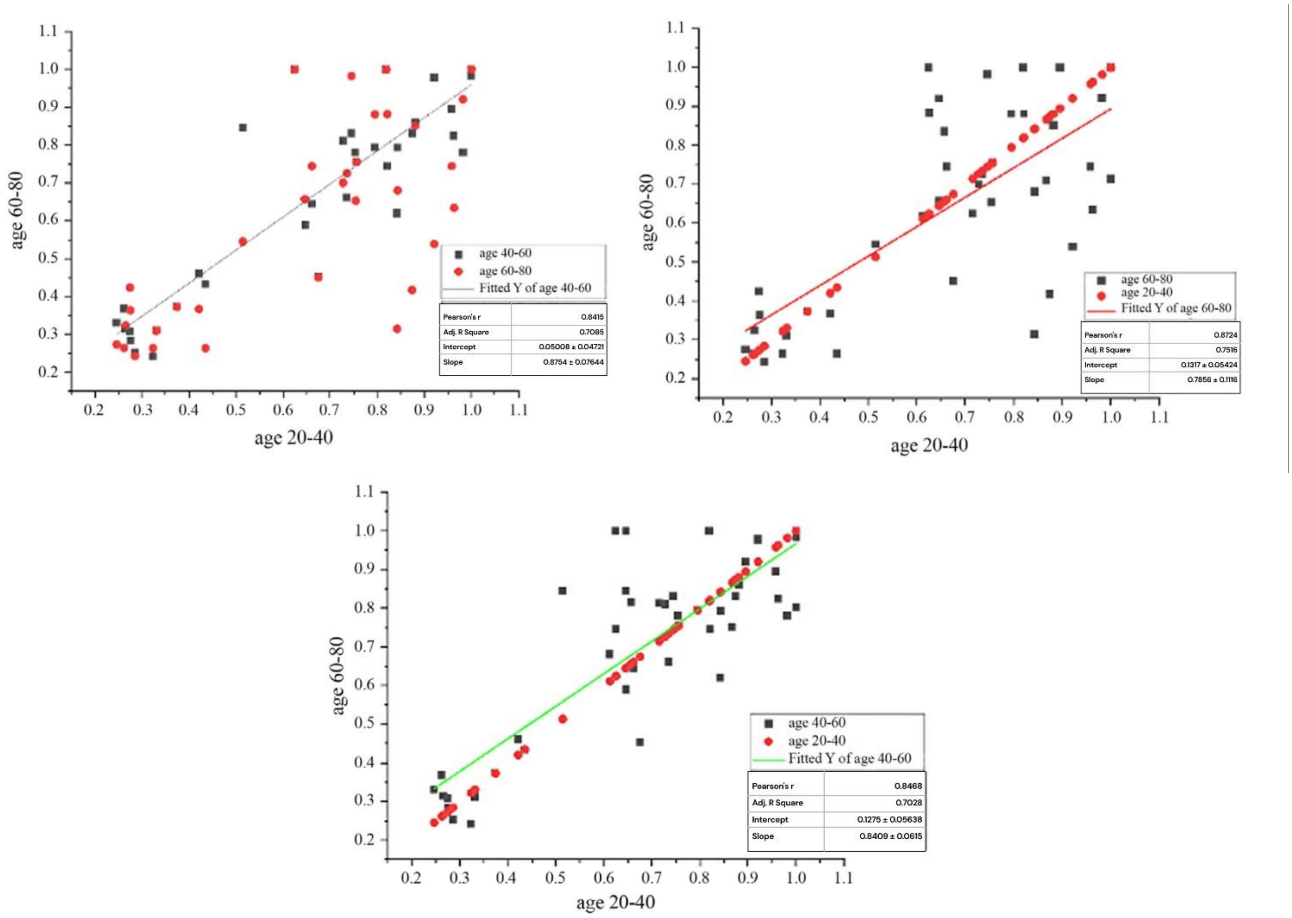


Figure 4. The fit between the mystery indices of Tehran Museum of Contemporary Art in different age groups.

7. Conclusion

This study shows that perceived "mystery" in museum interiors—and, more broadly, audience engagement with exhibitions—is age dependent at TMoCA. Among the nine enigmatic components examined, message flow contributes most for ages 20–40, text/scripts for ages 40–60, and graphics for ages 60–80, while navigation yields comparatively lower contributions across cohorts. These findings reinforce an audience-centered approach to exhibition design, aligning spatial cues with age-specific perceptual needs at TMoCA.

Practical implications:

- Ages 20–40: prioritize narrative sequencing and coherent message flow across galleries.
- Ages 40–60: provide concise, legible wall texts with minimized jargon and clear hierarchy.
- Ages 60–80: emphasize large, high-contrast graphics; reduce reliance on dense text.

Limitations and future work: The study relies on self-reported perceptions and a single-site sample; future research could validate these findings through multi-site studies, behavioral tracking, and experiments manipulating message flow, text complexity, and graphic salience.

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