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The Impact of Functional Integration Between Graphic Design and Signage Systems in Enhancing the Visitor Experience at Archaeological Sites

City "Jerash"–Jordan

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Abstract

This research aims to study the impact of functional integration between graphic design and wayfinding systems in enhancing the visitor experience within archaeological sites in the Hashemite Kingdom of Jordan, with a focus on developing a smart hybrid guidance system that combines physical signage with modern digital technologies, including QR, NFC, and smart maps, to facilitate access to information and improve the overall visitor experience.The research relied on a descriptive, analytical, and experimental approach to analyze old wayfinding systems at archaeological sites, assess their strengths and weaknesses, evaluate their compliance with international standards in wayfinding system design, and design a new interactive practical experience. The 2020 master's thesis questionnaire by researcher Mohamed Al-Afif was used to assess visitor satisfaction with the existing guidance system, which has not undergone any development to date. The results showed low to moderate satisfaction due to poor coordination between officials, designers, and implementers, lack of maintenance, and the use of materials unsuitable for the nature of the site. This data formed the basis for developing the research and designing an integrated guidance model that takes into account the needs of visitors and the historical character of the site. The study concluded that enhancing the visitor experience at archaeological sites requires an integrated guidance system that combines modern graphic design with interactive technologies such as QR Codes and NFC. This system provides clear information and accurate guidance, creating an enjoyable interactive experience that includes digital maps and visual and audio content. The adoption of uniform design standards and durable materials ensures the sustainability and efficiency of the system, while promoting collaboration between designers and officials to develop the system in line with visitor needs and contemporary technologies.

Keywords: *Environmental Graphic Design, Wayfinding Systems, Smart Guidance Systems, Jerash Archaeological City.*

Introduction

Tourism is one of the most important activities affecting the lives of peoples and countries, playing a vital role in promoting economic development, cultural exchange, and the preservation of cultural and natural heritage. Tourism in the Hashemite Kingdom of Jordan includes several types, such as cultural, environmental, therapeutic, recreational, and religious tourism.

Jordan is characterized by its diverse tourism, combining historical archaeological tourism found in several cities. We will focus on the archaeological aspect of the city of Jerash, which displays numerous Roman artifacts (Al-Khatib, 2015; Mohammad et al., 2024). In this context, this research was conducted to analyze the current signage systems in the archaeological city in the Jerash Governorate and their compliance with international signage standards and rules, ensuring that they reflect the

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cultural diversity, sophistication, and heritage of the archaeological site. A questionnaire was distributed to a sample of visitors to tourist areas in Jordan. The questionnaire measures the extent to which visitors benefit from the current signage systems at archaeological sites and proposes some solutions by designing a practical experiment for a more modern and advanced signage system.

Study Terms:

Environmental graphic design: Design that encompasses urban planning, behavior, and psychology, focusing on visual elements in the design of signage and maps. It is used in public places such as airports, museums, hospitals, and universities (Mollerup, 2005; Mohammad et al., 2025)

Wayfinding system design: This involves planning and creating wayfinding systems to help convey information clearly and effectively. It plays a vital role in guiding people through different environments by providing directions and information and identifying locations (Galindo, 2011; Shlash et al., 2025)

Wayfinding systems: These are organized units of signage that help convey directional, informational, or identarian messages in a consistent manner throughout an environment (Uebele, 2007; Mohammad, 2025)

The ancient city of Jerash: Located in northern Jordan, Jerash is considered one of the best-preserved Roman cities in the world. It features colonnaded streets, temples, theaters, and plazas, reflecting a high level of urban planning in the Roman architectural style (Al-Dahir, 2002)

Research Problem

1. Archaeological sites in Jordan face a major challenge in guiding visitors and enhancing their experience, due to the limited effectiveness of traditional wayfinding systems in terms of design, signage locations, and materials used. The scarcity of signs, their placement in inappropriate locations, and the use of materials that cannot withstand climatic conditions reduce the clarity of guidance and weaken visitor interaction with the site. With significant advances in modern technologies such as smart systems, QR codes, and NFC technologies, it is now possible to create interactive guidance systems that combine graphic design and digital technologies to enhance the visitor experience and ensure clear and sustainable guidance within archaeological sites.
2. **Dimensions of the research problem:**
    - Limited and inefficient traditional route-finding systems.
    - Sign locations that do not comply with international standards.
    - Use of materials that are unsuitable for weather conditions.
    - Lack of integration between graphic design and modern technologies.

Research Questions:

- How do traditional and smart wayfinding systems influence the visitor experience at archaeological sites in Jordan?
- What are the international standards and guidelines for designing wayfinding systems that ensure clear direction and ease of use?
- How can graphic design incorporate interactive elements such as QR codes and NFC technologies to improve the effectiveness of wayfinding systems?
- What is the role of the materials used in wayfinding systems in terms of their resistance to weather conditions and support for the continuity of interactive systems?

Research Objectives:

- Explore the impact of integrating graphic design with smart digital systems, such as QR codes and NFC technologies, on enhancing the visitor experience at archaeological sites in Jordan.
- Analyze the role of graphic design in improving the clarity and effectiveness of traditional and modern wayfinding systems and their impact on visitor interaction with the site.
- Evaluate the extent to which visitors benefit from current guidance systems and measure their satisfaction with the guidance and orientation experience within archaeological sites.

- Propose a practical, advanced model for a wayfinding system that integrates graphic design and modern technologies, with the aim of providing an interactive, effective, and sustainable visitor experience.

Research Significance:

- Developing a wayfinding system within archaeological sites to make it more effective and interactive by integrating graphic design with modern technologies such as smart systems, QR codes, and NFC, thereby facilitating visitor guidance and enhancing their experience during the visit.
- Identifying current problems in existing guidance systems and providing innovative design and research solutions that ensure clear guidance, durable materials, and sustainable systems, thereby contributing to an overall improvement in the visitor experience.

Research Hypotheses:

- The thoughtful use of graphic design in wayfinding systems contributes to the clarity of information provided to visitors, facilitating their navigation within archaeological sites and making their experience more organized and seamless.
- The integration of carefully considered visual elements—such as colors, fonts, and symbols—with modern interactive technologies such as QR codes and NFC technologies creates a more interactive and satisfying visitor experience, reducing confusion while navigating and providing innovative and easy-to-use guidance.
- The integration of professional graphic design with modern digital systems results in a comprehensive guidance system that provides visitors with a fully interactive experience while ensuring the system's continued effectiveness and sustainability in various environmental and field conditions.

Research Boundaries:

- Subjectivity: The study focuses on wayfinding systems at archaeological sites in Jordan from an integrated graphic design perspective, including traditional signs and maps, as well as interactive technologies such as QR codes and NFC.
- Temporality: The study spans from 2020 — based on the original master's thesis — to 2025, covering data collection, development, and analysis.
- Spatial: The sample is limited to visitors to archaeological sites in the Hashemite Kingdom of Jordan, with a particular focus on visitors to the ancient city of Jerash as a practical site for applying the proposed model.

Research Methodology

The research relied on descriptive, analytical, and experimental methods to analyze old wayfinding systems at archaeological sites, evaluate their strengths and weaknesses, assess their compliance with international standards in wayfinding system design, and design a new interactive practical experience.

The Theoretical Framework:

Tourism differs from exploration in that tourists follow a “well-trodden path” and take advantage of the guidance systems available at archaeological and tourist sites, as all of these types require a good guidance system that allows tourists to reach their intended destination as quickly as possible (Al-Daaja, 2019.(

- Design helps organize and transform our physical world and change how we interact with it, because it is more than just aesthetics; it primarily influences the decision-making process of the traveler. At the beginning of the decision-making process, visitors or travelers are often confused when arriving at a “new” building due to the simple fact that they do not have sufficient knowledge of their destination, which makes them feel lost as users .

Environmental Graphic Design:

In our modern world, urban life has become complex due to giant transportation systems and large vehicle streets surrounding huge complex buildings. When we consider the population or visitors to a place, we notice that they are multicultural. Without good environmental design, living in an urban environment becomes very difficult .

Environmental graphic design is design that focuses on visual aspects, such as wayfinding, exhibition design, entertainment, and information design to enhance the overall sense of place. The relationship between art and science can also begin through the use of signs, symbols, maps, sculptures, installations, lights, walkways, and all architectural and graphic elements. (Calori & Vanden-Eynden, 2015)

The new term “environmental graphic design” has been developed to refer to the integration of architectural design and graphic design, and that all design disciplines must be interconnected and complementary to produce good environmental design work. Graphic communication design should not be merely a meaningless composition and design of space or spaces, as wayfinding design must be integrated (SEGD, 2015) .

All elements in environmental graphic design are visual and/or linguistic representations used for human communication, and human behavior resulting from the interpretation of signals attempts to understand them. Graphic signs consist of verbal elements (letters, words, spoken and written messages) and non-verbal elements (colors, shapes, and font styles). During the conceptual and graphic design process, these elements are deliberately combined to form signs that influence the audience's experience (PNRPC. 2014)

Route Finding Systems:

Design, wayfinding and environment：

Good design helps people find their way and makes it easier for them to get around, increases satisfaction, reduces confusion when navigating complex spaces, and also reduces employee errors, saving time and money and preventing accidents. An individual's ability to find their way, enter and exit a building with ease and convenience is the primary goal of wayfinding. (Borges & Silva, 2015).

Design plays a big part in creating solutions that help wayfinding systems be clear and super effective. Landmarks and mental maps can be created using all the senses, not just sight, to create a powerful and highly effective “signal.” (Chang, 2013).

The subtle connotations of colors, as part of our daily experience, are used to help us understand and navigate space with ease. Understanding the characteristics of color, how people perceive it, and how they interact with each other is the primary goal of the designer. (Steinfeld & Maisel, 2012).

Navigation occurs in environments whose visual and structural characteristics affect the ease of route determination. Terrestrial environments differ in type from other environments, such as maritime and aerial environments. As environments differ, so does route determination information, such as that provided by maps and verbal descriptions‹. (Carpman & Grant, 2002).

Although this distinction is not perfect, some useful generalizations can be made to help with finding one's way. Built environments contain more “regular” patterns, such as straight lines and right angles, in various built environments, where the road network consists of straight lines or patterns that are symmetrical in their composition. The presence of asymmetrical shapes in regular environments gives them greater visual complexity in one respect, but at some point, this creates visual homogeneity compared to the simpler nature of built environments

The main factors affecting ease of navigation Route determination:

Structures in built environments can vary greatly in terms of color and height, or they may lack diversity to a large extent. Three key environmental factors that affect ease of orientation and route finding have been identified: differentiation, visual access, and layout complexity. (Weisman,1981) .

- The first factor: Distinctiveness is the degree to which different parts of the environment appear similar or different. Environments can be distinguished in terms of size, shape, color, architectural style, etc. In general, more distinctive environments support wayfinding because distinct parts are more recognizable and memorable. However, at some point, differentiation can reach a point where it becomes confusing.
- The second factor: Visual access helps travelers see different angles of the environment. Travelers can see their starting points, destinations, and various landmarks along the way. Clearly, greater visual access makes orientation easier.
- The third factor: Planning complexity is a heterogeneous idea that is difficult to express. More complex layouts usually make route determination more difficult. Less clear spaces, divided into different parts, are generally more complex, although the way in which the different parts are organized is crucial. Certain types of path networks are clearly more or less complex in this sense; they can determine whether a particular element is confusing or not.
- Signs can be considered a fourth environmental factor. Signs (including published maps) represent the symbolic meaning of helping to determine the route. The design and placement of signs in the environment clearly affect orientation. They should be clear and simple in design, containing sufficient information without being too numerous or complex.

1. (Display information to determine the route):

Considering that route-finding systems are a system of symbols that can be regarded as a display of information for determining desired destinations in a good and effective manner, information technologies are considered an essential element in route-finding, in the contexts of travel, transportation, and continuous route exploration. Verbal and graphic information varies, as does the ideal sensory method of presenting information. The issue of visual versus auditory information is of fundamental importance, although tactile information can also be useful, especially for travelers with visual impairments. (Burnett & Joyner 1996).

2. (Verbal Route Directions)：

Verbal directions, whether written or spoken, are the best way to provide information for finding a route, and most travelers may prefer verbal directions with different styles, as the emergence of automated systems to assist in finding routes stimulates research in this field (Allen 1997). Verbal directions should focus exclusively on distinctive landmarks. Despite cultural differences among travelers, some people prefer “route” information that focuses on describing a series of landmarks and simple turning procedures. Others may prefer some survey instructions compared to direct spatial relationships between places in the environment.

3. (Finding your way with maps):

Maps are a prime example of presenting information for navigation purposes. and there are many designs to solve negative issues in maps, such as designing understandable symbols. Maps used for navigation do not need to convey very detailed and accurate information about distances and directions, especially when using the map to navigate a limited network of routes, such as a subway system. Most travelers may only want to know the stations and stops .

For example, the distance between stops may not be very important to the traveler. However, although a subway map such as the one in (Figure 1) may not accurately depict the information, it is a graphical representation that depicts travel information more simply. One important aspect of maps used for route determination is direction. 1) may not accurately depict the information, it is a graphical representation that depicts transportation information more simply. One important aspect of maps used for route determination is their orientation (Levine & Hanley 1984).

Figure (1) shows a map of the subway system in Egypt, source: Metro website.https://files.mobilitycairo.com/cairo/master/public/fichiers/PDF/Network%20maps/20231220_CairoMetroMap.pdf

- **Systems) :(Signage**

Wayfinding systems are widely used in urban environments to help building occupants find their way around.These signs fall into two categories: wayfinding signs, which provide navigation solutions in non-emergency situations, and emergency signs, which are designed to help building occupants locate exits in emergency situations. These signs are particularly important when occupants cannot see the potential destination (exit) directly and find it difficult to determine direction due to a lack of reference points. The data conveyed by directional systems compensates for the complexity of tourists and/or when exits are not sufficiently clear, improving route-finding efficiency. (Arthur & Passini 1992).

Given the importance of providing information through wayfinding systems to facilitate route identification, there is a general lack of effectiveness in the use of this information by users. A series of experiments was recently conducted to study how visitors perceive, interpret, and use the information conveyed by emergency signs, and it was found that only 38% of people see traditional fixed emergency signs in simulated emergency situations in unfamiliar built environments. Even if the sign is directly in front of them and clearly visible, most people who seethe sign follows it and comply with it. The results indicate that emergency directional signs are less effective as aids in finding one's way, and that signs are likely to become more effective if their detectability is improved while maintaining the understandability of the directional and informational guidance they provide. (Filippidis & Galea 2006).

In order to address the problem of low detectability of traditional, static wayfinding systems, it is necessary to increase the perceptual capacity of the sign. Perceptual capacity is provided through features and elements that support people in their perception; for example, the green color of the sign helps people distinguish it from the wall. There are a number of ways to enhance the perceptibility of signs, such as increasing the size of the sign, making the sign stand out more from the background, or providing additional sensory stimuli. It is also necessary to ensure that the simplicity and clarity of the information conveyed by the sign is not unintentionally reduced by changing the design of wayfinding systems (Xie & Filippidis 2012).

The advanced design increases the discoverability of the wayfinding system by introducing illuminated and flashing wayfinding components. (Figure 2) shows the design of the standard outdoor wayfinding system. The traditional static wayfinding system is then converted to a dynamic signage system (DSS), while the size of the sign and the format of the sign information remain unchanged. The dynamic nature of the sign (i.e., the flashing cycle) is activated only during an emergency, when the alarm is triggered) .Nilsson & Frantzich 2008).

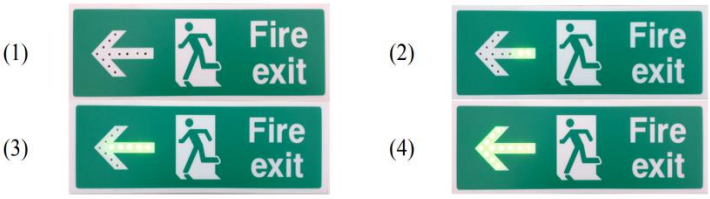

Figure (2) shows the dynamic exit sign, with the flashing arrow appearing in four stages

To clarify the difference between signs and the wayfinding system, the wayfinding system consists of a set of signs and signals that complement each other in design and share the same goal. In many cases, designers make a great effort to create a clever explanation of the symbol on the sign, so that it is consistent with human interactive capabilities towards letters, words, signs, and colors. (Chandler,2017).

Rules For Designing Route Finding Systems:

Design is an important aspect of creating and maintaining visual communication. It is not only the production of the design that must be addressed, but also the trained professional graphic designers who are well versed in all aspects of visual communication. Here are four things to consider when working on wayfinding system design:

1. **Vision location**

The size of the sign should be appropriate for the overall visible area. You will need one inch of letter height for every 10 feet of viewing distance, (As shown in Table 1), which illustrates the standard dimensions in wayfinding systems to ensure visibility, signs should be placed in locations that offer maximum exposure to the target audience. In addition, there are many forms of visual communication that are visible at night. Illuminated wayfinding systems are an ideal solution for nighttime viewing, and solutions range from electric signs and LED signs to digital displays and illuminated cabinets.

(Table 1) Shows the Standard Dimensions in Road Finding Systems to Ensure Clear Visibilityhttps://Image360.Com/Resource-Center/Design-Elements

Letter Height (Inches)	Distance For Best Impact (feet)	Maximum Readable Distance (feet)
3"	30'	100'
6"	60'	200'
9"	90'	400'
12"	120'	525'
18"	180'	750'
24"	240'	1000'
36"	360'	1500'
48"	480'	2000'
60"	600'	2500'

2. **(Readability):**

Signs should be organized in a way that easily conveys their intended message. Legible signs and graphics contain key words and phrases that are emphasized with capital letters, bolder typestyles, and additional colours. Ideas should be grouped logically and separated by layout and spacing. . Graphic elements, especially digital colour graphics, can greatly enhance the speed and comprehensiveness of communication. Signs must be legible, and the choice of font style is critical to the effectiveness of the sign ،.(Calori, 2007).

3. **(Legibility):**

The clarity of the sign depends on the type of font used to convey the desired image without losing the ability to distinguish between individual letters, as many scripts and typestyles are difficult to read when there are larger viewing distances ،.(Peters, & Murdoch,. 2014)

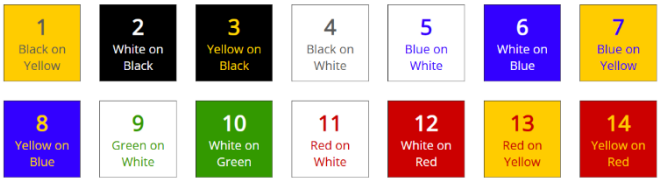

Figure (3) Represents Legibility in Wayfinding Systems.

https://image360.com/resource-center/design-elements

4. Color Combination Effects :

The color contrast factor improves visibility. The following are the best combinations, ranked in order of visibility from a distance, as shown in Figure (4) .

Figure (4) Illustrates the Effect of Color Combinations.

https://image360.com/resource-center/design-elements

5. Ability to observe:

The sign should include some design elements that will help it stand out clearly in the natural landscape. Contrasting colors, variable components, and movement can make the sign more visible. If there is little contrast in colors, the differences can be enhanced with an external shadow or drop shadow.

6. NFC technology in enhancing the visitor experience:

Electronic accessibility and visitor interaction through Near Field Communication (NFC) technology allows a small chip to be embedded in signs or information boards, enabling visitors – simply by tapping a compatible smartphone – to instantly access rich digital content such as historical information, photos, maps, or even audio and video tours. This technology enhances the level of interaction compared to traditional static signs and gives visitors a more in-depth and personalized experience, as they can choose the content they want to view directly on their phone, as shown in Figure.(5) .

Figure (5) Example of NFC System Use in An Information Panel

Https://Qrlab.Com/Blog/Post/Nfc-In-Museums-And-Historical-Sites-Interactive-Tours

7. Indoor Wayfinding

In large or complex locations such as museums or archaeological sites, where GPS often does not work well indoors, NFC tags can be distributed at strategic points. When a visitor touches these tags, a navigation app updates their current location and guides them step by step to the desired destination. The NFC Internal system is a practical example of this, and has proven to be highly effective and low cost compared to traditional indoor navigation systems. (Özdenizci, Coskun, & Ok, 2015; Cai, 2015).

8. Content management and visitor behavior analysis

In addition to providing information and guidance, NFC can be used as a tool to manage dynamic content on panels, allowing content to be updated remotely via a central server. It can also collect visitor usage data such as the number of times a panel is touched, the most visited points, and the type of content that generates the most interaction. This data helps improve the distribution of panels and develop the visitor experience based on actual and accurate behavior. (Simanjuntak, Himawan, & Husaini, 2021).

Analytical Aspect：

Four models of the researcher's photography were used to analyze the reality of wayfinding systems in the ancient city of Jerash:

The archaeological sites in Jerash have attracted a large number of visitors from around the world, demonstrating the diversity and richness of the ruins found there. For this reason, it is important to provide information and directions for the guidance system available there, which serves the basic purpose of helping visitors locate the sites they wish to visit .

There are numerous problems with the design of wayfinding systems at archaeological sites in the Jerash Governorate due to a failure to comply with international wayfinding system design standards. These errors include the inappropriate distribution of wayfinding systems, their inappropriate height above the ground, the failure to use signage in a manner appropriate to the nature of the site, and the failure to use materials and raw materials that are compatible with the environment, especially since the area is exposed and subject to harsh and changing climatic conditions. It is well known that good wayfinding systems are characterized by clarity and guidance, easily and conveniently directing visitors to their desired destination and enhancing the visitor experience by connecting them to the location and facilitating the absorption and recall of information, which makes navigation easier .

A comprehensive map of all archaeological sites in the city must also be prepared. This map must include the location and names of archaeological sites and indicate each site. The following is an overview of the road finding systems in the ancient city of Jerash, which have been analyzed, and an alternative experience has been designed for them.

1. The map signs at the Jerash ruins and Figure (6) represent this type of wayfinding system:

Figure (6) The Researcher's Photograph of the Map Sign At The Jerash Archaeological Site.

Sign Analysis:

- The colors on the sign have faded and changed due to changing weather conditions.
- The height of the signs is low compared to international standards and measurements.
- There is a break in the middle of the sign, causing distraction and loss of information.
- Use of Calibri font throughout the design.
- Noticeable weakness in the sign's color scheme.

2. **Existing information signs: In the ruins of Jerash, Figure (7) represents this type of wayfinding system:**

Figure 7: The Researcher's Photograph of the Information Sign for the Site Of Sabil Al-Houriyat in the Ruins of Jerash.

Sign Analysis:

- The design was printed on ceramic, which reduces the strength and durability of the sign.
- The sign has undergone many changes, including fading in color.
- The sign is not very high above the ground and is not suitable for different age groups.
- There is significant damage to the sign, which hinders the process of restoring and repairing the information on it.
- More than one type of font is used on the same sign.

3. **Directional signs: Found in the ruins of Jerash, Figure (8) represents this type of wayfinding system:**

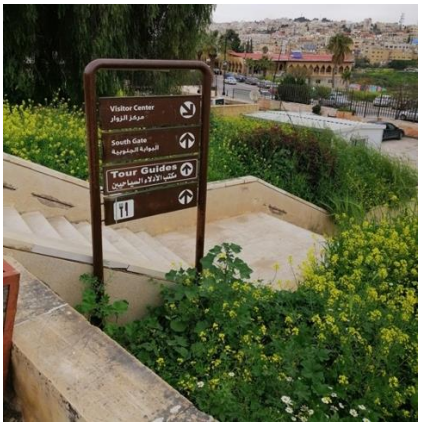

Figure (8) The Researcher's Photograph of the Direction Sign at the Jerash Archaeological Site.

Sign Analysis:

- The design was printed on non-corrosion-resistant iron panels.
- The height and location of the sign are inappropriate.
- There are differences in the design of all the elements on the sign.
- The font size is inconsistent and inappropriate.

4. dentification signs: Found in the ruins of Jerash, Figure (9) represents this type of wayfinding system :

Figure (9) The Researcher's Photograph of the Identification Sign at the Jerash Archaeological Site.

Sign Analysis:

- The design was printed on wooden boards that are not moisture resistant, as shown in the photo of the damage to the signs.
- The black print colors on the background are barely visible due to fading.
- The information is insufficient to identify the location

Practical Demonstration of the Researcher's Design:

- This research is an extension of the master's thesis presented by researcher Mohammed Al-Afif on the design of signage in the archaeological city of Jerash, with the study being developed to include an interactive and technologically advanced dimension through the proposal of a smart hybrid guidance system that combines physical signage with modern digital technologies. The study began by focusing on the shortcomings of the various types of existing wayfinding systems, which were analyzed previously. It was found that these systems throughout the ancient city of Jerash did not achieve their intended purpose and were not in line with the historical value of the site. Hence, the endeavor to improve the visitor experience while taking into account the historical uniqueness of the place and the importance of its architectural nature.

- The research was based on the results of a survey conducted in 2020, which was included in the original master's thesis, with the aim of evaluating the extent to which visitors benefited from the guidance system at that time, while introducing technical and interactive improvements aimed at enhancing the visitor experience and increasing the efficiency of the system (ALAFEEF, 2020) .

- The researcher noted that the current wayfinding system has not achieved the desired results and that the city needs a comprehensive guidance system that covers all archaeological sites in a sequential and coordinated manner. It was also found that most signs face problems such as damage caused by neglect and the use of materials unsuitable for the nature of the site, which negatively affects the functionality of the guidance system.

- The proposed system is based on four key pillars: clear and durable physical signage; the integration of interactive digital content via QR and NFC technologies; smart maps suggesting suitable itineraries for different types of visitors; and a unified visual identity in harmony with the city's historical character. The integration of augmented reality technologies also allows for 3D reconstructions of certain landmarks, enhancing visitor interaction and understanding. This system aims to facilitate wayfinding, increase information clarity, and improve visitor satisfaction, while reducing the need to touch artifacts and ensuring easy maintenance and continuous content updates.

Proposed System:

- The researcher proposes a smart hybrid wayfinding system designed specifically for the archaeological site of Jerash, which aims to address the obvious shortcomings of the current signage system (as identified by field analysis) and improve the visitor experience by combining durable physical signage with interactive digital technologies . And The system is based on four pillars:

1. Physical signs designed according to standards of legibility, clarity, and placement (letter height and viewing distances are determined according to standard tables) and made of weather-resistant materials (anodized aluminum with UV printing and protective coatings).
2. Digital communication via QR codes and NFC to access multimedia content (short texts in several languages, audio recordings, historical photos, and short videos).
3. A smart map that suggests timelines (30–60–120 minutes) and displays a customized route for seniors, families, and photographers.
4. A unified visual identity inspired by elements of Roman architecture in Jerash: a balanced color scheme, a unified Arabic/Latin font, and standardized icons.

The proposed system is expected to deliver several practical benefits:

- Increased clarity of information and ease of navigation.
- Higher overall visitor satisfaction.
- Provision of digital alternatives that reduce the need to touch artifacts.
- Improved maintainability and content updating without frequent physical changes .

The integration of augmented reality (AR) to display 3D reconstructions of certain landmarks enhances emotional and cognitive connection with the site and enriches the educational experience. The proposal is consistent with SEGD and ISO principles for signage and wayfinding, and is a model that could be applied as a guidance system at other archaeological sites.

Rules Adopted in the Design of Wayfinding Systems At Archaeological Sites:

- In conducting the practical experiment, the researcher relied on a set of principles that are considered fundamental when designing guidance systems in historically sensitive sites. These rules were chosen based on the special requirements imposed by the nature of archaeological sites, which balance functionality and aesthetics while preserving the heritage value of the site. The most important of these rules can be summarized as follows:

- **Clarity and readability:**

The researcher was keen to use simple fonts that are easy to read from different distances, choosing appropriate font sizes that allow visitors to quickly grasp the information. Care was also taken to provide clear contrast between the text and the background to improve readability in different weather conditions and natural lighting.

- **Multilingualism:**

Given the wide diversity of visitors' backgrounds, more than one language was used in the guidance texts, including the local language as well as international languages such as English and French. The wording of the texts was simplified so that they could be understood by different age and cultural groups.

- **Connection to historical identity:**

The design ensured that the signs reflected the character of the archaeological site, either through the choice of colors that harmonized with the surrounding environment or through the inclusion of visual elements such as maps and images that enhanced understanding of the historical context of the place.

- **Material selection:**

Materials that can withstand prevailing environmental conditions such as heat, humidity, sunlight, and wind were selected, while also taking into account the environmental impact by using nature-friendly materials that respect the privacy of the site.

- **Installation locations:**

The signs were placed in carefully considered locations where they can be easily seen without obstructing the view of the archaeological site or distracting attention from it. Care was taken to avoid any work that could damage the archaeological structure of the site, such as digging or installing the signs directly into the ancient floors.

- **Aesthetic harmony:**

The signage was designed in a style that harmonizes with the overall character of the site without being excessive or visually distracting. This included choosing colors, fonts, and graphic elements that fit the atmosphere of the place and support the identity of the signage system.

- **Content diversity:**

The signs included identifying information about the site and its components, as well as simplified maps to help visitors navigate. Safety instructions were also included where necessary to ensure a safe and clear visitor experience.

- **Interaction, maintenance, and updating:**

The researcher worked on enhancing the interactive aspect of the archaeological site by introducing modern technologies that make it easier for visitors to access information in a direct and simple manner. This included the use of QR codes linked to digital content that visitors can refer to during their tour, as well as the use of near field communication (NFC) technology. This technology allows information to be transferred simply by bringing a smartphone very close to the sticker, usually between 2 and 4 centimeters, without the need for visual scanning or even an internet connection.

The integration of NFC technology into signage is a practical step that contributes to providing instant content such as explanations, interactive maps, or audiovisual materials related to the location. The researcher also emphasized the need for regular maintenance of the signs, both in terms of their physical quality and through updating the associated digital information, to ensure that the signage system remains effective and keeps pace with visitor needs.

The Practical Side of the Experiment：

Figure (10) shows the QR code used in this study, which was employed in the practical experiment as an actual model illustrating the mechanism of integrating digital technologies into the signage system at archaeological sites. The use of QR codes is one of the most effective modern methods of enhancing visitor interaction, as it allows quick scanning via smartphone to directly access reliable sources of information such as the official website of Jerash Antiquities.

It also helps expand the experience to include photos, maps, and rich historical content, giving visitors a deeper understanding of the site and enhancing the quality of guidance and orientation. Thus, the QR code is a key element in the development of modern wayfinding systems within archaeological sites.

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Figure (10) QR Code for the Jerash Archaeological Site, Designed by the Researcher.

2. Map label: The researcher designed the map label as shown in Figure 11.

- Dimensions (panel): 90 × 120 cm (vertical)
- Material: 3–4 mm anodized aluminum panel + UV printing + protective coating
- Total height above ground: 200 cm
- Elements: Simple 2D map, “You are here” indicator, points of interest icons, QR, NFC device, Arabic and English languages.

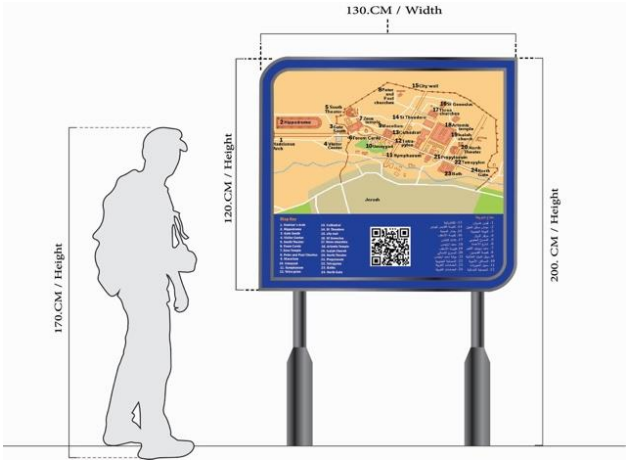

Figure (11): The Researcher's Design For A Signpost Indicating the Archaeological Sites of Jerash

3. Directional sign: Directional sign for a group of locations designed by the researcher, as shown in Figure (12)

- Single panel: 80 × 20 cm in each direction; column height 220 cm
- Material: same series (aluminum/resistant coating)
- Colors: sandy/light background and contrasting dark text
- Lighting option: small solar cell for nighttime reading.
- Content: directional symbol and location name, Arabic and English, NFC device

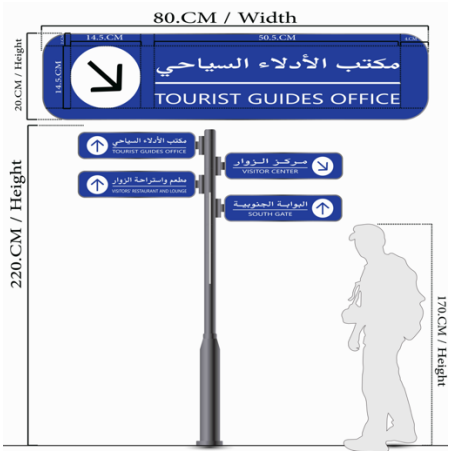

Figure (12) Shows The Researcher's Design For A Direction Sign For A Set Of Directions

4. **Information sign:** Designed by the researcher for an archaeological site (Sabeel al-Houriyat). Figure 13 shows all measurements, color codes, and font types used in the design.
    - Dimensions: 120 × 100 cm (horizontal/vertical depending on location)
    - Material: Composite panel + protective laminate
    - Content: Title, introductory paragraph (50–80 words), date, Arabic and English languages, QR code, NFC device
    - Reading height: 175 cm (for easy access.

Figure (13) Shows the Researcher's Design for An Information Sign Displaying a Range of Information About an Archaeological Site (Sabeel Al-Houriyat) In the Ruins of Jerash

5. **Warning sign:** The researcher designed samples of warning signs and observation signs, as shown in Figures (14, 15), which show all measurements, color codes, and font types used in the design.
    - Small dimensions: 30 × 40 cm
    - Fire and moisture resistant material
    - Standard icons and short phrases in Arabic and English, NFC device

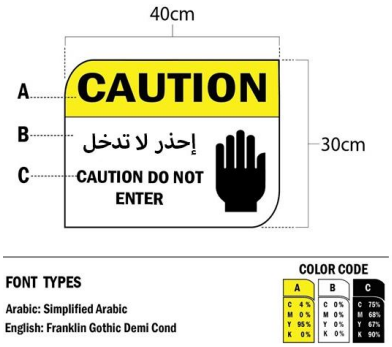

Figure (14) The Researcher's Design for Warning Signs.

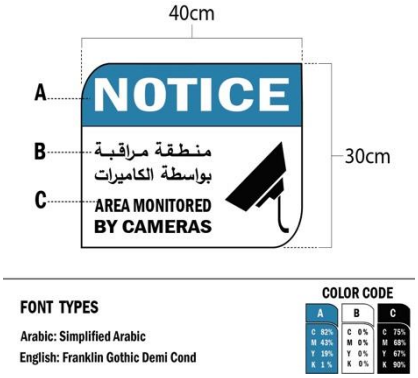

Figure (15) Shows the Researcher's Design for Observation Markers.

6. **Identification sign:** The researcher designed an identification sign for the Hellenistic Temple of Zeus, as shown in Figure (16.)

- Small dimensions: 45 × 50 cm, total height from the ground 145 cm
- Fire and moisture resistant material
- •Standard icons and short phrases in Arabic and English, NFC device

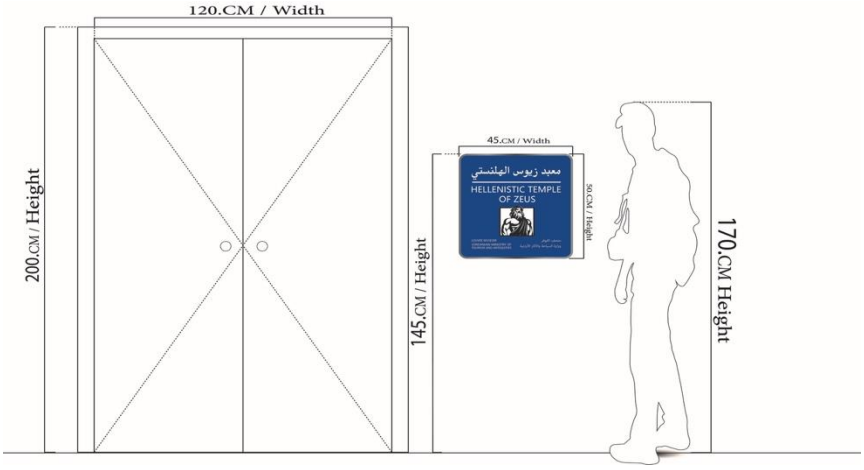

Figure (16.)Shows the Researcher's Design for An Identification Sign for The Hellenistic Temple of Zeus at the Archaeological Site of Jerash.

Final Research Results:

The researcher based this study on a questionnaire designed in a previous master's thesis to measure visitor satisfaction with traditional wayfinding systems at archaeological sites. These results were used to support and enhance the current research by incorporating modern technologies and advanced designs. The data showed that visitor ratings ranged from poor to average, reflecting the

limited effectiveness of traditional systems and their insufficient responsiveness to visitor needs. Based on this, the following conclusions were drawn:

1. Clear information and easy navigation: Integrating graphic design with modern visual elements and interactive technologies such as QR codes and NFC helps clarify information and facilitate visitor navigation within archaeological sites, making the navigation experience more accurate and effective compared to traditional systems.
2. Enhance visitor engagement: Systems integrated with digital technologies create an interactive experience that includes digital maps and visual and audio content, reducing confusion and increasing visitor satisfaction and enjoyment.
3. Improved coordination and operational efficiency: Adopting a unified design and clear standards among designers and officials raises the level of coordination and ensures more efficient management of the signage system, while maintaining its performance and suitability for visitors' needs.
4. System sustainability and quality: The use of durable materials and modern smart technologies ensures the system's ability to withstand various climatic conditions, providing a comfortable and safe experience for visitors while maintaining the system's long-term effectiveness.

Research Recommendations:

1. The researcher recommends focusing on developing an integrated guidance system that combines graphic design and modern interactive technologies such as QR Codes and NFC to enhance the clarity of information and the visitor experience within archaeological sites.
2. The researcher believes it is important to reassess the locations of signage to ensure they comply with international standards, thereby enabling visitors to navigate the site without confusion.
3. .The researcher emphasizes the importance of strengthening cooperation and coordination between designers and website administrators, while activating feedback mechanisms to develop and improve the system in line with modern technologies and visitor needs.

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