Wayfinding for Pedestrians in the Crowded Areas of Al-Hajj: How Can Wayfinding System Designs Increase the Efficiency of Wayfinding and Navigation Performances for Pedestrian Pilgrims During the Islamic Pilgrimage (Al-Hajj)

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Dedication

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Abstract

Over the years, the lack of a thoughtful and educated wayfinding system design in the areas of Al-Hajj has caused an epidemic of adverse incidents. One of the reasons for this is that the current wayfinding system design does not support the vast diversity of this multicultural event, which includes a large number of people with different backgrounds and ethnicities. The primary goal of this study is to develop a new proposed wayfinding system that will help in increasing pilgrims' performances and wayfinding experiences during the period of Al-Hajj. This goal is accomplished by examining the efficiency and design of the current wayfinding system and the new proposed wayfinding system according to design theories and guidelines, and users' preferences and recommendations.

The examination process started with a thorough analysis based on an extensive study of literature on design, wayfinding, and design theories and guidelines for both systems. Next, both designs are examined through two mixed-method approaches that included a series of qualitative and quantitative questions in the form of in-depth personal interviews and an online survey. The personal interviews involved six individuals who had experiences in performing Al-Hajj before, some of whom performed Al-Hajj more than 18 times, whereas the online survey targeted a more comprehensive and diverse group of participants, which resulted in 209 valid entries.

For each approach, both qualitative and quantitative questions are designed with specific rubrics that help in highlighting the strengths and weaknesses of each system. The qualitative questions are intended to collect user viewpoints, ideas, remarks, and recommendations concerning both systems. The answers gathered from this method are thoroughly analyzed to extract as many beneficial inputs as possible that will support the topic of the research. On the other hand, the quantitative questions are intended to assist in collecting user preferences concerning design decisions and implementations, choises of language, iconography, typefaces, colors, and other design elements. The data gathered is categorized based on the participants' completion of the survey questions, their experiences of performing Al-Hajj, and their gender. Then, a test for a difference in proportion is conducted to see how many people prefer a particular design, qualities or system over the other.

The results of the study show that the current wayfinding system is found by most interviewees, participants, and literature to be inadequate, inconsistent, and unreliable. Further, the results suggest that for many, the most used wayfinding

strategies did not include using the existing elements of the wayfinding system. On the other hand, the new proposed wayfinding system proved to be the preferable choice for the majority of users. On most occasions, the new proposed wayfinding system communicated clear messages, displayed correct, accurate, and readable information, and used universally-known elements such as symbols or numbers. Also, the new proposed wayfinding system was praised for its utilization of color and color-coding, creating landmarks-like features and multilingual support. Furthermore, the data collection methodologies resulted in a large number of beneficial suggestions that will help in improving and developing future wayfinding systems. These suggestions included introducing educational or training programs on wayfinding systems for pilgrims, developing and distributing multilingual brochures and handouts to pilgrims, introducing more pedestrian walkways and services, integrating the system with Google maps, and using tracking chips that link between pilgrims' bracelets and wayfinding elements.

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CHAPTER ONE –– INTRODUCTION

Al-Hajj (the Islamic pilgrimage) is one of the most significant annual multicultural religious events worldwide. Annually, Saudi Arabia accommodates millions of Muslims from all over the world who have diverse backgrounds and speak different languages. These pilgrims arrive at Mecca by air, sea, or land to complete the rituals of Al-Hajj within a period of six to seven days. These rituals have to be completed at specific times within specific days and cannot be performed anytime otherwise. Therefore, it is customary for pilgrims to camp in an area called Mina, which is the area where many of the rituals must be completed.

To complete the rituals of Al-Hajj, pilgrims must travel to three other areas within their stay. These areas are Muzdalifa, Arafat, and The Holy Mosque. To travel between these areas, pilgrims can take either a train, a bus, or travel by foot. To take the train, pilgrims need a special ticket issued for each pilgrim registered through an official Hajj campaign. Busses are usually used by unregistered pilgrims (such as locals and pilgrims who came on their own) or pilgrims who are not comfortable using or waiting in line to use the train. Bus tickets are cheaper and available at multiple locations. However, bus drivers usually expect the bus to be filled by passengers for it to leave. Further, busses typically get stuck in traffic, which might increase the traveling time and pressure on many pilgrims. Therefore, it is quite common to see people getting off the busses in the middle of traffic jams and continue their journey on foot. Unfortunately, these pedestrians are traveling by foot using roads that are designated for vehicular movements only, which can result in creating many problems (Reffat, 2012).

That being said, there are many walkways that are designated for pedestrians, which are highly prepared to accommodate pilgrims who choose to travel on foot from the start. Different from train and bus stations, pedestrian roads usually start from points inside each of the different areas, which makes them more convenient for many pilgrims. In 2014, 437,766 out of 2,085,238 pilgrims were registered traveling by foot, which is 20% of the total number of pilgrims (Abdulmajeed, 2014). Moreover, to travel within each area, pilgrims must travel by foot unless they cannot do so due to a particular disability. Accordingly, a well-designed and comprehensive wayfinding system must be prepared to assist pilgrims to travel efficiently and successfully within and between the areas.

Problem Statement and Statement of Purpose

Unfortunately, over the years, there have been many documented reports of various incidents of pilgrims getting lost or separated from their groups or families, or on some rare and severe occasions, getting run over by vehicles or crowds of pedestrians and killed. Many of these incidents might occur due to the deficiencies in the wayfinding system available to assist pilgrims in finding their way. These assumptions are based on the experience of friends and family members who performed Al-Hajj before and experienced the wayfinding system themselves. Moreover, many news reports and social media outlets assisted in recording some of the general public views and problems that had occurred throughout the years. Further, having the opportunity to visit the areas of Al-Hajj personally during the preparation period of the 2017 Al-Hajj season, which helped in understanding and documenting some of the deficiencies of the current wayfinding system elements used there.

According to most of these sources, one of the leading problems of the current wayfinding system is that it is not reliable and cannot function independently. Therefore, most people are obligated to use the assistance of personal guides to navigate the areas and find their way. This led to the assumption that there is a lack of consistency and universality to the current system, which might have resulted in an inefficient system that most pilgrims do not find beneficial.

Accordingly, the primary goal of this study is to develop a proposal for a new unified and comprehensive wayfinding system that pilgrims can rely on and use independently during their journey of Al-Hajj without the consistent need for additional guidance. The purpose of the new proposed wayfinding system is to operate as a universal communication system that will assist in facilitating and highlighting the commonalities among the different cultural groups to make their experience throughout their journey more efficient, comfortable, and successful.

Another important goal of the study is to evaluate and examine the current wayfinding system based on design theories and principles and user preferences. This will help in documenting the efficiencies and deficiencies of the current wayfinding system and will assist in improving and designing future wayfinding systems that respect design theories and user preferences.

Research Questions and Hypotheses

Primary Questions

1. *Can the current wayfinding system of Al-Hajj help people find their way efficiently and successfully without the constant need for additional help?*

The hypothesis stated for this question is, no, the current wayfinding system cannot work on its own, nor can it help people efficiently and successfully. Also, it is highly dependent on other guides, security guards, and locals.

2. *Will the use of a new well-designed, and unified wayfinding system help pilgrims to efficiently and successfully find their way throughout the journey of Al-Hajj without the constant need for additional help?*

The hypothesis stated for this question is, yes, a well-designed and unified wayfinding system will help pilgrims to efficiently and successfully find their way independently without the persistent need for additional guidance.

Supporting Questions

Additional to the primary questions presented, the following questions will help in supporting the design and research processes of wayfinding for crowded areas in general. These questions are:

3. *Is the current wayfinding system used in Al-Hajj inconsistent and lacks in design quality?*

The hypothesis stated that, yes, it is inconsistent and lacks in design quality.

4. *Are the icons and symbols used in the current wayfinding system universal enough for pilgrims to understand?*

The hypothesis stated that, no, the icons and symbols used are not universal.

5. *Will pilgrims benefit from using color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags, bracelets, accessories, etc., to help in easily identifying specific camps and services?*

The hypothesis stated that, yes, pilgrims will benefit from using color-coding in various Al-Hajj services.

6. *Can previous training on wayfinding systems minimize people getting lost during their journey in Al-Hajj?*

The hypothesis stated for this question is, yes, previous training can help in minimizing problems of wayfinding for pilgrims.

Approach and Methodology

First, to test the research questions and hypotheses, the current wayfinding system is thoroughly analyzed based on a set of rules and guidelines developed from an extensive literature study. This thorough analysis is conducted on a selected group of personally collected images of some of the elements of the current wayfinding system in Al-Hajj. Moreover, the rules and guidelines used to analyze the current wayfinding systems are also used to develop and design the new proposed wayfinding system.

After the analysis of the current wayfinding system and the design of the new proposed wayfinding system, both systems will be compared and examined through a mixed-methodology approach that consists of personal interviews and an online survey. This approach goal is to collect users' preferences data regarding wayfinding system designs, which will help in developing new and future systems. Further explanation of the research approach and methodology are presented in the upcoming chapters.

Significance

Throughout the literature reviewed to conduct this study, there was little academic research on wayfinding systems in multicultural and crowded areas. Further, the literature on wayfinding systems in the crowded areas of Al-Hajj is almost nonexistent. Accordingly, this study intends to benefit the fields of wayfinding and environmental graphics by providing excellent references that are proven and examined academically. Further, the study will help in gathering data on users' preferences regarding wayfinding systems in crowded multicultural areas. This will assist the authorities of Al-Hajj to understand the various user groups of pilgrims and improve their experiences through wayfinding system designs along with other services.

Additionally, providing a new wayfinding system that pilgrims can use without the constant need for additional guidance will not only be beneficial to pilgrims but will also help the authorities in focusing their efforts to deal with more persistent matters. More importantly, the new proposal intends to blend with current and future services and implementations in Al-Hajj to help in creating a coherent and unified designed system of services that will help pilgrims throughout the upcoming years. This new well-designed and unified proposed wayfinding system will provide an elegant and professional look that will help in tying all the other services together.

Role of the Researcher

As an academic and designer with a background in both graphic design and architecture, I believe that the field of environmental graphics represented by wayfinding systems needs further research and development. Accordingly, one of my goals is to learn and understand what this area of study needs and try to help in filling in the gaps. This is achieved by a constant research for new developments and academic work done by scholars and professionals in the field. Also, it must be accompanied by conducting research and design projects to help in developing my set of skills and capabilities in this area of study.

More importantly, I believe my role in conducting this study and designing a new wayfinding system for Al-Hajj is one of the biggest challenges and achievements in my life that hopefully will help pilgrims from all over the world. Further, hopefully, this study will be presented to the authorities of Al-Hajj for future developments and implementations.

In this study, I will be examining how the design of wayfinding systems can affect people's wayfinding efficiency during their journey during Al-Hajj. My role will be visible through the following points:

- Gathering the necessary academic evidence and resources on the topic of wayfinding and other related topics to build a solid ground for this research.
- Applying the knowledge obtained on the different processes of research, analysis, design, and data collection.
- Conducting an academic examination of the current wayfinding system and the new proposed wayfinding system designs.
- Thoroughly analyzing the necessary data that is gathered throughout this research to test my hypotheses and my design.
- Developing design improvements and recommendations for future research and design projects.

Document Organization

The structure of this thesis consists of six chapters: introduction, literature review, methodology, results, discussion, and conclusion. The first chapter includes the introduction to my topic, which consists of general background information on the subject of Al-Hajj, the problem statement, the purpose of the study, and the research questions

and assumptions. The chapter concludes by mentioning an overview of the methodology used, the research significance, and my role as a researcher.

The second chapter introduces the literature review regarding the research topic. The first section of the chapter presents the concept of wayfinding, its definition, processes, techniques and styles, and its different elements. The second section includes information regarding Al-Hajj (the Islamic pilgrimage) and some of the related statistics and studies regarding the topic. The third section will address some of the challenges regarding wayfinding and disorientation in crowded areas in general and specifically during Al-Hajj. The fourth section introduces the design theories and principles used to guide the design and the analysis of the study. The fifth section exhibits some of the recommendations for designing wayfinding elements in crowded areas. Lastly, the chapter concludes by introducing the conceptual framework and the research questions.

Chapter three introduces the methodology used to conduct the study. The chapter includes the study design, setting, content, data collection methodology, data analysis procedures, and issues of validity and reliability. The chapter concludes by mentioning some of the limitations and challenges of the study.

Chapter four introduces the raw results obtained through the mixed-methodology approaches, whereas chapter five introduces an in-depth look at the data gathered. The findings from the data collection methods are discussed with respect to what the literature suggests regarding similar findings. Also, the discussion in this chapter provides answers to the research questions presented earlier and some design recommendations.

The final chapter, chapter six, is the conclusion of the study. The chapter consists of a summary of the other chapters, along with the concluded outcomes of the study. Then, the chapter presents some suggestions and design recommendations for the final wayfinding system proposed by the study. Finally, the chapter will conclude by introducing some suggestions to other research and design projects in the future.

CHAPTER TWO — LITERATURE REVIEW

One of the main goals of this research is to investigate the topic of human wayfinding in general and how people manage to find and orient themselves in familiar and unfamiliar environments. Further, this research is interested in social wayfinding behaviors, and systems in crowded areas, specifically the areas of Al-Hajj, which contain numerous variables and various user groups. Consequently, designing wayfinding systems and managing people within these areas is considered very challenging. Therefore, to start this literature investigation and build a broad idea of the main topics, some general terms and keywords were used. These keywords included the terms “wayfinding systems,” “wayfinding systems in crowded areas,” “environmental graphics,” “urban graphics,” “designing for crowded areas,” “designing for multicultural areas,” “universal design,” and many others. Then, to focus the research, more specific and topic-related keywords were used, such as “wayfinding in Al-Hajj,” “pilgrimage wayfinding systems,” and “the Islamic pilgrimage.” Also, the literature review included various academic studies and specialized books, as well.

The literature review presented is categorized into five main areas. The first area discusses the general topic of wayfinding, its definition, process, techniques, and styles. The second area focuses on matters related to Al-Hajj and the different rituals and practices that pilgrims do. Further, this area includes some of the latest statistics concerning pilgrims and Al-Hajj, which will help in understanding the users and will assist the designing process for such vast areas. The third area discusses several wayfinding and disorientation challenges in crowded areas. These challenges are discussed with respect to crowded areas in general and to Al-Hajj areas in specific. The fourth area of investigation is focusing on the general theories and principles of design that can be applied to the design of wayfinding systems. Lastly, the fifth area reviews some of the recommendations and standards for designing wayfinding elements and systems for crowded areas.

As a conclusion of this chapter of the literature investigation, a conceptual framework for human wayfinding is developed. Further, the literature inspired some potential areas and questions that are worth exploring and answering. Both the conceptual framework and questions will be further explored and tested in the methodology chapter.

The Topic of Human Wayfinding

"Wayfinding" is a term first introduced by architect Kevin Lynch in his book "the image of the city," published in 1979. Lynch used the term "wayfinding" to refer to signs, landmarks, paths, nods, street names and numbers, and other environmental cues and entities used to help people navigate and find their way (Lynch, 1979). In 1981, Passini used the term wayfinding to describe reaching a giving destination through successful environmental problem-solving (Passini, 1981, p. 22). To solve such problems, the wayfinding process must go through specific decision-making mechanisms. According to their collaborative work, Arthur and Passini (1992) suggest that these wayfinding decisions are composed of two main parts: human behavior, and an environmental entity. The behavior part deals with the physical and mental activities that a human might do, such as turning, searching for information, and perceiving specific information. The environmental entity, which refers to the wayfinding system according to Arthur and Passini, contains the information that a human receives through the environment, such as a street sign, a pathway, or a specific landmark (Arthur & Passini, 1992, p. 31). This indicates that this process will be different amongst different humans and different environments and systems.

However, it is impossible to design various systems that can satisfy everyone. Although we cannot control the group of people who use a specific environment, we can control the wayfinding system that they are using to find their way in that environment. Therefore, the wayfinding system must serve a diverse group of people by guiding them through the same environment using similar means of communication (Gibson & Pullman, 2009, p.46). Additionally, the wayfinding system must provide users with information on where they are, where their destination is, and how to read and follow the best cues to reach their goal. Moreover, a successful wayfinding system must provide users with the necessary signals to be able to know that they have arrived at their desired destination. Finally, the system must provide users with essential information for them to be able to go back from where they have started (Imani & Tabaeian, 2012, p. 54).

The Process of Wayfinding

The wayfinding process that most humans will go through is relatively similar. Wayfinding is a problem-solving process that requires finding solutions and making decisions depending on the user's cognitive abilities and specific environmental cues.

Arthur and Passini suggest that the wayfinding process for most humans will go through three phases: the perception and processing phase, the planning and decision-making phase, and the action and execution phase. However, they explain that these phases might not occur in order; i.e., someone might execute a decision before receiving the necessary environmental information or adopting a decision plan depending on their previous experiences of decision making or wayfinding (Arthur, & Passini, 1992). These phases depend on the individual differences between the users and the environment.

In his work, Allen suggests that there are three main wayfinding tasks that people utilize: navigating through a familiar environment, going on an exploratory journey, or commuting to new and unfamiliar environments and destinations. (Allen, 1999, p.50). That being said, some of these tasks might be easier than the others (i.e., navigating a familiar environment vs. an unfamiliar one). However, these tasks must undergo the three phases of processing suggested by Arthur and Passini earlier. The literature further supports this point by indicating that wayfinding tasks must require cognitive processing, decision making and planning, and executable actions (whether physical or mental) (Wiener, Büchner, & Hölscher, 2009, p. 154).

Wayfinding Techniques and Styles

Allen further illustrates that during commuting, people tend to use specific techniques to find their way. These techniques vary depending on how complex the wayfinding task is, or how well-trained or experienced are the users in finding their way. These wayfinding techniques are (Allen, 1999, p.48-51):

1. **Oriented search** is following a specific direction, such as heading east or west, to reach the desired destination.
2. **Following a trail** is the task of tracing a marked track or a path either physically or virtually (such as GPS navigation). This technique is widely used in healthcare facilities and sometimes in airports and highways.
3. **Landmark-based piloting** is navigating or commuting by depending on well-known physical elements (landmarks) visible in the surroundings.
4. **Habitual locomotion** is the act of following a familiar route to reach a previously known destination, such as commuting between home, school, and work following the same route every time. This technique often leads to going back and forth without paying much attention to the surrounding environment.
   As Arthur and Passini mentioned, following a familiar route is switching the mind

to focus on decision execution rather than decision making (Arthur, & Passini, 1992, p. 28).

5. **Path integration** is navigating through the assistance of the environmental sources surrounding the user to find the way. For example, using the smell of food to locate the food court or a restaurant in a shoppingmall, or using stars locations to locate the north.
6. **Cognitive mapping** is the technique of building an internal relational map inside the mind that is a representation of what the real world looks like. Each person's cognitive map is different, and it is a combination of the knowledge and other techniques a user might have.

That being said, each user can use one or more wayfinding techniques at the same time. The wayfinding system design and designer can only suggest specific techniques for users to use. For example, a colored path in a healthcare facility might indicate that the user should use the "following a path" technique. However, a physician who is familiar with space might use the "habitual locomotion" technique since he visits the place more often than a first-time user.

On the other hand, wayfinding styles depend on the users' abilities and experiences that will help in finding their way and destination. According to literature, there are two main human wayfinding styles: the linear or the route perspective style, and the spatial or the survey perspective style (Passini, 1981, Hund, Schmettow, & Noordzij, 2012, & Allen, 1999). If the user relies on following a sequence of wayfinding elements such as signs to know their way, then they are plausibly using the linear or the route perspective style. However, if they rely on their understanding of the environmental elements visible in their surroundings as a whole, then they are believably using the spatial or the survey perspective style (Passini, 1981, p. 25-28). Both styles are necessary for a successful wayfinding problem-solving task. A route perspective will result in an effective wayfinding task and process, while a survey perspective will give the user a sense of orientation and a sense of direction. Further, these styles are explicitly related to the users' cognitive mapping capabilities and representation, and the users' expertise in problem-solving using environmental contextual elements (Passini, 1981, p. 25-28 & Allen, 1999, p. 72).

Cognitive Mapping and Wayfinding

As mentioned earlier, wayfinding is a process that depends on the users' cognitive abilities and specific environmental cues. Sometimes, we need to follow a detailed plan to be able to execute specific decisions. At other times we can act based on a previously stored plan in our minds that depends on our past experiences and skills. Further, even when we are following a detailed plan, we will use our previously-stored experiences to read them. In the wayfinding process, we use both processes simultaneously to build what is called by scientists a cognitive map.

A cognitive map, or cognitive mapping, is the product of the mental process of learning, storing, and using the information regarding a spatial organization (Kitchin, 2015, p. 79). Although the term "mapping" might suggest that the information is stored as a real-world map, however, this is not always the case. The term is used to explain how humans navigate spatial information in their heads before the process of decision making. (Kitchin, 2015, p. 79).

Additionally, cognitive mapping is an individual process that is different among humans. This indicates that cognitive mapping is an ability that everyone is using. However, since cognitive maps depend on individual abilities and experiences, the construction of these maps will vary between people, and each individual has a unique way of organizing their cognitive maps.

Elements of Wayfinding Systems

Reflecting on what was discussed earlier, it is safe to say that the human mind cannot build a perfect image of the information received from a complex spatial organization. Therefore, spatial and wayfinding system designers must allow for their designs to send a wide range of information that can be received by various groups of users and can be compatible with multiple experiences and skills. In his work, Weisman indicates four major elements that constitute a successful wayfinding system which users rely on when they want to find their way (Weisman, 1981, O'Neill, 1991, & Zimring, 1982):

- **Signs** are elements that send directional, identification, or cautionary information to users.
- **Visual and perceptual access** are portals to perceive spatial and environmental details, such as landmarks, landscapes, or structures, through architectural elements, such as windows or spaces between building blocks.

- **Visual and architectural differentiation** is the variations between the spatial and environmental elements that will help the users to recognize one architectural structure from another.
- **Plan legibility and layout configuration** is the level of complexity of the floorplan of a spatial organization. Weisman indicated that during the wayfinding process, users are mostly influenced by the plan legibility and configuration of a space (Weisman, 1981, & Zimring, 1982).
- Golledge added **choice or decision points** as a sub-element to the plan legibility and configuration element. Decision points refer to the places in a spatial organization, which users are most likely to stop at and look for more information to help them in making their next decision (Golledge, Smith, Pellegrino, Doherty, & Marshall, 1985).

Although each user has a preference that is different from others and might develop different decisions when following the same wayfinding system, Arthur and Passini indicate that each wayfinding system element could influence various users to execute similar decision plans.

Additionally, wayfinding systems designers must provide users with the necessary information to help them in the process of problem-solving to find their way (Arthur, & Passini, 1992, p. 49). This indicates that for each wayfinding project, there must be some constant universal elements along with some unique and specific characteristics that respect the environmental and spatial configuration and its users.

Al-Hajj (The Islamic Pilgrimage)

This section is dedicated to the topic of Al-Hajj (the Islamic Pilgrimage). It will cover some definitions of terms, the main rites of Al-Hajj, and some of the latest statistics and demographics concerning the topic.

Definitions of Terms

Mina, also known as the Tent City, is a large neighborhood (almost 4.8 squared kilometers of a used area) located in Mecca province (“Mina, Saudi Arabia,” n.d.). During Al-Hajj season, pilgrims must spend most of their time at Mina. It accommodates the pilgrims’ camps, many restaurants, shops, medical centers, information centers, police stations, fire stations, and many other services. Further, some of the main rites of Al-

Hajj, such as Jamarat, is located within the area of Mina. Mina's topography is very challenging to plan and organize since it has a mix of flat and small hill-like features.

Arafat is an area located in the east of central Mecca that has a 12 mi (20 km) hill called Jabal al Rahma (The Mountain of Mercy), Mount Arafat, or Mount Arafah. Arafat area is considered an Islamic tourist attraction that many Muslims visit during the offseasons ("Mount Ararat," n.d.)

Muzdalifa is an open leveled area southeast of Mina, on the route between Mina and Arafat, which pilgrims must visit to collect small stones to complete their rituals ("Muzdalifa," n.d.)

Al-Mashaaer is a term used to describe the areas allocated to Al-Hajj. These areas are Mina, Muzdalifa, Arafat, and the Holy Mosque.

Umrah is an Islamic ritual that includes a pilgrimage to the Holy Mosque at Mecca. Different from Al-Hajj, Umrah is not mandatory on Muslims, and it can be performed at any time of the year. Further, it has fewer rituals and is easier and more manageable to complete than Al-Hajj ("Umrah," n.d.)

Tawaf is the act of counterclockwise circling the Kaaba at the Holy Mosque at Mecca. In Al-Hajj and Umrah, to complete tawaf correctly, one must complete seven rounds around Kabba. Each round must start and end from the black-stone corner of the Kaaba.

Jamarat refers to an area that contains three distinct walls (formerly pillars) located within the area of Mina. During Al-Hajj, pilgrims must perform the ritual of symbolically stoning the Devil three days in a row in this area. ("stoning the Devil," n.d.)

Ihram is a sacred Islamic state that Umrah and Al-Hajj pilgrims must perform. It is also the name of the two-piece white cloth that Muslims must wear to be in that state. Ihram must not have any stitches or sewn parts, such as pockets. Muslims entering the state of Ihram and wearing the white cloths are forbidden from doing certain activities, such as engaging in sexual conducts, clipping their nails and cutting or shaving their hair, using perfumes, damaging plants, killing animals, and many others ("Ihram," n.d.).

The Rites of Al-Hajj

Al-Hajj is an annual Islamic event that occurs during the last month of the Islamic lunar calendar, Dhul-Hijjah. It takes place in Mecca and the nearby sites of Mina, Arafat, and Muzdalifa. Al-Hajj is mandatory once in a lifetime on every healthy and sane adult

who has the financial, physical, and mental competency to travel to Mecca and is capable of performing the various rituals of Al-Hajj.

The rituals of Al-Hajj start by making the intention of making Hajj and wearing Ihram at Miqats (specific places around Mecca) before arriving at Mecca. By the 8th day of Dhul-Hijja, Muslims begin their Hajj journey by visiting and spending the night in the camps designated for them in Mina. By the sunrise of the next day, the 9th, all pilgrims must travel to Arafat and stay there till sunset. While in Arafat, pilgrims are free to pray and make prayers at any place they wish as long they do not leave the boundaries of the area. However, many pilgrims try to acquire a spot at the top of the Mountain of Arafat, while others set their portable tents or spread their mats to preserve a place to spend the day. By sunset, pilgrims are free to leave to Muzdalifa, where they must pray and then sleep for two to three hours or till midnight. By midnight and the beginning of the 10th day, pilgrims have to gather 70 stones and leave going back to the camps at Mina by the morning. At Mina, most pilgrims camp till the 13th day of Dhul-Hijjah, while others prefer to live outside Mina and come each day to perform the rituals and leave. Although most pilgrims usually camp at Mina, they are only required to spend between six to eight hours a day in the area of Mina. During these hours, they must symbolically be stoning the Devil in Al Jamarat, which is part of the Mina area. Lastly, before or by the 13th, Al-Hajj ends by visiting the Holy Mosque and performing the farewell Tawaf around the Kaaba (Al Fozan, 2010; Khan, & Shambour, 2018, p.38, Hamhoum, & Kray, 2011, p. 1014). Figure 1 below illustrates a map of Mecca, Mina, Muzdalifa and Arafat, and the walking distance between them.

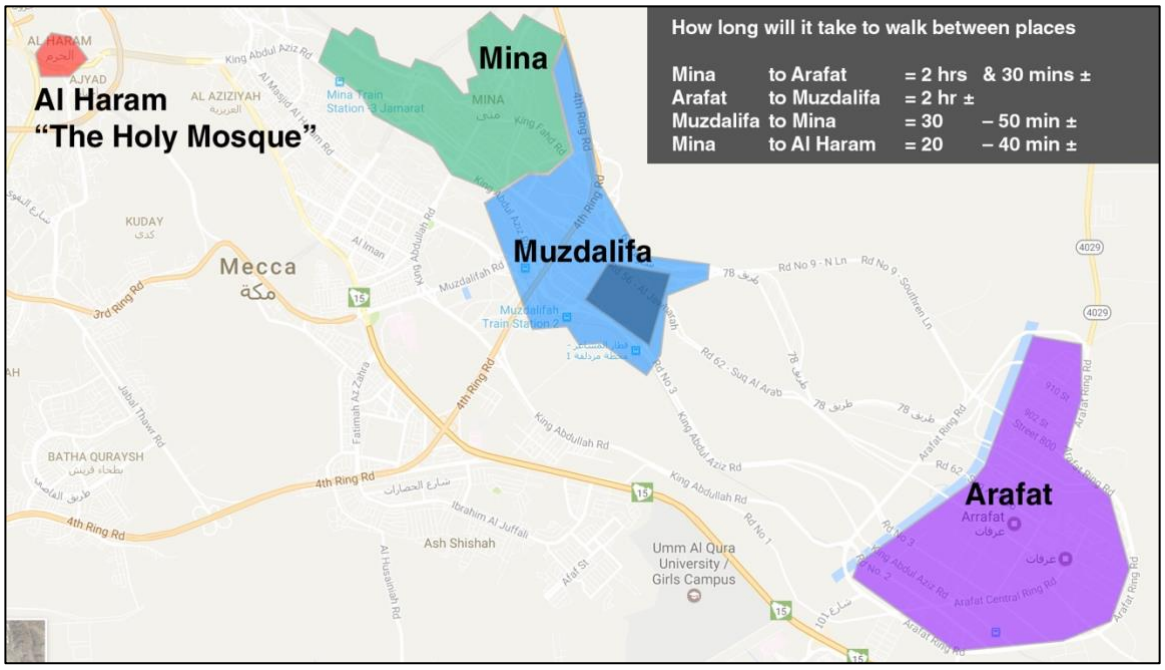

Figure 1: A map showing the areas of Al-Hajj and the walking distance between them

Statistics and Demographics

The statistics exhibited further show beneficial information regarding the pilgrims' countries of origin, age and gender, spoken languages, and other related information that will help in the process of designing wayfinding systems in the crowded areas of Al-Hajj. Before the season of Al-Hajj starts, millions of people travel to Mecca to perform the rituals annually. According to the General Authority for Statistics in Saudi Arabia, the total number of pilgrims during Al-Hajj season of 1439 (2018) was 2,371,675 pilgrims in total, of which 1,758,722 were foreign pilgrims. During the past nine years, the highest number of pilgrims registered was 3,161,573 in 1433 (2012), and the lowest was 1,862,909 in 1437 (2016) (General Authority for Statistics, 1439, p. 11). Table 1 below further shows the statistics for the total number of pilgrims, domestic pilgrims, and foreign pilgrims for the past nine years.

Table 1

Statistics of Pilgrims for the Past Nine Years from 2009 till 2018

Year in Lunar Calendar (Hijri)	Year in Gregorian Calendar	Domestic pilgrims	Foreign pilgrims	Total number of pilgrims
1430	2009	699,313	1,613,965	2,313,278
1431	2010	989,798	1,799,601	2,789,399
1432	2011	1,099,522	1,828,195	2,927,717
1433	2012	1,408,641	1,752,932	3,161,573
1434	2013	600,718	1,379,531	1,980,249
1435	2014	696,185	1,389,053	2,085,238
1436	2015	567,876	1,384,941	1,952,817
1437	2016	537,537	1,325,372	1,862,909
1438	2017	600,108	1,752,014	2,352,122
1439	2018	612,953	1,758,722	2,371,675

Note. The data in this table is provided by (General Authority for Statistics, 1439, p. 11)

Between 1439 (2018) and 1438 (2017), the number of foreign pilgrims participated in Al-Hajj coming from outside the country increased by 0.4% while the highest number registered was 1,049,496 from Asian countries who do not speak Arabic (General Authority for Statistics, 1439, p. 37). Male pilgrims were dominant in this category by almost 53% of the total number of pilgrims with 931,450 registered pilgrims. In contrast, the total number of female pilgrims were 827,272 (General Authority for Statistics, 1439, p. 34).

The total number of foreign pilgrims coming from inside the country was 108,956 pilgrims, with almost 65% (70,792 pilgrims) male and only 35% female (38,164). The highest number of non-Saudi pilgrims coming from inside the country was from Egypt, with 44,314 pilgrims. The second highest was 12,838 pilgrims from Pakistan, then India with 12,319 pilgrims, and the fourth highest was from Yemen with 10,823 pilgrims in total (General Authority for Statistics, 1439, p. 23).

Concerning further demographics, a study conducted in 1438 (2017) on 1,212 pilgrims chosen from a convenient sample visiting Mina, Muzdalifa and the Holy Mosque, revealed that 87.96% of the sample were non-Saudi participants with 16.36% from India and 13.79% from Pakistan (Aljamal, Khan, Shambour & Almowarei, 2017, p. 22, 23). The average age of the participants in the sample was 44 years of age, with four participants younger than 11 years and 12 participants older than 70. Additionally, the study showed that the educational level of the majority of the participants at 35.33% was either a high-school or diploma, whereas 32.67% held an undergraduate degree (Aljamal, Khan, Shambour & Almowarei, 2017, p. 29-32).

Regarding languages, Arabic and Urdu were the most dominant two native languages of the participants, whereas Malay and Bengali came next. However, English was the second most spoken or common language, with 55.18% (Aljamal, Khan, Shambour & Almowarei, 2017, p. 33-36). Although this study sample might be insufficient in comparison with the statistics for all pilgrims, the study findings are useful concerning understanding some general ideas about the demographics of the participants.

Wayfinding and Disorientation Challenges in Crowded Areas

This section is examining the reasons concerning disorientation and wayfinding challenges that might occur along the way in crowded areas in general and specifically during Al-Hajj. As mentioned beforehand, wayfinding is a problem-solving process.

Therefore, it can be highly governed by the level of difficulty the problem, or the task in hand is. Consequently, any external factor that can cause these problems or tasks to get harder can be considered problematic.

The Inadequacy of the Wayfinding System

Proper communication. It is reported in the literature that one of the biggest wayfinding challenges during Al-Hajj is the lack of proper design, consistency, and communication of the wayfinding system available. A study conducted in 2013 on 1,238 Muslims found that one of the common reasons why children from certain countries get lost during Al-Hajj is because the wayfinding system is not unified and not simple enough for them to follow. Accordingly, the study highly recommends the adaptation of a unified, simplified, and up-to-date wayfinding system to help in minimizing such a problem (Shalabi, Mariya, & Qndeel, 2013).

Another supporting study indicates that most pilgrims might have difficulties following information displayed on signs, maps, and brochures because of language barriers (Reffat, 2012, p. 366). As a result, pilgrims might feel disoriented and lost because the wayfinding system cannot communicate the proper information to them. This finding is further strengthened by what Shumaker and Reizenstein achieved in their study, indicating that people might feel stressed due to systems or environmental designs if presented by one of two situations. The first is when the design of the environment seems that it does not respect the user and might be understood negatively. An example is a signage design that is using a complicated language or iconography system. Such a situation might cause people to feel un-respected and not necessary. The second situation is when the users' expectations of an environment or design are unmet (Shumaker, & Reizenstein,1982, p. 212).

Additional literature shows that people might feel stressed if they are not permitted the necessary access to their goal. In his work, Passini states that complex designs and systems might lead to stress and, consequently, wayfinding challenges (Passini, 1996, p. 330). Further, changes in the route or the environment during habitual locomotion through familiar environments might cause frustration and anger, which will lead to more stress (Zimring, 1982, p. 157, 163).

Accordingly, the literature on the matter suggests that designers must provide users with sequential and straightforward decision plans through a well-thought-out wayfinding system to decrease the stress in these situations. The wayfinding system

must also be suitable and work in harmony with the environment. Moreover, the wayfinding system must be easy to understand and easy to use by the users (Zimring, 1982, p. 157-163, 161and Passini, 1996, p. 330-331).

Signs and message display. Signs are the most common element in a wayfinding system that people depend on to help them find their way. At the same time, signs can be the most problematic and challenging, specifically in unfamiliar environments. In their book, Arther and Passini indicate some of the main reasons on the challenges caused by signs and messages display during wayfinding (Arthur, & Passini, 1992, p. 184-185):

- **Ambiguous message display.** Messages must be clear for both the designer and the user.
- **Conflicting message display.** This happens when new signs are installed next to the old ones, or when new information is added to a sign without updating the old information.
- **Deficiency in displaying information.** This means that there is too little information is displayed.
- **Excess of information.** This happens when there is too much information, which might cause confusion.
- **Glare and light reflections.** The type of material might affect the way the information is displayed.
- **Illegibility.** Usually, this is a result of too small visual or textual elements, too small sign size, an unsuitable typeface, bad placements, unsuitable material, or bad manufacturing and fabrication.
- **Unreadability.** A sign can be legible, visible, and clear. However, it might be unreadable or understandable by the user.
- **Inaccuracy.** Messages might be incorrect, not up-to-date, or inaccurate.
- **Obstructions.** The position or location of a sign with respect to its surroundings might affect how people perceive it.
- **Unreliability.** Unreliable signs might be displaying incorrect information, designed unsuccessfully, placed in an unnecessary area, or are irrelevant.

Design consistency. The design and placement of the wayfinding system must be consistent throughout the spatial environment. This will help in giving the user a sense of completeness and will assist in creating a relationship between all the design elements to be understood as a whole. Further, consistent signs design will help the

users when searching for information. It will make it easier and faster for people to locate the necessary information they need to find their way. Arthur and Passini indicate that designers must not randomly display information and must structure the information according to its importance regarding the spatial arrangements. For example, primary information must be more prominent and appear more visible than secondary information. Additionally, signs must share similar fonts, iconography, design elements, coherent color palette, color coding, and must follow a uniform system of shapes and sizes. (Arthur, & Passini, 1992, p. 51).

Further, redundancy in a wayfinding system can be beneficial. Information that is displayed in different elements of the system might be repeated using other elements to allow different user groups to use what is suitable for them. The information displayed in large scale signs must be repeated in small scale signs as well. It must be noted that some users might not be able to read large scale signs because of their location, placement, or because of the user's vision and focus abilities. (Arthur, & Passini, 1992, p. 202).

Clutter and information overload. Too much information on a sign or too little can cause many problems. Too many signs can also cause confusion and creates clutter. Public spaces and urban design codes can govern these challenges in order to ensure that the information and amount of signs display are suitable for that specific environment (Berger & Grieshaber, 2009, p.41).

To avoid design clutter and information overload, Passini suggests that designers must design coherent and consistent systems (Passini, 1996, p. 329). Users will rely on their experiences and will learn to look for the information on a sign if the system keeps giving them the same hierarchy and structure of information. Passini explains that this would lead to what he refers to as "directed-perception," which means that people will rely on scanning and searching for the information they know where to find rather than reading every sign entirely and learning the system all over again every single time (Passini, 1996, p. 329).

Layout and decision points. When arriving into space, people usually rely on spatial environmental cues or wayfinding elements to understand and behave in the space accordingly. Lynch explains that these elements usually act as decision points for the user. These elements are paths, edges, districts, nodes, junctions, and intersections (Lynch, 1979). However, some designers take Lynch's suggestions literally and relied too much on designing the wayfinding system to be available only at the decision points

they know. In their book, Arthur and Passini indicate that this design decision might lead the system to neglect to provide the users with the information needed to make decisions that do not necessarily lead to actions. Further, sometimes, users need more time to process, modify, and make arrangements for their plans before reaching a decision point. Therefore, designers must provide the users with information prior and in-between decision points (Arthur, & Passini, 1992, p.46).

Another problem that might arise is that the arrangement of the spatial elements is too complex for the user to comprehend (Arthur, & Passini, 1992, p. 39). Further, even if the layout is not too complicated, users might find it challenging to connect between the wayfinding system and the environment, especially if some elements, such as buildings or structures, are not thoroughly presented in the wayfinding system (Arthur, & Passini, 1992, p.39). Moreover, Passini indicates that if wayfinding designers focus on highlighting or designing the system based on the major routes in the environment, these major routes will govern the system. Consequently, if the environment is complex and ambiguous, the wayfinding system might be complex and ambiguous, too (Passini, 1996, p. 327).

Additionally, in crowded environments, users might get disoriented and distracted easily. People might need constant feedback on where they are and where to go next. Therefore, signs that have the names and numbers of streets, junctions, intersections, buildings, and structures must be present and designed along the path of the users. Further, primary wayfinding information must be visible and legible at day and night if the environment is highly active at both times (Arthur, & Passini, 1992, p.15). Another problem with designing a wayfinding system is the difference in scale between the system and the environment. Users might get confused if the scale of the system might suggest a reflection of the environment and will try to find references of scale that will help them understand the environment (Arthur, & Passini, 1992, p. 130).

Time Constraints, Traffic, and Overcrowding

In a study conducted in 2012, Zheng reports that during wayfinding tasks, the participants' behavior was highly influenced by time constraints. The participants were focusing on reaching their destinations correctly in the time limit. Further, the participants were not paying too much attention to learn the wayfinding system rather than trying to reach their goal by spending the least amount of time. Consequently, participants were following a sequential order of a sort instead of dealing with the task as a problem that

needs solving. Additionally, people might rely too much on their previous experiences and cognitive abilities regarding wayfinding. This behavior might be suitable for wayfinding in familiar environments but not in unfamiliar situations (Zheng, 2012).

Moreover, during Al-Hajj, pilgrims must complete various rituals at specific times in specific areas. This usually results in pilgrims feeling stressed that they will lose their chance of reaching a specific destination in time. Consequently, they might feel that they are losing control, threatened, stressed, anxious, disoriented, frustrated, and angry (Baum, Singer, & Baum, 1982, p. 24, Hidayetoglu, Yildirim, & Akalin, 2012, p. 50).

Also, being under a time constraint might imply that that mistakes, traffic, and crowded situations will lead to spending more time on the task. This might lead many pilgrims to believe that it is more time-efficient to travel on foot, especially during traffic congestion and possible bottlenecks. A study done in 2014 on 33,713 vehicles commuting from Arafat to Muzdalifa found that 75% of the vehicles take around 5 hours and 43 minutes to travel between the two areas. Further, the study found that in extreme cases, some vehicles take approximately 9 hours to finish the trip (Aljamal, & Sharawi, 2014). In 2014, the number of pilgrims traveling on foot on roads that are designated for pedestrians between Arafat and Muzdalifa was 313,211 pilgrims. The number of pedestrians in 2013 was 134,011 pilgrims, and in 2012 the number of pedestrians reached 544,642 (Abdulmajeed, 2014, p. 5).

Furthermore, for many pilgrims, traveling by busses means waiting for the bus to get filled with passengers, which might take a long time that many pilgrims do not want to waste. Therefore, many pilgrims depart their vehicles in the middle of the road to walk the rest of the distance. In 2012, the number of pedestrians walking on roads that are designated for vehicles reached 150,440 pilgrims, while in 2013, the number was 22,532, and in 2014 was 124,555 pilgrims (Abdulmajeed, 2014, p. 5).

Unfortunately, since these roads are designated for vehicular movement only, they are not suitable for pedestrian movement. Moreover, the wayfinding system installed on these roads is designed for vehicular movement and not pedestrians. This will cause pedestrians to feel more stressed, lost, or disoriented. Consequently, this might cause them trying to cross from side to side or walk along with vehicles and disrupt the traffic and the flow of movement (Reffat, 2012, p. 367).

That being said, these studies are beneficial when designing a sufficient wayfinding system that will help in minimizing the pressure of losing time for users. This can be achieved by providing multiple signs with different information that can be

accessible for various users at the same time. Additionally, the system must be clear, easy to follow, and easily understandable to reduce the time that people might spend trying to read and understand it. Further, the system might provide information about the estimated time of arrival and the distance remaining to the next decision point or destination, which will help many users in planning and adjusting their wayfinding plans along their journeys.

Electronic Resources Deficiencies

Although using a smartphone during navigation and wayfinding tasks might be a great resource, wearing Ihram might make it difficult for many pilgrims to carry around their mobile phones. Since Ihram has no pockets, the most suitable way to carry a phone is to wear a belt that has pockets or a messenger bag. Wearing such accessories might not be ideal for many pilgrims since it will add a certain amount of weight, and it might make the area underneath very sweaty and uncomfortable. Further, due to the dense crowd, using smartphones might not be safe because it requires a certain amount of focus that might lead to people stopping in the middle of the road and disrupting the pilgrims' flow of movement. Also, due to the vast amount of people gathering at the same time, the mobile signal might not be strong enough to work correctly. Additionally, using a smartphone might disrupt the religious rituals related to checking the phone very often or worrying too much about losing the phone or having it stolen (Hamhoum, & Kray, 2011, p. 1015). Not to mention that many pilgrims might not have the luxury of having a smartphone to use during their journey. Consequently, these reasons make accessing electronic resources using mobile phones not suitable for all pilgrims and cannot be considered as a primary source of navigation.

On the other hand, using other electronic resources such as large public displays and dynamic signage systems might be more feasible for wayfinding in Al-Hajj. In a study on the effect of using electronic billboards (EBBs) conducted in 2014, the study indicates that most pilgrims found the billboards to be practical and helpful. However, due to some factors, the billboards were not efficient in engaging pilgrims' attention, message recall, and their capacity to produce awareness and learning. Accordingly, the study suggested the following regarding the use of billboards (Gazzaz, Khan, & Iqbal, 2014):

- To be more beneficial to users, bigger billboards and digital screens must be installed in new locations around the Great Mosque.

- Messages on billboards must be simplified and accompanied by illustrations.
- Textual language must be bigger and must stay longer on the screen.
- Textual language must be multilingual – the languages suggested were Urdu, Persian, Malay, Bengali, French, English, and Arabic.
- Messages content must have practical relevance for the pilgrims – such as accessibility services, transportation, direction to toilets, emergency numbers, guidance to health clinics, complaint offices, etc.

The Unfamiliarity with the Surrounding Areas

During Al-Hajj season, many pilgrims arrive with no prior knowledge or preparation regarding the different areas that they are supposed to accommodate and roam. Their unfamiliarity with the layout and the features of the different areas can cause them to be unable to understand the spatial arrangements for each area. To help in resolving such an issue, a study indicates that some countries such as Malaysia and Singapore conduct training on the rituals of Al-Hajj months in advance. The training might involve scaled-down models of Kaba, or 2D and 3D simulations of the different rituals and areas of Al-Hajj (Yasin, Yusoff, Isa, & Zain, 2010). This training is believed to help these pilgrims in minimizing the wayfinding challenges they might encounter during their journey of Al-Hajj.

On the other hand, during Al-Hajj season, there are many guides, such as officers and scouts, to help pilgrims in situations of them getting lost or disoriented. Also, each pilgrim is provided with a wrist band that has an identification number, which will allow the authorities to help in serious situations (Reffat, 2012, p. 366). However, these measures cannot be used by the pilgrims themselves and are designed for authorized personnel to use.

Contextual Meanings and Cultural Interpretations

In his book “This Means This, This Means That” Hall clarifies that cultural preferences and interpretations usually reflect the society’s understandings and descriptions of specific communicational elements and messages. Additionally, signs are the result of how and what a culture learns, thinks, and interacts. Consequently, signs will indicate the outcomes of a particular culture or, at least, will give an opinion of how a specific culture thinks (Hall, 2012, p. 8-12). Hall further indicates that for a sign to mean the same thing for most people, it has to be in the right context. Where the message

appears is a significant factor in what it means and how to use it, which is called the contextual meaning of the sign (Hall, 2012, p. 10, 14).

A study conducted by Hund, Schmettow, and Noordzij on two groups of Dutch and US participants indicates that cultural differences affect the way people give directions during wayfinding tasks. The study found that participants tend to use cardinal descriptors when dealing with recipients who use survey perspective approaches and left-right descriptors when coping with recipients who use route perspective approaches. Additionally, the indication of cultural preferences and interpretations was apparent in the choice of using landmarks descriptors by Dutch participants and the preference of using street names descriptors by US participants. Based on these findings, the study suggested that there must be a psychological, social, and physical effect of the different cultural interpretations and preferences related to signs and verbal descriptions during wayfinding tasks. Therefore, there must be a standard reference for both recipients and wayfinding directional givers to minimize any confusion in the process (Hund, Schmettow, and Noordzij, 2012).

Furthermore, in their work, Imani and Tabaeian indicate that the level of education or frequent travel might affect the way people behave during wayfinding tasks, and the differences in the educational and financial status of users might change the way they perceive a space. Consequently, people who are educated or can travel and visit more places and environments will have more experience and skills than others when it comes to wayfinding. Accordingly, these factors might help in shaping one's cognitive map differently than the others, which will result in a different understanding and behavior during the performance of wayfinding tasks (Imani, & Tabaeian, 2012, p. 56).

Design and Color Connotations

Many of the literature indicates that color connotations and meanings depend on individual preferences. These differences can be due to many reasons, such as religion, cultural implications, and different unique abilities. The age of the recipient might also affect how individuals perceive color (Hutchings, 1995, p.299). Further, color can play an essential element that helps in the process of cognitive and spatial mapping and help to improve the performance of problem-solving during wayfinding tasks (Kumoğlu, & Olguntürk, 2016).

Additionally, color is used for the identification of spatial elements, color-coding of signs and icons, and as an indication of symbolism. In spatial arrangements, each color must have enough contrast for it to be visible, clear, and communicate information sufficiently. Therefore, if used in a way that it might affect and changed the meaning of what it represents, the color will have negative connotations and might lead to many problems (Hutchings, 2003, p. 64).

Furthermore, colors can be used to define the form of a building, influence the perception of space, and can affect users' personalities and moods. In his work, Smith indicates that using no colors in design can affect users' spatial perceptions and sense of orientation negatively. Consequently, using color in a wrong way might result in inducing psychological stress and might help in stimulating negative feelings of being under pressure, which will affect the users' performances and wellbeing (Smith, 2008, p. 313-316).

Gender and Age Differences

Regarding gender differences, in their study, Liao and Dong found that during wayfinding, females tend to focus on route strategies, going in sequence from a place to place and following the left and right directions. Accordingly, they found that females reported being under high levels of stress due to feelings of spatial anxiety. This finding was associated with users who adopt the route wayfinding technique. Further, the study found that females scored higher in tasks that are associated with memorizing locations. Females also were found to score higher in following directions and using landmarks during wayfinding tasks (Liao, & Dong, 2017).

On the other hand, males were found to tend to use orientational and directional descriptors that are more general, such as east, west, north, and south. This finding was not in contradiction to the fact that males registered high levels of utilizing information related to landmarks during wayfinding tasks. However, as mentioned, females scored higher (Liao, & Dong, 2017).

When using color, gender differences must be taken into consideration, as well. Studies show that concerning the colors red and green, 9% of males are color blind. On the other hand, color blindness in females was found to be only 2% (Arthur, & Passini,1992, p.35).

As for age disparities, many studies report that older people have more challenges during wayfinding tasks than younger people, especially in unfamiliar

environments. Due to cognitive decline, older people scored less when tested for memorizing maps, navigation throughout spaces, learning new paths and layouts, and spatial understanding of new areas (Kumoğlu, & Olguntürk, 2016).

Furthermore, due to the decline in visual abilities, older people need more light and color contrast to be able to read and understand spaces correctly. Arthur and Passini indicate that people who are 50 years of age might need double the amount of light in an area than a 20 years old person. This number will double by the age of 70. Of course, these suggestions are for ordinary healthy people who do not have any eye-related illnesses that might affect their vision abilities (Arthur, & Passini,1992, p.35).

Design Theories and Principles

This section will focus on discussing some design theories, principles, and approaches that can help designers and researchers to minimize some of the challenges and difficulties that people might face during wayfinding and dealing with wayfinding system designs. The theories and principles discussed in this section are the theory of affordances, the affordances-based design theory, and the Gestalt's principles of design.

The Theory of Affordances

Developed by Don Norman in 1988, the theory of affordances states that there must be a relationship between the properties of used objects and the agent who is using them. The term affordance refers to a relationship rather than a property of an object. Accordingly, affordances can either be visible or invisible. Norman's theory of affordances was developed based on Gibson's concept of affordances in 1979. (Norman, 2013, p. 11-13).

The theory assumes that the relationship between an object and a user is determined by what the object can afford the user, and by how the user perceives what an object affords (Norman, 2013). For example, a book can afford reading; therefore, a user can understand the affordance of reading and might read the book. This constitutes a relationship between the book and the user based on the reading affordance. Another assumption made by the theory is that what an object can afford the user can be invisible and cannot be seen by the user (Norman, 2013). For example, a book can afford reading; however, the user cannot perceive this affordance of reading due to a particular deficiency. Therefore, according to this assumption, the affordance of reading

is invisible to the user. This constitutes no relationship between the book and the user based on the affordance of reading.

Based on the literature, the theory of affordances by Norman is one of the primary and essential theories in the field of practice-based design research. It is a well-known theory that is used widely by designers as a base for designing and practice, a foundation to create other theories, develop conceptual frameworks, and build user preferences to develop design guidelines. Further, the theory encourages designers to think about what they want the design to offer or afford the user before, during, and after the designing process. This can be very beneficial for wayfinding systems designers since most of their work must rely on users' behaviors and preferences. Consequently, the theory of affordances will allow designers to learn, respect, and account for user preferences and needs, collect useful information regarding specific types of users, and test many prototypes before the final stages of design and systems production.

The Affordance-based Design Theory (ABD)

The affordance-based design (ABD) theory is one of the popular applied theories in design that helps in bridging the gap between design and the user. Developed in 2008 by Maier and Fadel, the ABD theory states that there must be a conscious design decision that emphasizes the quality of affordances in designs that are achieved through the design process concerning specific users. (Maier, & Fadel, 2008). The ABD theory was influenced by Gibson's affordances theory introduced in 1979, and Norman's take on the theory of affordances by Gibson in 1988 (Maier, & Fadel, 2008, p 19). The ABD adopted the two theories, with reference to Norman's more than Gibson's, to create a coherent applicable theory that can be used in the process of design thinking and design application.

The advantage of the ABD theory is that it is not limited to the functionality of the artifact, or the decision-making process of the designer. This theory allows designers to think about the design problems and requirements within one conceptual framework (Maier, & Fadel, 2008). The ABD theory expects the designer to develop the affordances based on the guidelines and rules of design along with the preferences of the users of the artifact. In other words, designers must consider the users' preferences along with their design process and adjust their designs accordingly. Therefore, designers must design objects that can afford to be used by various users with different backgrounds.

There are three main components for the ABD theory that are used as a framework to adopt the theory properly in the design processes (Maier, & Fadel, 2008, p. 18-22):

1. **The Designer-Affordances-User Framework (DAU):** The DAU system is the main framework that ties all three major components; the designer, the artifact, and the user together. The designers set the rules for the potential affordances of the artifacts and the possible behaviors for the users depending on the designed artifacts. In other words, the relationship between the designer and the user must include the information needed to specify the potential affordances of the designed artifact (the AUA subsystem). Moreover, the relationship between the designer and artifact includes the information required to determine the potential affordances that the artifacts can afford each other (the AAA subsystem).
2. **Artifact–User Affordances Subsystem (AUA):** The AUA examines what the artifact potentially can afford the user. Accordingly, a design plan can be developed to achieve these affordances. As a result, these affordances will determine how the system can potentially behave. Additionally, there must be an understanding that these potential affordances might occur after the user uses the artifact, which will require an ongoing evaluation or prototype testing depending on the design process at hand.
3. **Artifact–Artifact Affordances Subsystem (AAA):** The AAA examines the potential affordances that the different artifacts can afford each other. In other words, the artifacts must complement each other to create a coherent design that the user can use as a whole.

Additionally, the properties of affordances of an artifact have the following characteristics (Maier, & Fadel, 2008, p 21):

- **Complementarity**: An artifact can afford different behaviors for different users. For example, a chair can provide seating for certain people and can afford standing for others.
- **Polarity**: An artifact can possess multiple affordances that can be positive and beneficial to the user, or harmful and non-beneficial to the user. For example, a positive affordance of a smartphone is connectivity and the ability to search the internet on a small screen that can fit in a pocket. On the other hand, a negative affordance of a smartphone is that it can have adverse effects on sight and posture if it was used excessively and incorrectly.

- **Quality**: What is the quality of the affordance of the artifact? In this case, the function of the artifact itself does not matter. What matters is how well the user can use the artifact. A sofa and a coffee table both afford seating. However, a sofa, probably, will provide a better seating quality than a coffee table would.
- **Form Dependency**: The form of the structure of the design is what determines what they can afford for specific users. In other words, the affordances of the artifact are form dependent. For example, a plain plate on a door will afford pushing more than pulling.

The ABD theory is one of the theories that focus on the different aspects of design and user preferences, and the relationships between the environment, the design, and the user. This theory will help in the design process by understanding the complex relationship between the design and the user, and by formulating a coherent applicable system that will serve the vast majority of users in a crowded multicultural wayfinding system.

The Gestalt Principles of Design

Developed by Wertheimer, Koffa, and Kohler in Germany in 1912, the Gestalt theory was mainly concerned with the organization of cognition, mental processes, and perception (Sharpe, 1981, p. 101). The Gestalt theory is based on two main principles that work in harmony with each other. The first defines the relationships between the whole of the subject or artifact, its parts, and the dependency of the context. (Metz-Göckel, 2015, p. 21-22). This is also known as the “figure-ground” phenomenon. (Sharpe, 1981, p. 102). The second is called Prägnanz principle of perception, which defines the perception of the separate elements of a coherent pattern as a group that defines a complete system. (Metz-Göckel, 2015, p. 21-22; Arthur, & Passini, 1992, p. 108). Additionally, the theory claims that the same environment can be perceived differently by different people. (Sharpe, 1981, p. 102). To apply Gestalt’s theory, two main assumptions must be made (Horn, 1998, p. 75-76):

- **The whole is different from the sum of its parts.** This assumption claims that a part of an entire system does not reflect and cannot replace the whole system. For example, the signs mounted on the side of the road do not reflect a whole wayfinding system.
- **Elements tend to be grouped as a whole if they are part of a simple, regular, balanced, or coherent pattern.** This claim is more tied to the

physiology of how people group things. The six principles of Gestalt mentioned above are an extension of this assumption.

These two main assumptions are governed by six human perception principles (Horn, 1998, p. 75-76):

1. **Proximity:** group elements that are closest to each other as a single unit;
2. **Similarity:** group elements that are similar visually as a single unit;
3. **Common region:** group elements enclosed by a line on a surface as a single unit;
4. **Connectedness:** to perceive connected elements as a single unit;
5. **Principle of good continuation**: group elements that are in a directional continuation of one another as a single unit;
6. **Closure:** group elements that constitute a closed entity rather than an open one as a single unit.

Further, the Gestalt theory and principles are considered one of the four main patterns for creating circulation and wayfinding systems for complicated settings. This is mentioned in one of the leading books in wayfinding design developed by Arthur and Passini. Their book explained in detail how the Gestalt theory and principles could be used in the processes of decision making and execution, people perception of wayfinding systems as a whole and as parts and can influence the development of effective strategies and techniques for wayfinding in complex layout designs (Arthur, & Passini, 1992).

Recommendations for Designing Wayfinding Elements in Crowded Areas

A wayfinding system is more than just a signage system. It is a coherent communication system that will help users navigate through complex environments. For the wayfinding system to be successful and appealing to the users, it must be well planned and designed following universal design rules and guidelines. The wayfinding system must be clear, simple, and elegant for it to be more informative and easier to understand and received by users (Gibson, & Pullman, 2009, p.74). Additionally, the information a wayfinding system must provide has to be clear, sufficient, complete, accurate, precise, and up to date. (Montello, & Sas, 2006, p. 3).

Further, the wayfinding system must use different communicational elements such as graphical signs, architectural elements, lighting, materials, and colors to assist in communicating messages properly (Berger & Grieshaber, 2009, p.110). For the

wayfinding process to be successful, the wayfinding systems must provide the necessary information for human decision making and execution at the appropriate places (Arthur, & Passini, 1992, p. 32). In other words, to know where the appropriate places for decision making and execution are, the wayfinding systems design must be based on how humans think and navigate through specific environments.

Signs Design and Signs Types

Signs are one of the most essential and used elements in wayfinding systems. People rely heavily on signs in their wayfinding tasks to give them the necessary information they need to complete their goals. Additionally, when entering an environment, the first thing most people will do is to look for the signage system that can tell them some information about the environment. Therefore, wayfinding designers must pay careful attention and must be knowledgeable about signs and signage designs. In their book, Arthur and Passini mention that people need three main signage types in wayfinding systems in unfamiliar environments (Arthur, & Passini, 1992, p.143):

1. **Orientation and general information about the setting.** This type of signage carries the information necessary for decision making. The information in this signage system can be displayed using maps, floor plans, exploded views, models, and building directories.
2. **Directional information to destinations**. This type of signage carries the information necessary for decision execution. The information in this signage system can be displayed using directional signs, floor directories, and colored directional lines on walls or ceilings.
3. **Identification of destinations**. This type of signage carries the information necessary for decision execution. The information in this signage system can be displayed using informational signs with names or pictographs, safety colors for identification, and caution signs.

On the other hand, in his book, Calori categorizes signage types into seven categories depending on the information displayed in each type. These types are: identification, directional, warning, regulatory and prohibitory, operational, honorific, and interpretive signs (Calori, 2007, p.71-75).

Maps Design and Map Types

In crowded and large environments, signs solely cannot successfully guide people to reach their destination and find their way. A successful wayfinding system

must contain other elements that can help people orient themselves and understand the space as a whole. Richter and Klippel explained that although signs can provide information that is faster to process, they lack other qualities that maps can provide. For example, signs show directions to specific destinations and not the routes of multiple destinations. Therefore, signs must be placed at every decision point to indicate the next direction that people must take. Further, signs might not always offer a way back and cannot provide information on self-orientation and localization. Lastly, people who use the survey perspective wayfinding style might not be able to understand the environment using signs alone (Richter, & Klippel, 2002, p. 364-365).

On the other hand, maps are used as supporting elements in wayfinding systems. Maps allow people to know the routes of multiple destinations at once. Further, they give an overview of the environments which will enable users to understand the environment as a whole. Maps must be carefully placed and provided as needed. Additionally, maps are suitable for people who use the survey perspective styles and great for self-orientation and localization (Richter, & Klippel, 2002, p. 365).

Furthermore, maps must be placed very carefully and placed with respect to the local features of the environment. They must be detectable and perceived from a distance and must be easily accessible by the users. Further, maps must be positioned along the most frequently used and visited places and routes by users in the environment (Richter, & Klippel,2002, p.370).

In their book, Berger and Grieshaber indicate that, since signs and maps must display similar information, they must be designed simultaneously. However, maps must be designed with respect to the scale of the environment they convey. Accordingly, maps in a wayfinding system must be designed as abstract diagrams to reflect the surrounding environment (Berger, & Grieshaber, 2009, p. 29-30).

Berger and Grieshaber indicate that for wayfinding systems, there are three main types of maps in general (Berger & Grieshaber, 2009, p. 31):

- **System maps** are the maps used to illustrate a specific transportation system such as the subway or the underground metro system.
- **Geographic maps** are the maps showing the geographic and physical elements in a particular environment around a system map such as the floor-plan information and the places surrounding the system.

- **Neighborhood maps** are the maps showing the pedestrian district that encompasses the system map, including exciting places, landmarks, and other specific information.

To further support the use of maps for wayfinding tasks, and specifically for orientation and localization, the you-are-here (YAH) symbol is used. The YAH symbol is a small icon, usually a star or a circle, placed on a fixed-location map to indicate the user's location relative to a specific area. Richter and Klippel mentioned some of the recommendations and considerations regarding the design and use of YAH symbols and maps (Richter, & Klippel, 2002, p. 366-367):

- Information on the YAH map must reflect the information on signs and labels in the environment.
- The shapes of paths and routes on the YAH map and the features displayed must reflect the actual landmarks, architecture, and the shapes of paths and routes in the real environment.
- The placement of the YAH map must be near the entrances and at critical decision points.
- Use a directional YAH symbol to indicate the orientation and the viewing direction of the user.
- The YAH maps must be placed in alignment with the real-world environment.
- The YAH maps for a specific environment must all look similar and redundant to help the users to build references and allow for ease of orientation and localization.

Visual and Textual Language

The messages that signs and maps display are essential for the success of the design of the system and these two elements. The way we read signs and maps is very different from the way we read texts in books or printed handouts and brochures. Arthur and Passini indicate that most people read signs and maps using the scanning and glancing technique, which can be easier and quicker when searching for information (Arthur, & Passini, 1992, p.181).

In his book, Horn explains that in elements of wayfinding systems, both visual and textual language must be used compatibly with each other to allow the users to receive clear and precise messages. He explains that icons alone could not send clear and unified messages because they are usually context-dependent, and their meaning

might be affected by external factors such as cultural and social factors (Horn, 1998, p. 55-57). Additionally, text alone could not send clear and unified messages either. Some people cannot read or understand the text because they might be illiterate or do not understand the language. Therefore, Horn suggests that both visuals and texts will help users to develop better contextual meanings and help them to understand the information received quickly (Horn, 1998, p. 55-57). He further mentions that there are four types of visuals that can be used as elements of visual language: icons, concept diagrams, informational graphics (infographics), and information mural (info-mural) (Horn, 1998, p. 55-56).

Symbols and icons make messages simple, clear, and easy to read and design. Most people might know and recognize landmarks and architectural structures by their unique shapes and designs. However, many people might not know the name of the landmark, how to spell it, or sometimes, how to pronounce it, especially if they speak a different language. Berger and Grieshaber call symbols and icons “the essential shorthand behind any environmental graphic design project.” They explain that symbols and icons must be treated as unique wayfinding vocabulary. Accordingly, some of these symbols and icons are already being received as universally recognized wayfinding vocabulary such as arrows and the w/c signs. Further, they suggest that letters alone and numbers could be used as abstract images that act as symbols and icons. Some people might use whole words as a symbol, especially if the word is an acronym or a unique word (Berger & Grieshaber, 2009, p.56-58).

To use symbols in design successfully, they must be universally understood and easily comprehended by most users. Further, designers should consider designing unique symbols for each wayfinding system project. However, these new and unique symbols must be learned by the users to work with the system successfully. Accordingly, designers must allow users to learn these new symbols by frequently using them and explaining their meaning in signs, maps, and printed supporting elements (Calori, 2007, p.98).

For designing textual language, the messages must be clear and precise, as well. The typefaces type and sizes used must be carefully considered. Berger and Grieshaber indicated that when designing wayfinding systems for urban crowded areas, designers are advised to make the letter size of the words to be between 3 to 4 inches (76-10.2 mm) in height. Letters must be simple to read, have narrow stroke widths, and have wide kerning. Helvetica, Clearview, and Garamond are some of the most favorable

and recommended used typefaces in wayfinding systems designs (Berger & Grieshaber, 2009, p.124).

Furthermore, for both horizontal and vertical spacing between elements of visual and textual language, the gutter distance must be a minimum of half of the cap height of the element used. However, this is a choice that each designer will make differently depending on the visual comfort that can be perceived after making this decision (Calori, 2007, p.139).

Colors and Material

Color and material must go hand in hand when designing for wayfinding systems, especially background colors for signage and large wayfinding elements. The type of material surface can affect the colors and the messages the users perceive along the day. Further, materials can be considered not only for their surface's qualities but also for their unique colors. For example, metallic material might be used to serve as a background for the message of the sign and to reduce the cost of sign production. (Gibson, & Pullman, 2009, p.90).

Color and color-coding are used to distinguish messages and signs in spatial arrangements from each other. However, color coding cannot solve bad or poor design decisions. Calori indicates that color-coding might cause more harm than good if it was perceived poorly by the users. Many people might see color differently than it was designed or might have trouble perceiving color in the first place (Calori, 2007, p.130).

On the other hand, Kress and Leeuwen argue that color-coding could increase the attention span of people by more than 80%. Color is usually used to evoke and stimulate certain emotions and actions (Kress, & Leeuwen, 2002, p. 349). Further, Sharpe indicates that warm colors (such as red, yellow, and orange) are usually used to energize and make people act while cool colors (such as green and blue) have more of a calming effect. This is why warm colors are mostly used as foreground and cool colors as backgrounds (Sharpe, 1981, p. 107). However, this is not always the case. Arthur and Passini indicate that light-colored messages on the darker background are perceived larger than dark-colored messages on light backgrounds (Arthur, & Passini, 1992, p. 168). As a general rule, Berger and Grieshaber explained that the color contrast between the foreground and the background must be at least 60%. This percentage is to account for people with visual difficulties (Berger & Grieshaber, 2009, p.124).

To design for roads wayfinding systems, both pedestrians and vehicular, Calori provides a list of the official background colors used in these signs (Calori, 2007, p.129,130):

- Green background for guide and orientation messages
- Blue background for motorist services messages
- Brown background for recreational and cultural interest messages
- Yellow background for warning messages
- Red background for prohibitory messages (such as Stop, Yield, Wrong Way, and Do Not Enter)
- White background for regulatory messages

Legibility, Dimensions, and Sizes

For legible and readable signs, the dimensions and the sizes of signs and messages must be carefully designed. According to Gibson and Pullman, the most relevant regulations for letter sizes for signage designs established by the Americans with Disabilities Act (ADA) (Gibson, & Pullman, 2009, p.80-81), are:

- For people with visual difficulties, the regulations require letters and numbers to have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:10 and 1:5.
- For signs, letters, and words must be spaced farther apart than they would be in regularly printed formats. Additionally, on darker backgrounds, light-colored letters must be spaced a bit farther than standard letters are.
- When placed to support each other, the scale of text, symbols, and icons must look relatively similar.
- Weight, size, and letter format must be carefully considered when choosing a specific typeface to design.
- Larger signs will need supersized font sizes.
- Letters legibility is affected by the height of the x-height of the letters, and by the openness of the voids inside the letterforms.
- It is advisable to choose a typeface that has a versatile type family.

According to Calori, to choose an appropriate and legible typeface family, a typeface must have the following characteristics (Calori, 2007, p.107, 108):

- Clearly defined, easily recognizable letterforms
- A large x-height

- A medium weight, with stroke widths that are neither too thick nor too thin
- A medium or standard character width, with letterforms that are neither too condensed nor too expanded

Consequently, the letter sizes will determine the signage size. Arthur and Passini explain that under ideal situations (i.e., no visual distortion or noise, perfect weather, perfect lighting, and excellent vision by the users), the Helvetica letterforms are the ideal tool used to determine signs sizes in urban crowded areas. They mentioned that the legibility factor for the Helvetica letterforms is 50 feet (15 m) per inch (25 mm) of cap-height. That means that for a sign that is 200 feet (60 m) away, the cap-height of the letters must be at least 4 inches (100 mm) (Arthur, & Passini, 1992, p. 165).

Another factor to consider when designing signs is the negative designed space. The negative designed space is the open area between the contents of the sign itself. Negative space is vital for the legibility of the messages, and it will help to make the messages look sharper and cleaner to the users. Negative space in signage must be at least 60% of the background of the sign (Sign Legibility Rules of Thumb, 2006, p. 8).

Signs sizes and shapes vary depending on their purpose. Arthur and Passini mention that there are three main shapes that are used for signs depending on the function of the sign itself (Arthur, & Passini, 1992, p. 172-173):

- Circles for regulation
  - prohibition signs (DON'Ts) – a red circle with a slash through it
  - obligations / mandatory action signs (DOs) – a black disc with a white glyph inside
- Triangles for warning
  - potential hazards (Cations) – yellow triangle
  - imminent hazards (Danger) – red triangle
- Squares for identification
  - emergency and life-protection equipment or facilities – a green square
  - everything else – a blue square identifies everything else, including the concept of permission.

Additionally, sign sizes can be determined by the speed of the users. The average sign size related to speed is (Sign Legibility Rules of Thumb, 2006, p. 14):

- at 25 MPH (40 kph) = 50 square feet (4.6 square m)
- at 40 MPH (64 kph) = 128 square feet (11.89 square m)

- at 55 MPH (88.5 kph) = 242 square feet (22.5 square m)

Conceptual Framework for Human Wayfinding

Based on the literature, a conceptual framework for human wayfinding is developed (figure 2 below). The base of the framework is inspired by Arthur and Passini's phases of the human wayfinding process (Arthur, & Passini, 1992).

Figure 2: A conceptual framework for human wayfinding and wayfinding systems design

Following Arthur and Passini's explanation of the wayfinding processes phases, the framework is developed to be used as a continuous loop that can begin at any phase and continue to the next. The framework can easily be adopted by designers throughout the various phases of researching, investigating, and designing wayfinding systems.

Also, it can be simply used by the general user who will use the system to reach a specific destination. Each of the framework's phases has a sub-framework that acts as a lens that will control and define the process of each phase. The interpretation of the framework is as follows:

Phase One – Perception and Processing

This phase includes the wayfinding elements necessary for communicating information to the user in order to proceed with the wayfinding task. The lenses for this phase utilize the design theories and principles mentioned previously in the literature, which will assist in guiding the design of the wayfinding system through educated and scientific means. These design theories and principles are The Theory of Affordances developed by Norman in 1988 and 2013 (Norman, 2013), The Affordances-Based-Design Theory developed by Maier and Fadel (Maier & Fadel, 2008), and the Gestalt Principles of Design developed by Wertheimer, Koffa, and Kohler in Germany in 1912 (Sharpe, 1981, p. 101). This phase is essential for wayfinding designers and researchers to help in shaping the wayfinding experience for the users.

Phase Two – Planning and Decision-Making

This phase is governed by elements that assist in planning and making decisions to accomplish wayfinding tasks. According to the literature, to be able to plan and make a decision to commute and complete a wayfinding task, humans must follow specific techniques and strategies to find and orient themselves. These techniques are oriented search, following a trail, landmark-based piloting, habitual locomotion, path integration, and cognitive mapping (Allen, 1999, p.48-51).

Although, some designers and researchers might think that this phase seems out of their control and more of a user preferences type of process. However, it is essential to understand these techniques and consider designing for them throughout the design phase. Consequently, the wayfinding system will be comprehensive, which will help in minimizing many of the challenges and difficulties that might arise during wayfinding.

Phase Three – Action and Execution

After choosing one or more of the techniques mentioned in phase two, along with the perception and processing of the wayfinding elements in phase one, the users must act and execute the plan and the decisions they made to complete their wayfinding task. These actions are dependent on the users' style of approaching wayfinding tasks.

These main wayfinding styles are the linear or the route perspective style, and the spatial or the survey perspective style (Passini, 1981; Hund, Schmettow, & Noordzij, 2012; and Allen, 1999).

Although these styles might govern how users approach their destinations regardless of their techniques, however, these styles are profoundly affected by the wayfinding design elements developed through phase one. Therefore, wayfinding designers and researchers must be aware of and consider both of these styles in their development of the different design elements of the wayfinding system to accommodate all types of users.

CHAPTER THREE — METHODOLOGY

This chapter is dedicated to the research study designed to examine and design a new wayfinding system to be used in the areas of Al-Hajj. The chapter will cover the design and setting of the study. Then, it will introduce an analysis of the current wayfinding system and the design of the new proposed wayfinding system. The chapter will conclude by discussing the study sample, data analysis procedures, the study's validity and liability, and some of the limitations and challenges that might face the research and the study.

Study Design

The primary goal of this study is to develop a new proposed wayfinding system that will help in increasing pilgrims' performance and wayfinding experiences during the period of Al-Hajj. This goal is achieved by examining the efficiency and design of the current and the new proposed wayfinding system according to design theories and guidelines, and users' preferences and recommendations. Accordingly, two main research questions are developed:

1. *Can the current wayfinding system of Al-Hajj help people find their way efficiently and successfully without the constant need for additional help?*
2. *Will the use of a new well-designed, and unified wayfinding system help pilgrims to efficiently and successfully find their way throughout the journey of Al-Hajj without the constant need for additional help?*

To answer these questions, the current and the new design proposal underwent a thorough analysis based on design theories and guidelines. These theories and guidelines are developed based on the literature review in the previous section. Next, both designs are examined through a mixed-method approach that includes a series of qualitative and quantitative questions with specific rubrics intended to highlight the strengths and weaknesses of each design. The qualitative questions aim to collect further user viewpoints, ideas, remarks, and recommendations concerning both designs. The quantitative questions intend to help in gathering user preferences regarding design decisions and implementations, preferences of language, iconography, typefaces, colors, and other design elements.

Additional to the primary questions presented, four additional questions are developed to support the methodology and design set for this study. These questions are:

3. *Is the current wayfinding system used in Al-Hajj inconsistent and lacks in design quality?*
4. *Are the icons and symbols used in the current wayfinding system universal enough for pilgrims to understand?*
5. *Will pilgrims benefit from using color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags, bracelets, accessories, etc., to help in easily identifying specific camps and services?*
6. *Can previous training on wayfinding systems minimize people getting lost during their journey in Al-Hajj*?

Setting, Content, and Data Analysis and Collection Methods

Phase 1 – The Analysis of the Current Wayfinding System

The analysis criteria of the current wayfinding system are inspired by the Gestalt principles of human perception (Horn, 1998) and Arthur and Passini's reasons on why signs might cause challenges during wayfinding tasks (Arthur, & Passini, 1992, p. 184-185). Accordingly, the criteria for analyzing the current wayfinding system are as follows:

A. **Verbal and Visual Language**. Since millions of people will be using the system, the system must consider using multiple languages, common, and universal terminologies and symbols that can be easily recognizable and understood by multiple users with different backgrounds.
B. **Location and Placement.** The location and placement of the sign must take into consideration intersection points, the diversity of users, and the surrounding built and natural environment.
C. **Legibility and Readability.** The legibility and readability of a sign can be affected by the location and placement of a sign on the site, sign size, color, typeface, and other design decisions.
C. **Design Consistency**. In crowded areas, users tend to build a reference to where to find easy access to information. The design must be consistent in using verbal and visual communication elements throughout the system, and the consistency of location and placement of the signs.
D. **Materials and Colors.** The design must consider the consistency, choices, durability, and usage of both materials and colors in the different wayfinding design elements.

The case studies analyzed are a collection of some elements of the current wayfinding system. These elements are selected from a group of images taken from various places in Mina, Muzdalifa, and Arafat. Accompanied by a friend, the researcher captured the images using an iPhone 7 during a personal visit before the start of the Hajj season of 2017.

That being said, the images analyzed here are not by any means a full representation of the current wayfinding system in its entirety. However, the primary intention is to focus on some of the most questionable choices and design decisions made that might have an effect or increased the chances of wayfinding deficiency.

Case study 1 – Pedestrian road services legend. The analysis of this case study is conducted concerning a pedestrian road services legend from the current wayfinding system in Al-Hajj (see Image 1) as follows:

A. Verbal and Visual Language:

- There is a balance in using verbal and visual elements.
- The use of bilingual is evident. However, not all pilgrims understand these two languages.
- The phrase “rest seats” is not as common as “rest areas” or “resting points.”
- Some verbal and visual elements do not reflect the correct services and might be ambiguous to some people, such as “food stuff”.
- The term “guidance center” next to a pictograph that is used widely for informational services might indicate an informational service center. Further, the term is written in Arabic, “مركز دعوة وإرشاد”, means a place that is used for religious guidance and not for general information.
- The term “Al-Mesha-er Al-Hara-m” is a complicated name to learn and memorize. Also, it is written in fragments, which makes it look more confusing (the name should be Al-Mashar Al-Haram). Moreover, the name itself might not be well-known for most pilgrims, especially those who do not speak Arabic. Therefore, using a more widely known term such as “pilgrims services center” might be much more suitable and more understandable.

B. Location and Placement:

Since this is intended to be used by pedestrians, the location of the signs on the main pedestrian walkway is convenient. Moreover, it is apparent from the photo that the sign is located on an intersection, which is considered to be a decision point for most people.

C. Legibility and Readability:

- The location seems that it does not have an effect on legibility and readability.
- The sign is very legible, and the typeface color and size are readable. However, some of the visual elements are not readable or might be confusing. For example, the “Al-Mesha-er Al-Hara-m” symbol consists of thin lines and faded color, which makes the icon challenging to read from a distance or to people with visual deficiencies. Additionally, some words and elements have different sizes, which might affect their readability. For example, the brackets for the WC and Health Center might cause people to think that they represent letters, especially if they do not know the language and are memorizing the shape of the word.
- The lack of using grid lines and alignment is very evident, which makes the design looks uneven and unprofessional. Consequently, along with using different typeface sizes to fit the design, this causes some of the text to bleed into each other. This is very visible when reading the Arabic terms for “Al-Mesha-er Al-Hara-m” and “food stuff.”

D. Design Consistency:

There seems to be consistency in using verbal and visual language in this legend. However, there is inconsistency in font sizes. Also, since most other signs are based on this legend, further evaluation of other signs is needed to see if they are consistent with this legend or not.

E. Color and Material:

- The material seems to be of conventional and durable quality material that is usually used in signage manufacturing.
- There seems to be a random use of color-coding in this legend. By grouping the color-coded pictographs used in this legend, we can conclude that there is no color-coding or color meaning that is used in the design of this sign. For example, the green pictographs represent both “rest seats,” and a service center. These two symbols do not have anything in common. Moreover, the color green is a color that is widely used in signage systems to illustrate explicit permission of doing something; green means GO or OK. However, with these two pictographs, green is used for something different.

Case study 2 – Identification and directional street signs. The analysis of case study 2 is conducted concerning some identification and directional street signs from the current wayfinding system in Al-Hajj (see Image 2) as follows:

A. Verbal and Visual Language:

- There is no balance between using verbal and visual elements. Some signs have one but not the other.
- The use of the yellow pictograph for road numbers has no meaning and is taking away from the intended message rather than adding value to the design.
- There is no balance in using Arabic and English. The street names in the green signs are either in Arabic or English but not the two languages together, which makes it difficult for pilgrims who do not speak these languages or speak one and not the other.
- The crescent symbols used in the white directional signs are confusing. A red crescent symbol pointing right is usually used for health care or urgent care centers, whereas a red crescent symbol pointing up does not mean anything in particular. A gold, black, or green crescent symbol pointing upwards with a star in the middle is usually used to identify mosques and prayer areas. However, the symbol here does not reflect that.
- Some of the visual elements used in the directional signs are ambiguous. The brown shield symbols in the directional sign represent a Saudi police department. However, pilgrims from outside Saudi Arabia might not know this symbol. Similarly, the green and white symbol in the other directional sign, which represents the logo for the “Ministry of Islamic Affairs,” is another ambiguous logo that many pilgrims might not know or even understand. Further, what does the logo even represent? Is it to direct people to the Ministry of Islamic Affairs? Why would pilgrims want to go to the Ministry? The directional sign here does not make sense.

B. Location and Placement:

- The placement seems to be based on the convenience and the cluster of signs installed in each location. It is clear that some signs were not designed to be placed together since they do not share the same placement.
- The location and placement of some of the signs are not well thought out. The signs that are located on the side of a street that people are using to walk forward might force people to stop and turn to the side to read them. This sudden stop in the middle of a moving crowd might disrupt the flow of people moving, which might cause injuries, discomfort, people getting lost, or separated from each other.

C. Legibility and Readability:

- Some signs suffer from information clutter and lack of white space.
- Typeface sizes are not consistent, which might cause problems in the legibility and readability of some of the signs.
- Some of the Arabic text is written using elongation slabs, which is a calligraphic technique used to make texts look more beautiful. However, this technique cannot be understood by many people who do not speak the language. Moreover, the word will look different (طريق سوق العرب) if it was written without the slabs, which might confuse people even more.

D. Design Consistency:

- The symbol and color for directional signs are not consistent. Some directional signs are white, some are green, and others are blue.
- The placement of the directional arrows is consistent in the white and green signs. However, in the blue sign, the arrow is placed in the opposite direction and looks different. This might cause people to miss this directional sign since they are used to look at directional signs that have different shapes and colors and at arrows that have different placements.
- Directional signs and identification signs have different placements with respect to each other. Sometimes directional signs are above identification signs, and sometimes they are below.

E. Color and Material:

- Some elements are starting to peel-off of the sign, which will cause people to misread the sign or miss the information entirely.
- The yellow color for the pictographs that represent the road's numbers seems to be fading away due to the exposure to the high heat of the sun. The choice of a more durable color and material might help in solving such a problem.

Case study 3 – Bathroom signs. The analysis of case study 3 is conducted concerning some of the bathroom signs used in the current wayfinding system in Al-Hajj (see Images 3, 4, 5 and 6) as follows:

A. Verbal and Visual Language:

- In all of the images, there is no balance of using verbal and visual elements, and rarely these two elements are placed together.
- In the areas of Al-Hajj, bathroom buildings are spread all over the areas of Mina, Muzdalifa, and Arafat. However, they are not numbered or have any other

elements that might help in identifying a building from another, which might cause people to be confused and lost since they cannot identify a building from another.

- There is a balanced use of bilingual signs to indicate the function of the building. However, there are many other spoken languages other than Arabic and English that are not served by this system.
- The bathroom symbols used for both men and women can be confusing for many reasons:
- Most of the symbols used are not universally known and might not be identifiable as bathroom signs.
- The symbol for men's bathrooms indicates a man wearing the traditional headdress and a goatee, whereas the women's symbol indicates a female who is covering her head and face or wearing a niqab. These symbols do not resemble what most pilgrims look like during Al-Hajj. Further, this look might be identifiable by people from certain areas from the Arab world but not by people from other countries.
- From a distance, the two symbols might not be identifiable and might look similar, which might result in people confuse one of them with the other.
- The men's symbols seem to have many details, whereas the women's symbols are almost a block of color with a small white line.

B. Location and Placement:

Although the signs' locations are suitable based on their function as identification elements, the placement of some of the signs is unfortunate. Some of the signs are located on a very high streetlight, some are placed only in one direction, and others are placed directly above the door of the facility, which can result in them being harder to see and might require knowing the location of the facility itself first.

C. Legibility and Readability:

From a distance, the two male and female symbols might not be identifiable, which might cause legibility and readability problems for many pilgrims.

D. Design Consistency:

- There is no consistency in the verbal language, the visual choices of the symbols and icons, and the color of the signs and symbols. In crowded areas, these inconsistencies can affect people to get lost, enter a wrong facility, or doubt

themselves when seeking a destination that has a different symbol thinking that they might represent something else.

- There is no logical reason to have multiple symbols representing the same facility in the same place. This will only confuse people and might result in some users to think the wayfinding system to be unreliable and flawed.
- By going back to case 1, the design of the symbols is not consistent with the WC symbol presented in the legend.

E. Color and Material:

It is evident in some of these images that the material and color are starting to fade or turn into a burnt brown color that affects the readability of the sign itself. This is a clear indication that the material used in the manufacturing of these signs cannot sustain the harsh weather of Saudi Arabia.

Case study 4 – Signs for camps and camp services in Mina. The analysis of case study 4 is conducted concerning signs for camps and some other services in the camp areas from the current wayfinding system in Al-Hajj (see Images 7) as follows:

A. Verbal and Visual Language:

- There is a balance in using bilingual signs. However, the numeric information presented might be too little since it might not be understandable by most pilgrims.
- Since the text in the clinic sign is too small, the sign might benefit from having another identifiable element, such as a red crescent symbol.

B. Location and Placement:

The placement of the signs is excellent. Placing the signs at a high level makes them very visible and identifiable from a distance.

C. Legibility and Readability:

- The symbol of the camps might not be readable by many people since it is a bit ambiguous.
- The text and logo in the clinic sign are too small and are not legible or readable from a distance.

D. Design Consistency:

There is a consistency in design decisions between the size and color of the signs. However, the typeface choice and size are inconsistent.

E. Color and Material:

Looking at signs that are placed high in the sky sometimes will require people to look at the direction of the sun. Further, signs with white background might not have enough contrast to the sky behind them.

Case study 5 – Directional signs in various pedestrian walkways. The analysis of case study 5 is conducted concerning some directional signs in different pedestrian walkways from the current wayfinding system in Al-Hajj (see Images 8 and 9) as follows:

A. Verbal and Visual Language:

- There is a balance in using both the verbal and visual elements in the signs and in using bilingual text as well.
- There are no text descriptions next to some of the symbols, which might be ambiguous or confusing to some people.
- Some signs have no further text explanations of what they mean. The “NO ENTRY” sign might be confusing since it is placed next to directional signs that indicate that people need to go to these directions. However, the sign does not indicate for whom is the prohibition of entry.

B. Location and Placement:

The location and placement are very convenient and excellent.

C. Legibility and Readability:

Some of the symbols might cause some legibility and readability problems because of the use of thin lines and detailed designs.

D. Design Consistency:

The directional signs represented in the images lack consistency. The signs have different arrows, different typeface weights and sizes, and different background colors. Further, the placement of the symbols is not consistent either in shape or alignment.

E. Color and Material:

- The white-colored signs might cause some glare or readability problems for some users.
- The material seems to be durable and withstand the test of time.

Analysis Summary. As a conclusion from the previous cases, the wayfinding design elements examined seem to lack in using proper phrasing of terms, multilingual signs, and universal and suitable symbols and iconography. Additionally, the choices of typeface sizes, weights, and colors cause many legibility and readability issues that might result in an unreliable and inadequate wayfinding system.

Furthermore, the design of the elements seems to be inconsistent either in the design choices of the color, sizes, and alignment for the signs themselves or in using different symbols for the same facilities in the directional and identification signs. This lack of consistency of design might cause many problems for pilgrims during wayfinding and navigation.

Phase 2 – The Design of the New Proposed Wayfinding System

After the analysis of some of the elements of the current wayfinding system in the areas of Al-Hajj, the design proposal for the new wayfinding system was developed. The proposal aims to show a variety of design elements that can improve pilgrims' wayfinding experiences during their journey in Al-Hajj. The proposed system's goal is to solve and enhance some of the deficiencies in the current system. Therefore, the same criteria that were used to analyze the current wayfinding system were taken into consideration while designing the new system. These criteria are as follows:

A. Verbal and visual language in the new proposed system. Since the current system is lacking in providing multilingual signs and universal symbols and icons, therefore, the new system will provide a trilingual signage system and multilingual legends that will help more pilgrims in understanding and using the system. The trilingual signs include Arabic, English, and Urdu, whereas multilingual legends include French, Malay, and Hindi, along with the previous three languages. The choice of languages is determined by the literature review conducted earlier. Further, the new system suggests a new set of symbols and icons that are inspired by universal symbols and icon design to help more pilgrims in their wayfinding tasks as well.

B. Location and placement in the new proposed system. Some of the cases presented earlier showed that the location and placement of some of the signage systems are inadequate and might cause problems. The new proposal suggests some changes in the location and placement of some of the signs. However, many of the excellent choices of signs' locations and placements in the current wayfinding system inspired the location and placement in the new proposal.

C. Legibility and readability of the new proposed system. The design of the new system uses popular and legible typefaces that are frequently used in signage design. This is intended to help in minimizing the cognitive effort of trying to read and understand a new typeface that might not be familiar to the users. Further, since the design contains multilingual verbal language, the sizes and weights of the typefaces of

the different languages in the new system are designed to be consistent and relative in proportion to each other.

D. Design consistency of the new proposed system. The main problem of the current wayfinding system is that the design of the system is inconsistent. The inconsistency in the design is apparent through the use of different typeface sizes and weights, using various symbols and icons for the same services, or by using different color-coding for similar signage design. Therefore, the new system is designed as a whole with the implementation of proper color-coding, typefaces, and symbols that are coherence with each other to minimize these inconsistencies and provide a more unified and comprehensive system.

E. Color and material of the new proposed system. The new system is enforcing color-coding on some of the main services provided to the pilgrims. The color-coding is enforced by using the codes in multiple installments through the systems, which will help pilgrims in relating these colors with the services more efficiently and quickly. Further, this color-coding system is intended to be used for future implementations for different services other than wayfinding systems such as accommodation services, pilgrim's identification cards, and barcodes, and group's clothing and accessories.

Based on these criteria, a new set of symbols and icons accompanied with identification and directional signs are developed to create a more consistent and unified wayfinding system that will help in improving and increasing the efficiency of the wayfinding experience of pilgrims. These newly proposed wayfinding elements follow the universal guidelines, colors, and sizes of symbols and signs that are presented previously in the literature. The following figures and images show the proposed symbols design, some signage design proposals, and some of the implementations of the new wayfinding systems design.

Phase 3, Method 1 – Data Collection Through Personal Interviews

Procedure and interviewees. This approach is achieved by conducting in-depth personal interviews with six individuals who performed Al-Hajj in the past at least more than once. The interview questions were designed to help in collecting in-depth answers that are based on storytelling and previous experiences. The interviewees were selected through a circle of friends and family members who fit the criteria and were willing to

participate. The interviews were conducted in three different countries, which are the United States, Saudi Arabia, and Jordan, across a period of approximately two months.

The total number of usable interview sessions were four out of five. This is due to one interviewee asking to be excused from the research after a week from their recorded session. The remaining four interviews included three males and three females, in which two of them were real-life couples. Each couple was interviewed together in one interview session. In these sessions, the questions were asked once for both interviewees to answer. The remaining two interviewees were interviewed separately. The audio recording was recorded for both members in one sitting as well. During writing the script for the interviews, each interviewee is referred to by name and color.

Each interview was completed in one session in a semi-quite area and included five main parts in which three of them were audio recorded. The audio recordings were recorded using a built-in microphone of a personal 2015 MacBook Pro and a QuickTime Player (version 10.5) software. The other parts of the interviews were collected by the interviewer in a data collection template using a Microsoft Word document. Based on the interviewees' preference, all interviews were conducted in an informal Arabic language.

After completing all interviews, the audio parts of each interview were thoroughly transcribed into written text in Arabic. Then, each script was analyzed to evaluate the relatable parts to the topic of this research. Next, the relatable chosen parts were translated into English. All interviews and scripts are presented in the appendix section for future references.

The interview questions were reviewed by the Institutional Review Board (IRB) on 04/30/2019 and were approved as research that does not involve human subjects as defined by DHHS and FDA regulations. Therefore, for this part of the data collection, there was no need for any consent forms from the interviewees.

Interviews structure. Each interview included five parts explained as follows:

Part 1 - Demographic Information. This part starts by explaining the research topic, its goals, and the interview procedure and structure. Then, each interviewee is asked a series of questions intended to gather some demographic information about them. These questions (question 1 through 10) are:

1. gender,
2. age groups,
3. nationality,
4. the languages they speak,

5. educational level,
6. the number of times they performed Al-Hajj,
7. the pilgrim's groups they classify as,
8. any previous training on Al-Hajj,
9. any participation in pilgrims service,
10. any eye-related medical problems they might suffer from.

Part 2 - Assessment of The Current Wayfinding System. This part of the interview contained four main questions, from 11 to 14, in which each of them asked the interviewees to talk about their personal experience regarding a specific aspect. The first and second questions asked the interviewees to recall an incident or an experience that they had regarding getting lost or met or heard someone who got lost during Al-Hajj. The third question asked the interviewees if they recall a unique wayfinding element that they have used before to locate themselves or know their way. The last question asked them specifically to mention, based on their own opinion, the main reasons for pilgrims getting lost in the areas of Al-Hajj. This part was audio-recorded and included questions 11 through 14 as follows:

11. During your journey of Al Hajj, can you recall an incident / experience with the current wayfinding system where you or a loved one needed help to find your/their way, got lost or separated from your/their group/family? And how you/they handled it?
12. During your journey of Al Hajj, can you recall an incident / experience of a pilgrim (or pilgrims) who you might just met or encountered who needed help to find their way, got lost or separated from their groups/families? And how they handled it?
13. During your journey of Al Hajj, can you recall a wayfinding element (map, YAH map, a group of signs, brochure, landmark, etc.) that you used or turned to frequently whenever you encountered a problem navigating the areas or wanted to find your way?
14. In your opinion, what are the reasons that might result in pilgrims lose their way, get lost or get separated from their groups, or families during their journey of Al-Hajj?

Part 3 - Symbols and Icons Identification Test. For this part, the interviewees were shown eight symbols representing different services during Al-Hajj. Four of these symbols represent four services from the current wayfinding system (questions 15 through 18), while the other four are from the new proposed wayfinding system

(questions 19 through 22). Each interviewee was asked to state what does each symbol represents to them. After each given answer, the interviewer mentioned the real meaning of the symbol to the interviewees to hear their reaction. This part was audio-recorded and included questions 15 through 22 as follows:

Main question: In your opinion, what does the following symbol represent?

15. The interviewee(s) is shown a symbol for **men's bathrooms** (see figure 7).
    A follow-up question: this symbol means men's bathrooms; do you have an opinion regarding that?
16. The interviewee(s) is shown a symbol for **women's bathrooms** (see figure 8).
    A follow-up question: this symbol means women's bathrooms; do you have an opinion regarding that?
17. The interviewee(s) is shown a symbol for **Al-Mesha-er Al-Hara-m Service Center** (see figure 9).
    A follow-up question: this symbol means Al-Mesha-er Al-Hara-m Service Center; do you have an opinion regarding that?
18. The interviewee(s) is shown a symbol for **Scarification Coupon Kios** (see figure 10).
    A follow-up question: this symbol means Scarification Coupon Kios; do you have an opinion regarding that?
19. The interviewee(s) is shown a symbol for **Pilgrims Services Center** (see figure 11).
    A follow-up question: this symbol means Pilgrims Services Center; do you have an opinion regarding that?
20. The interviewee(s) is shown a symbol for **Information Center** (see figure 12).
    A follow-up question: this symbol means Information Center; do you have an opinion regarding that?
21. The interviewee(s) is shown a symbol for **women's WC / bathrooms** (see figure 13).
    A follow-up question: this symbol means women's WC / bathrooms; do you have an opinion regarding that?
22. The interviewee(s) is shown a symbol for **Sacrificial Vouchers Sales Offices** (see figure 14).
    A follow-up question: this symbol means Sacrificial Vouchers Sales Offices; do you have an opinion regarding that?

Part 4 - System Comparison Test. In this part, the interviewees were shown four sets of images, each set alone. Each set contains two images. One is for a wayfinding element from the current wayfinding system, while the other is a manipulated image via Photoshop, which is representing a new design of the same elements as part of the new proposed wayfinding system. With each set, the interviewees were asked to give their opinion, the advantages, and the disadvantages of each design. By the end of each set, they were asked to choose their preferred design from the two. This part of the interview was audio-recorded and included questions from 23 through 26 as follows:

Main question: in your opinion, which of the alternatives presented (A or B) do you prefer? Can you mention the advantages and disadvantages of each design?

23. Set 1: Pedestrian walkway legend (see figure 15)
24. Set 2: Women's WCs (see figure 16)
25. Set 3: Camp identification signs (see figure 17)
26. Set 4: Pedestrian walkway signs (see figure 18)

Part 5 - Hypotheses Testing. For this part, the interviewees were asked six questions regarding the hypotheses of this research. Three questions were designed to collect information regarding the current wayfinding system. Whereas the other three were designed for the new proposed system. Each question is answered based on the Likert scale from 5 to 1. This part was filled digitally on the data collection form using a Microsoft word document and was not audio recorded. This part included questions 27 through 32 as follows:

Main question: On a scale from 1 to 5; 1 being strongly disagree and 5 being strongly agree, do you agree/disagree with the following statements

27. The current wayfinding system of Al-Hajj is inconsistent and lacks in design quality?
28. The current wayfinding system of Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts, or police officers?
29. The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand?
30. During Al-Hajj, pilgrims will benefit from a more unified, consistent, and well-designed wayfinding system?

31. Pilgrims will benefit from using the same color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags / bracelets / accessories to help in easily identifying specific camps and services?
32. The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts, or police officers?

All the data collection forms for this phase can be found in the appendix section by the end of this document.

Phase 3, Method 2 – Data Collection Through an Online Survey

Survey structure, setting, and participants. The survey questionnaire is designed to give straightforward statistical answers regarding the issues presented. However, along with the quantitative questions, a good percentage of the survey is designed to provide the research with qualitative information.

The survey started by providing the participants a brief explanation of the research, the title of the study, who is supporting it, and some background and contact information about the researcher. Then, the main survey questions are divided into four main parts.

In the first part, participants are asked to provide some demographic information about themselves (see table 2). The information included their gender, age, nationality, educational level, and additional specifics about their experiences with Al-Hajj in the past.

The second part is dedicated to the symbols and icons identification Test (see table 3). In this part, each participant is provided with a collection of eight different symbols with some suggested possible meanings for each symbol to choose from. The main quest of the questions is to select all the possible suggestions that better explain the meaning of the symbol presented.

The third part is designed to compare both wayfinding systems (see table 4). This part included four sets of images. Each set included two images, one from the current wayfinding system and one from the new proposed wayfinding system. In each set, the participants are asked to provide their preferences regarding the design based on a set of criteria. For each criterion, the participants are given the option of choosing one of the designs, both, or neither. The criteria used to compare the systems included, color contrast with the background, color harmony and balance, font choices and sizes,

alignment of design elements, design quality, and others. Since the survey is expected to be distributed to the general user, a simple definition of some of the criteria is provided. Then, after each set of images, each participant is asked to give an overall preferred design of the two presented in each set. Then, each participant is asked to provide at least one advantage or positive, and one disadvantage or negative that they see in their preferred choice. This part was mandatory to answer to move to the next part of the survey.

The last part of the survey is designed to test the hypotheses established by the researcher (see table 5). Each participant is asked to provide their opinion based on a Likert scale from 5 to 1 on a set of six different questions.

After finishing the survey, each participant was asked to provide additional comments and contact information. This part of the survey was entirely optional and did not affect the result given by the participants in case they did not respond to it.

The survey was designed using a web-based survey service called SurveyMonkey (http://www.surveymonkey.com). The cost of hosting the survey was around $32 a month. The survey was published for six months then was taken down by the researcher. The survey was distributed via various internet-based means through email, text messages, and social media platforms such as Facebook, Instagram, Snapchat, and WhatsApp. The survey was available for anybody using a laptop, a desktop PC, a smart mobile phone, a tablet, or any other devices that provide access to the web-based services mentioned during the time of the availability of the survey.

Table 2

Online Survey Part 1 – Demographic Information

#	Question	Suggested Answers	Type of answer
1	Gender	• Male • Female • Rather not say	Multiple choice (choose one)
2	Age	• Under 18 • 18 - 25 • 25 - 35 • 35 - 45 • 45 - 55 • 55 - 65 • 65+	Multiple choice (choose one)
3	Educational Level	• High-school or less • College Degree (Bachelor's degree) • Graduate Degree (Master's or Ph.D.) • No Education (illiterate) • Other (please specify)	Multiple choice (choose one) Comment box
4	Nationality	List of all the countries	List of all the countries
5	Languages	• Tongue or Native Language (please specify) • Secondary Language (please specify) • Other (please specify)	Comment box
6	How many times have you performed Al-Hajj (The Islamic Pilgrimage)?	• 1 time • 2 – 4 time • 5+ times	Multiple choice (choose one)

		• Never performed Al-Hajj before • Other (please specify)	Comment box
7	Which group of pilgrims do you identify with / belong to? (your group will be depending on the place that issued your Hajj permit / authorization / license)	• Internal Pilgrims (permit from inside Saudi Arabia) • G.C.C Countries Pilgrims (The Gulf Cooperation Council) (United Arab Emirates (UAE), Saudi Arabia, Qatar, Kuwait, Oman, and Bahrain) • Other Arab Countries Pilgrims (other than the countries mentioned above) • Africa Pilgrims (non-Arabic) • South Asia Pilgrims • Southeast Asia Pilgrims • The Americas (USA, Canada, and South America countries), Australia, Europe, and Turkey Pilgrims • Iran Pilgrims • Not sure / I don't know	Checkbox (can choose more than one)
8	Have you ever had previous training / knowledge regarding how to perform Al-Hajj?	• No - Never had training before • Yes – in school or took some classes • Yes - online or through 2D or 3D simulations • Yes - read some books or brochures • Other (please specify)	Checkbox (can choose more than one) Comment box
9	Have you ever worked with or served pilgrims during Al-Hajj season at the areas of Al-Hajj?	• No, I have never worked with or served pilgrims • Yes, as a guide • Yes, as a scout • Yes, as a police officer • Yes, in emergency services (EMT, fireman, evacuation units, etc.)	Checkbox (can choose more than one)

		• Yes, as a pilgrims group leader or Mutawaf • Yes, as a medical care personnel / a doctor / a paramedic / etc. • Other (please specify)	Comment box
10	Do you have any of the following medical conditions that might affect your sight or eye performance?	• No, I don't have problems or medical conditions that might affect my eyesight • Yes, I am color blind • Yes, I wear glasses on a regular basis • Yes, I wear glasses occasionally / specifically for reading or screen use • Yes, I have blurry vision / I am nearsighted or farsighted • Yes, I have dyslexia • Other (please specify)	Checkbox (can choose More than one) Comment box

Table 3

Online Survey Part 2 – Symbols and Icons Identification Test

	Main question: in your opinion, what does the following symbol represent? (choose all applicable answers)		
#	Symbols and icons	Suggested Answers	Type of answer
11		• Security officer • Pedestrian services • WC / Bathrooms for women • Rest area for men • Pilgrims services center for men • WC/ bathrooms for men • Prayer area (for either men or women) Other (please specify) _____	Checkbox (can choose more than one) Comment box
12		• WC / Bathrooms for women • Rest area for women • Pilgrims services center for men • Pilgrims services center for women • Security officer • Prayer area for women Other (please specify) _____	Checkbox (can choose more than one) Comment box
13		• The Holy Mosque (Mecca) • Mosque or Prayer Area • Pilgrims Services Center • Al-Mesha-er Al-Hara-m Service Center • Guidance Center	Checkbox (can choose more than one)

		• Namera Mosque • Religious Guidance Services Other (please specify) _____	Comment box
14		• Slaughterhouses • Sacrification Coupon Kios • Sacrificial Vouchers Sales Offices • Livestock sales offices or areas • Caution: Animals crossing • An area to sell livestock Other (please specify) _____	Checkbox (can choose more than one) Comment box
15		• Religious Services • WC / Bathrooms • Resting Area • Pilgrims Services Center • Prayer Area or Mosque • Police Station • Religious Area Other (please specify) _____	Checkbox (can choose more than one) Comment box
16		• Information Center • Resting Area • Pilgrims Services Center • Guidance Services Center • Police Station Other (please specify) _____	Checkbox (can choose more than one) Comment box

17		• Resting Area for women • WC / Bathrooms for men • Pilgrims Services Center • Mosque / Prayer Area • WC / Bathrooms for women • Pilgrims Services Center for women Other (please specify) _____	Checkbox (can choose more than one) Comment box
18		• Slaughterhouses • Sacrification Coupon Kios • Sacrificial Vouchers Sales Offices • Livestock sales offices or areas • Caution: Animals crossing • An area to sell livestock Other (please specify) _____	Checkbox (can choose more than one) Comment box

Note. The questions for this part were randomized for each individual participant. For larger images, see figures 7 through 14.

Table 4

Online Survey Part 3 – Wayfinding Systems Comparison Test

#	Question / Criterion	Suggested Answers	Type of answer
19, 23, 27, & 31	Main question: in your opinion, which image below (A, C, E, or G *depending on the question*) or (B, D, F, or H *depending on the question*) do you prefer or find more appealing regarding the criteria displayed in each question: • Color contrast of texts and pictograms with the design background (Definition: Color contrast is the difference in luminescence between two adjacent colors or overlaid colors.) • Color harmony and color balance (Definition: Color harmony refers to the property that certain aesthetically pleasing color combinations have. Definition: Color balance is the global adjustment of the intensities of the colors. • Font Choices. • Font size (from a pedestrian point of view.) • Alignment of design Elements (Definition: Alignment is the arrangement in a straight line, or in a correct or appropriate relative position.) • Symbols and icons are clear and easy to understand. • Design Quality – the design is professionally designed and follows clear rules and guidelines.	(Choices are repeated for each criterion) • Image (A, C, E, or G) *depending on the question* • Image (B, D, F, or H) *depending on the question* • Both • Neither	Multiple choice (choose one)

	• Information display and clarity. • Sign position and location.		
20, 24, 28, & 32	In your opinion, in general, which image (alternative) of the above, (A, C, E, or G *depending on the question*) or (B, D, F, or H *depending on the question*) do you prefer in terms of it being more appealing and well-designed than the other?	• Image (A, C, E, or G) *depending on the question* • Image (B, D, F, or H) *depending on the question*	Multiple choice (choose one)
21, 25, 29, & 33	In your opinion, what are the positives/advantages of the preferred design that you chose either (A, C, E, or G *depending on the question*) or (B, D, F, or H *depending on the question*)?	Comment …	5 comment boxes
22, 26, 30, & 34	In your opinion, what are the negatives/disadvantages of the preferred system that you chose either (A, C, E, or G *depending* on the question) or (B, D, F, or H *depending* on the question)?	Comment …	5 comment boxes

Note. Every four questions are about one set (i.e., questions 19 through 22 are about set 1, and so on). The images used in each set are available in figures 15 through 18.

Table 5

Online Survey Part 4 – Hypotheses Testing

#	Question	Suggested Answers	Type of answer
35	The current wayfinding system used in Al-Hajj is inconsistent and lacks in design quality?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)
36	The current wayfinding system used in Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts, or police officers?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)
37	The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)
38	During Al-Hajj, pilgrims will benefit from a more unified, consistent, and well-designed wayfinding system?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)

39	Pilgrims will benefit from using the same color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags / bracelets / accessories to help in easily identifying specific camps and services?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)
40	The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts, or police officers?	5 – strongly agree 4 – agree 3 – neutral 2 –disagree 1 – strongly disagree	Multiple choice (choose one)

Survey sample. The targeted sample is individuals who are older than 18 years of age and younger than 80. The targeted number of participants was initially between 30 to 40. However, after publishing the survey and sharing it with the public, a total of 209 surveys were submitted. Further information regarding this number and other results are explained in the results section of this document.

The participant's gender, nationality, and educational level and other demographic questions are used as categorization criteria and not as screening criteria. Although this study is conducted on wayfinding systems during an Islamic event, however, one of its goals is to develop techniques of analysis and designing wayfinding systems for crowded areas in general. Accordingly, the study is interested in collecting many points of view and users' preferences from all over the globe, regardless of their faith and religion. Therefore, questions about religion and belief will not be a primary concern in this study.

Wayfinding Elements Under Evaluation

Since this research is using the same set of images in multiple phases, this section includes all the images and figures under evaluation from both the current wayfinding systems and the new proposed wayfinding systems used in this research. Most of the images referenced across the thesis document can be found in this section unless it is indicated otherwise. The images and figures are as follows:

Wayfinding Elements in Phase 1 (The Current Wayfinding System)

Image 1: Pedestrian road services legend

Image 2: Different identification and directional street signs in Mina area

Image 3: Different identification signs for men's bathrooms

Image 4: Men's bathroom buildings and signs in Muzdalifa area

Image 5: Different identification signs for women's bathrooms

Image 6: Women's bathroom buildings and signs in Muzdalifa area

Image 7: Identification signs for camps and some camps' services

Image 8: Directional signs for pedestrians going from Arafat to Muzdalifa or Mina.

Image 9: Different directional and prohibitional signs at Mina area.

Wayfinding Elements in Phase 2 (The New Proposed Wayfinding System)

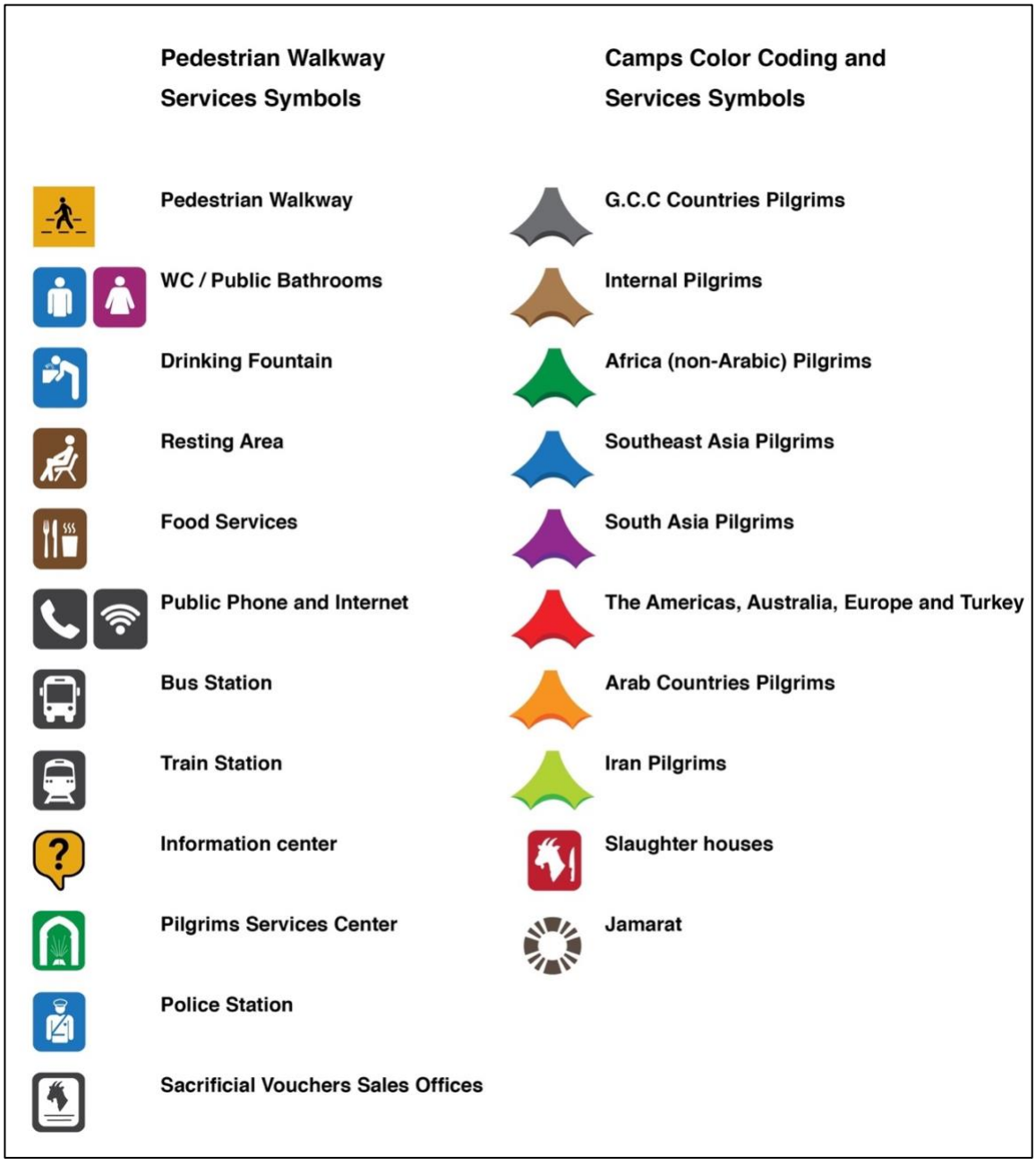

Figure 3: Symbols, icons and color-coding for different services

Figure 4: The typeface choices for Arabic, Urdu and English.

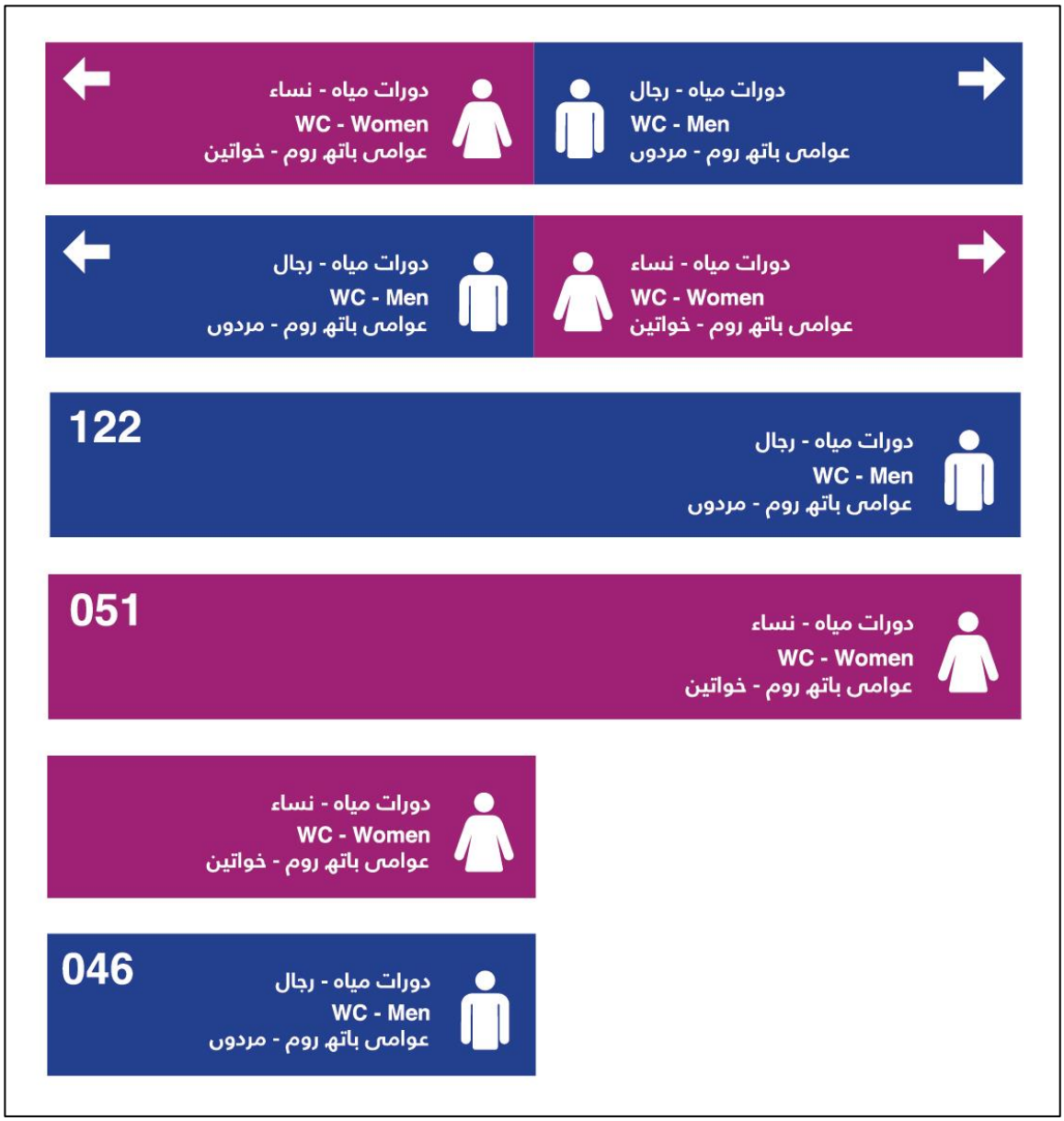

Figure 5: Trilingual WC signs for both genders

Figure 6: Trilingual camp signs and color-coding for the pilgrim's camps

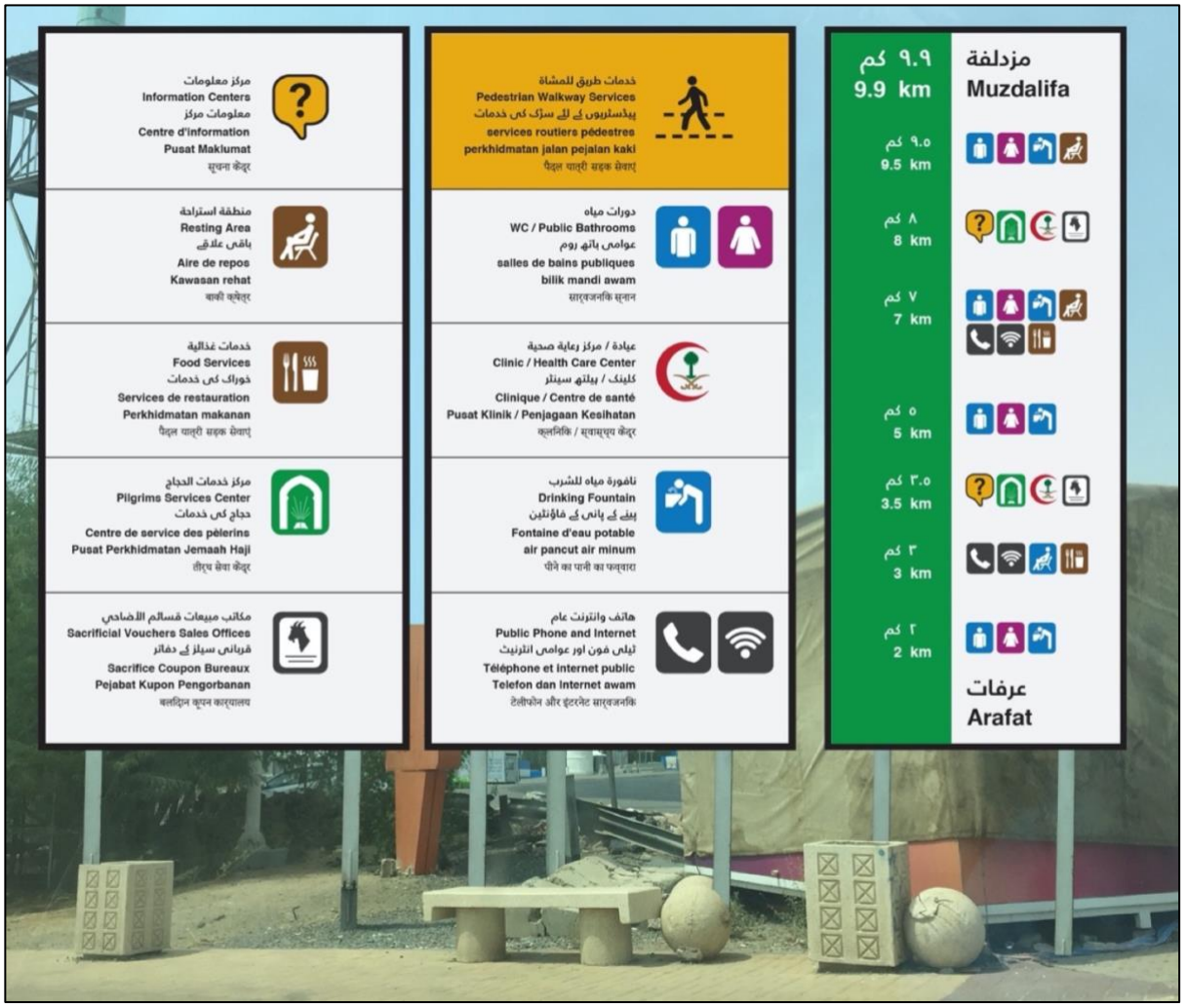

Image 10: A multilingual pedestrian walkway legend

Image 11: A pedestrian walkway identification and directional sign

Image 12: A pedestrian walkway identification and directional sign on the entrance of a pedestrian tunnel

Image 13: Different pedestrian walkway identification and directional signs on a main road

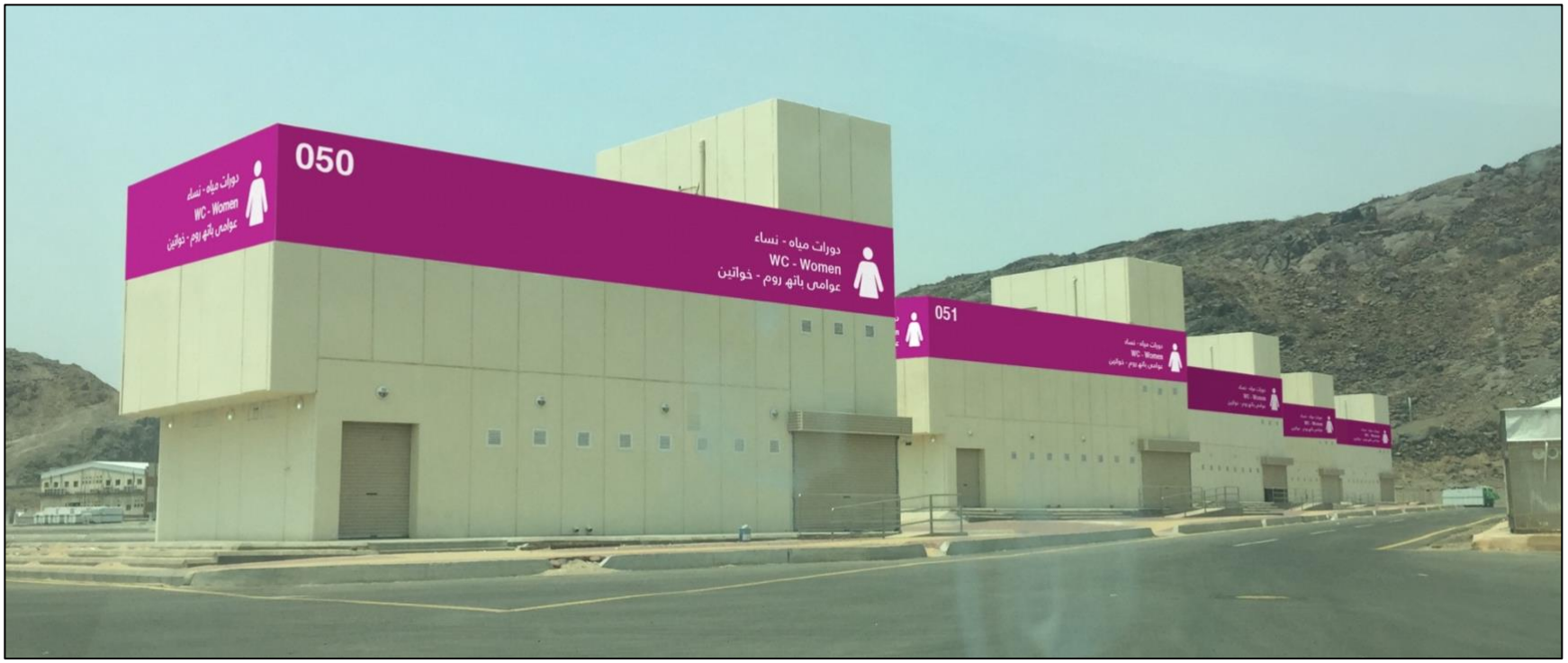

Image 14: Women's WC signs and buildings at Muzdalifa area

Image 15: Men's WC signs and buildings at Muzdalifa area

Image 16: WC signs on buildings that serves both genders

Image 17: WC signs on buildings that serves both genders

Image 18: Camp signs and color-coding for Southeast Asia Pilgrims' Camps

Image 19: Camp signs and color-coding for Arab Countries Pilgrims' Camps

Wayfinding Elements in Phase 3 (Elements from Both Systems)

Figure 7: A men's bathroom symbol from the current wayfinding system

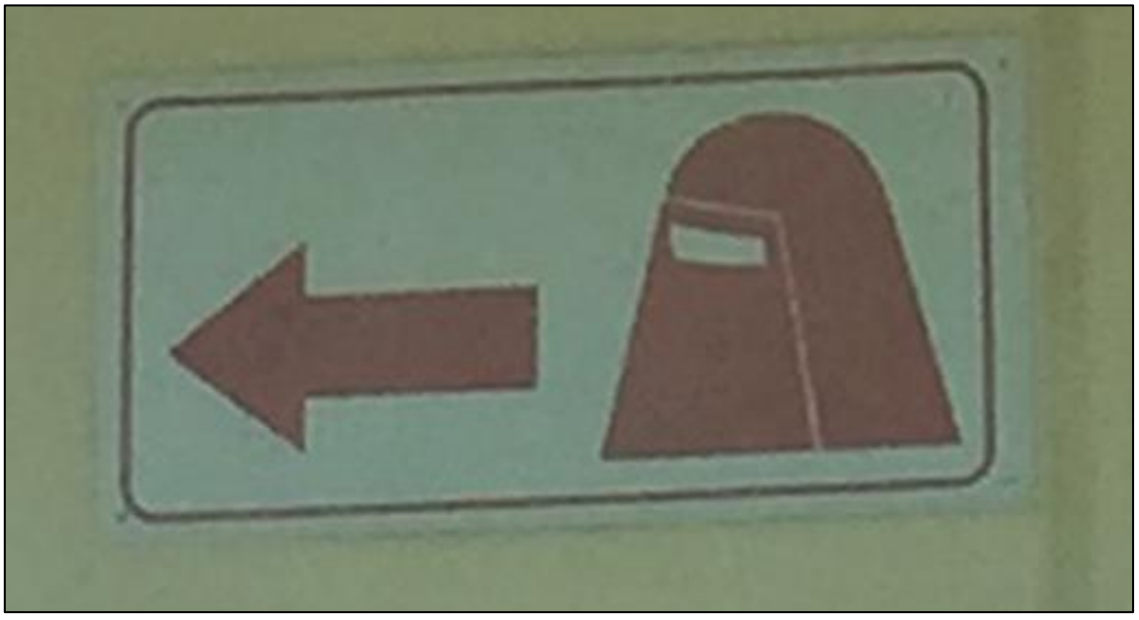

Figure 8: A women's bathroom symbol from the current wayfinding system

Figure 9: Al-Mashaer Al-Moqadasa Center symbol from the current wayfinding system

Figure 10: Sacrification coupon kios symbol from the current wayfinding system

Figure 11: Pilgrims' Services Center symbol from the new proposed wayfinding system

Figure 12: Informational Center symbol from the new proposed wayfinding system

Figure 13: Women's WCs symbol from the new proposed wayfinding system

Figure 14: Sacrificial Vouchers Sales Offices symbol from the new proposed wayfinding system

Image (A)
a pedestrian walkway legend from
the current wayfinding system
(see also image 1)

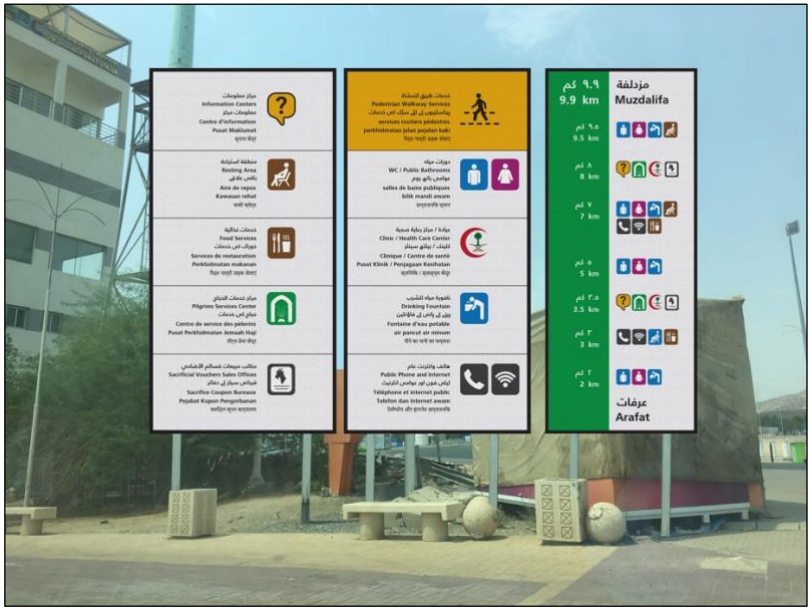

Image (B)
a pedestrian walkway legend from
the new proposed wayfinding system
(see also image 10)

Figure 15: Images in "Set 1 – The Pedestrian Walkway Legend" in the comparison test.

Image (C)
women's WC signs from
the current wayfinding system
(see also image 6)

Image (D)
women's WC signs from
the new proposed wayfinding system
(see also image 14)

Figure 16: Images in "Set 2 – Women's WC / bathroom signs" in the comparison test

Image (E)
Camps identification signs from
the current wayfinding system

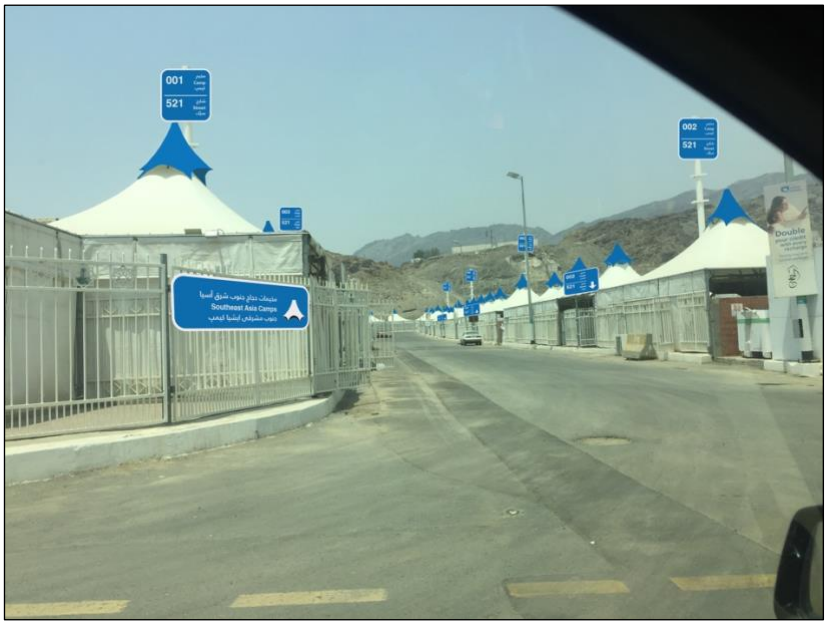

Image (F)
Camps identification signs from
the new proposed wayfinding system
(see also image 18)

Figure 17: Images in "Set 3 – Camps identification signs" in the comparison test

Image (G)
Pedestrian walkway signs from
the current wayfinding system

Image (H)
Pedestrian walkway signs from
the new proposed wayfinding system
(see also image 13)

Figure 18: Images in "Set 4 – Pedestrian walkway signs" in the comparison test

Data Analysis Procedures

The Analysis of Qualitative Data

The qualitative-based questions are designed to trigger the interviewees' and participants' sense of storytelling and elaboration. Also, the question's open-ended feature exposes the research to more exploration and investigation on the matter. The answered gathered from this method are thoroughly examined and dissected to extract as many useful inputs as possible that will help the topic of the research.

The Analysis of Quantitative Data

The quantitative-based questions are designed to give straightforward statistical answers regarding the participants and both systems. The data gathered are categorized based on the participants' completion of the survey questions, their experience of performing Al-Hajj, and gender. Then, a test for a difference in proportion to see how many people prefer a specific design and qualities over the other is conducted.

Issues Concerning Validity and Reliability

For the study to be valid, the questions asked must be general and non-leading. This will ensure that the researcher's point of view does not influence the participants, and their answers will reflect a more accurate representation of what they prefer. Further, for more assurance, both the current and proposed designs are examined and evaluated through different design theories and principles.

Additional to these techniques, the online survey is designed to collect data from various types of participants. This method will help in building a stronger valid study and will assist in making generalized claims that will enforce the findings of the study.

The study's reliability is accomplished through the study design and content, which follow well-defined rules and guidelines that can be easily evaluated and replicated. Further, the online survey questions and data collection method are consistent through all participants and the data gathered throughout the study.

CHAPTER FOUR — RESULTS

The data collection methodology consisted of two methods. The first is in-depth personal interviews with a selected number of participants, while the other method is an online survey that targeted a broader demographic. Both methodologies are explained throughout the section. Further, all the questions for both of the data collection methodologies are reviewed and approved by the Institutional Review Board (IRB) on 04/30/2019 as non-human research. Therefore, there is no need for any consent forms from the interviewees.

Personal Interviews

Procedure and Interviewees

The interviews were conducted in three different countries, which are the United States, Saudi Arabia, and Jordan, across two months approximately. The total number of usable interview sessions were four out of five. This is due to one interviewee asking to be excused from the research after a week from their recorded session. The remaining four interviews included three males and three females, in which four of them were real-life couples. Each couple was interviewed together in one interview session. In these sessions, the questions were asked once for both interviewees to answer and elaborate. Similarly, the audio recording was recorded for both members in one setting as well. During writing the script for these interviewees, each participant was referred to by name and specific color to distinguish their part of the interview. The remaining two interviewees were interviewed separately.

Each interview was completed in one session in a semi-quite area and included five main parts in which three of them were audio recorded. The audio recordings were recorded using a personal MacBook Pro's (2015) built-in microphone and a QuickTime Player (version 10.5) software. The other parts of the interviews were written on a Microsoft Word document by the interviewer. Based on the interviewees' preference, all interviews were conducted in an informal Arabic language.

After completing all interviews, the audio parts of each interview were thoroughly transcribed into written text in Arabic. Then, each script was analyzed to evaluate the relatable parts to the topic of this research. Next, the relatable chosen parts were translated into English. All interviews and scripts are presented in the appendix section for future references.

Interview Part 1 – Demographic Information

As mentioned earlier, there were three male and three female interviewees. The oldest was a 57-year-old male, whereas the youngest was a 26-year-old female. Five interviewees were from Saudi Arabia, and one was from Jordan. However, all interviewees performed Al-Hajj from inside the country as internal pilgrims. Additionally, one interviewee mentioned that one time, he performed Al-Hajj without a permit. The highest number of times performing Al-Hajj mentioned by the interviewees was 25 times, and the lowest was two.

The interviewees' educational level varied between one master's degree, three bachelor's degrees, and two high-school or less. All interviewees were native Arabic speakers, and they preferred to conduct the interviews in Arabic. However, their level of speaking and understanding English varied.

When asked about previous training on how to perform Al-Hajj, five interviewees mentioned that they had previous training in school, and three of them read some books and brochures on the matter. Additionally, four interviewees experienced Al-Hajj with their families when they were younger, whereas one mentioned training online through a specialized website.

Regarding working or serving pilgrims, two interviewees mentioned that they worked as official guides during Al-Hajj season. The other mentioned that they might have helped others but not as official guides.

Regarding vision-related problems, only two interviewees mentioned that they wear glasses most of the day and cannot see or read appropriately without wearing them. However, another two interviewees said that they need glasses occasionally, and one of them suffers from blurry vision sometimes. The following table shows all the demographic information gathered from the interviewees.

Lastly, some interviewees mentioned interesting facts about themselves during the different parts of the interview that are worth taking into consideration when analyzing the results of the research. For instance, interviewee 6 mentioned that he worked in sign and billboards production in the past. This fact will give his comments more weight, especially when analyzing the results for comparing designs. Additionally, both interviewees 1 and 2 are locals to Mecca, and they are older than the other interviewees. Therefore, they were able to experience Al-Hajj many times. Moreover, they are more familiar with the areas of Al-Hajj than other interviewees because of their location.

Table 6

Interviewees demographic information

#	Demographic information	Interviewees 1	2	3	4	5	6
1	Gender	M	F	M	F	F	M
2	Age	57	53	32	26	49	50
3	Nationality	Saudi Arabia	Saudi Arabia	Saudi Arabia	Saudi Arabia	Saudi Arabia	Jordan
4	Language	AR (native) EN (intermediate)	AR (native) EN (intermediate)	AR (native) EN (fluent)	AR (native) EN (fluent)	AR (native)	AR (native) EN (beginner)
5	Education level	Bachelor's degree	High school	Master's degree	Bachelor's degree	Bachelor's degree	High school
6	Times of performing Al-Hajj	18 +	25	3	5	2	4
7	Pilgrims' Group	Internal pilgrims	Internal pilgrims	• Internal pilgrims • Others / without a permit	Internal pilgrims	Internal pilgrims	Internal pilgrims
8	Previous training on Al-Hajj	• School • Books and brochures • Family when was younger	• School • Books and brochures • Family when was younger	• School • Family when was younger	• School • Family when was younger	None	• School • Books and brochures • Online

9	Participation in pilgrims service	Yes, as an official guide	Never	Yes, as an official guide	Never	Never	Never
10	Vision-related problems	Wears glasses most of the day and cannot see without them	Wears glasses occasionally and sometimes have blurry vision	None	None	Wears glasses occasionally	Wears glasses most of his day and has blurry vision

Interview Part 2 – Assessment of The Current Wayfinding System

This part of the interview contained four main questions, in which each of them asked the interviewees to talk about their personal experience regarding a specific aspect. The first and second questions asked the interviewees to recall an incident or an experience that they had regarding getting lost or met or heard someone who got lost during Al-Hajj. The third question asked the interviewees if they recall a unique wayfinding element that they have used before to locate themselves or know their way. The last question asked them specifically to mention, based on their own opinion, the main reasons for pilgrims getting lost in the areas of Al-Hajj.

Previous experiences with the system. Through this part, each of the interviewees had a story or more to tell regarding the matters. Additionally, in their stories, they mentioned some of the main areas that usually make pilgrims confused or lost, such as, heading back from Jamarat (the area of stoning the devil), or getting back to the camps at Mina. Moreover, most of them mentioned some reasons why this would have happened and how to avoid these incidents in the future.

Most of the stories mentioned involved interesting opinions on the current wayfinding system. For example, one of the interviewees said that “There are many signs at Mina that pilgrims can use to locate themselves. However, their location is higher than most people’s eye-level, which makes seeing or reading them to be very difficult by most pilgrims” (interviewee 1). Another interviewee mentioned in frustration that “Of course we got lost. The wayfinding system is very weak, especially on the way back from Jamarat” (interviewee 5). Then, she explained by saying that “There are no signs, and you cannot know where your camp’s location is. Even the guides and scouts available along the way, sometimes they do not know the way or the area very well” (interviewee 5).

Other stories might have involved interesting choices and personal strategies for finding the way. For example, one interviewee mentioned that “Once my mom and I got lost in Arafat and we could not go back to our camp, so we decided to go to Mecca and then try to figure our way from there” (interviewee 4). Another interviewee mentioned a story about a senior pilgrim who was coming to Al-Hajj with his son and got lost when he was coming back from the bathroom. When a police officer tried to help him, the senior pilgrim could not remember his camp name or his son’s phone number. The one thing that he could recall was his daughter’s phone number back home in Egypt. Then, the

police officer called the daughter in Egypt and told her that her father is with them at the station. The daughter called the camp and told her brother to pick his father from the police station, which was almost 200 blocks away. It took them more than two hours to get there from their camps (interviewee 1).

Another interviewee mentioned that sometimes, the campaign that is responsible for the pilgrims could have more than one camp in the same area. However, these camps are in a different location and serve a different group of pilgrims. She mentioned that one time after finishing from Jamarat, they got lost and asked about their camp location and was told it was up the hill. After going up the hill and reaching the camp, they found out that it was the other group camp and not theirs. They were exhausted and could not go down the hill and look for the other camp. There were no buses available or cars to go down the hill. Therefore, they took a motorcycle driven by one of the locals. It was expensive and dangerous (interviewee 5).

Recollection of existing wayfinding elements. When asked to mention the most unique and memorable wayfinding element, most of the interviewees mentioned a landmark of some sort, such as a mosque or a restaurant. Two interviewees mentioned that recently, the authorities installed giant balloons on top of the camp areas that have a number displayed on them (interviewee 1,3). They did not know what the number is. However, they said that it was one of the most memorable wayfinding elements that they have seen and used. Another interviewee who worked in sign fabrications and productions mentioned that the only sign that he could remember was the large billboard signs. These signs display information about the start and end of specific areas (interviewee 6).

That being said, most of the interviewees were saying that they do not remember the current wayfinding system. Moreover, most of them mentioned that they would rather use landmarks than signs (interviewee 4, 5, 6).

Possible reasons for getting lost or disoriented. When asked to mention their opinion on the reasons why pilgrims might get lost, the first reason most interviewees mentioned was the large crowd. Some of them elaborated that with a crowd this intense, it is very hard to see the signs, notice them, or read them. Moreover, one interviewee said that “You cannot compare the crowd there with the crowd that you might see at airports or festivals. Imagine approximately 2.5 million pilgrims present at an area between 4 to 5 square kilometers.”

Other interviewees mentioned that in addition to the large crowd, sometimes the behavior of the crowd might affect their initial wayfinding plan. For example, two interviewees mentioned that sometimes they were forced to go through a different walkway or a street because of many pilgrims sleeping on the street and blocking the movement. Another interviewee mentioned that a large crowd usually results in constant traffic jams. As a result, they were forced to get off their bus and walk through traffic to get to their destination. “The bus driver asked everyone to leave the bus and continue to Arafat on foot. However, since it was a street designated for vehicles, it was very hard for us to know where to go or how to reach Arafat. We did not have our group leader with us. So, we started searching, asking, and calling people until we reached Arafat.” he said (interviewee 3).

Another mentioned reason was that most pilgrims are unfamiliar with the areas of Al-Hajj. One interviewee remarked that sometimes, the official guides who are supposed to help pilgrims are unfamiliar with the entire area and can only guide pilgrims through complicated maps (interviewee 5). However, one interviewee said that pilgrims from certain countries, such as Malaysia, rarely get lost. He said that the reason could be because they receive training on the procedures and rituals of Al-Hajj, and they also study the areas of Al-Hajj before coming to perform (interviewee 1).

That being said, it is worth noticing that even knowing the areas very well might not be enough. This is because the areas look very similar. Almost all interviewees mentioned at one point that the different areas look very similar, and everything looks the same, especially in Mina. Moreover, two of the interviewees are locals to Mecca, and they knew the areas very well, yet they mentioned being lost or not knowing the areas very well (interviewee 1,2). Additionally, some of the stories pointed out that being in an area that has very few distinctive elements might have caused pilgrims to think that they are in the right area or taking the correct streets while they are not. “You must know your current location to be able to communicate some landmarks in order for them to be able to help you. However, most of the time, you cannot know where you are, or you cannot point out any significant landmarks because most of the area looks similar,” she said (interviewee 5). Then she continued: “So unless you find a significant landmark, you can spend more than 5 hours just trying to get back to your camp.”

Additional reasons were mentioned by some interviewees. Some mentioned that being tired and walking for long distances might result in losing focus and consequently getting lost (interviewee 5). Others mentioned that walking through vehicle-designated-

streets might cause some pilgrims to get lost and not know their way (interviewee 3, 5). Lastly, one interviewee mentioned that “many pilgrims lack the basic knowledge of performing Al-Hajj, communicating, or following the general rules of the area” (interviewee 6). The following tables (7 through 11) summarize all the related comments that the interviewees mentioned. The comments were categorized based on their relation to the research topic.

Table 7

Incidents or Experiences of Getting Lost During Al-Hajj

	Interviewees						
Incidents or experiences of getting lost	1	2	3	4	5	6	Total
Finding the way back to the group camps at Mina	✓	✓	✓	✓	✓	✓	6
Traveling or moving through the main areas and streets at Mina	✓	✓	✓	✓	✓	✓	6
Heading back from Jamarat at Mina	✓	✓	–	–	✓	–	3
Entering a wrong pathway or a street	✓	✓	–	–	✓	–	3
Commuting through the areas without the group	✓	✓	✓	–	–	✓	3
Traveling the main roads between the areas of Al-Hajj (Mina, Muzdalifa, Arafat and the Holy Mosque at Mecca)	✓	✓	–	✓	–	–	3

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 8

Wayfinding Strategies Used by Pilgrims During Al-Hajj

	Interviewees						
Wayfinding strategies	1	2	3	4	5	6	Total
Asking other pilgrims	✓	✓	✓	✓	✓	✓	6
Using a landmark or a distinctive sign as a reference point (a mosque, a restaurant, giant balloons, etc.)	–	–	✓	✓	✓	✓	4
Asking official guides for help (officers, scouts, military personnel, group leaders, etc.)	✓	–	–	–	✓	✓	3
Travel within groups	✓	–	✓	–	–	–	2
Traveling to areas or places close to their camp	–	–	✓	–	✓	–	2
Going to a point of reference that they know how to travel from – such as going all the way back from Arafat to Mecca then traveling from Mecca to Mina	✓	–	–	✓	–	–	2
Trial and error	–	–	–	–	–	✓	1
Look for the group's camp at their other location in other areas; (i.e., If they cannot find the camp in Arafat, then look for the camp in Mina and so on) – this is usually is suggested by group leaders to pilgrims	–	✓	–	–	–	–	1
Relying on the information given by group leaders	–	–	–	–	–	✓	1
Relying on memory – camp's name, street names and number, phone numbers, nearby landmarks, etc.	–	–	–	–	✓	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 9

Wayfinding Elements Available to Pilgrims During Al-Hajj

	Interviewees						
Wayfinding elements available	1	2	3	4	5	6	Total
Distinctive landmarks (a mosque, a restaurant, a specific place or area etc.)	–	–	✓	✓	✓	✓	4
General road or vehicular signs	✓	–	✓	–	–	✓	3
Informational billboard signs that tell where certain areas start and end	✓	–	–	✓	–	✓	3
Identification camp signs or flags that are held by group leaders	✓	–	–	–	–	✓	2
Informational balloons flying above each camp area	✓	–	✓	–	–	–	2
Brochures and maps handed out to pilgrims by their group leaders. These are officially produced by the Ministry of Pilgrimage to all groups and pilgrims.	✓	✓	–	–	–	–	2
Bilingual identification signs at the main entrance and exit of most camps	✓	–	–	–	–	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented

Table 10

Possible Reasons Why Pilgrims Might Get Lost During Al-Hajj

Possible reasons why pilgrims might get lost	Interviewees						Total
	1	2	3	4	5	6	
The large crowd in general	✓	✓	✓	✓	✓	✓	6
Everything looks similar	✓	✓	✓	✓	✓	✓	6
The lack of wayfinding elements, especially signs	✓	✓	✓	–	✓	✓	5
Pilgrims not following the general rules of Al-Hajj	✓	✓	–	–	✓	✓	4
Being unfamiliar with the areas	✓	✓	–	✓	–	✓	4
Making a wrong turn or going through the wrong street	✓	✓	✓	–	✓	–	4
Having difficulty seeing the signs	✓	✓	–	–	✓	–	3
Lack of useful or up-to-date information displayed on wayfinding elements	✓	–	✓	–	✓	–	3
Signs being blocked by some natural or man-made elements such as trees or garbage containers	✓	✓	–	–	✓	–	3
Not having enough information to help in navigating the areas or asking for directions or help	✓	–	–	–	✓	✓	3
Sign location might not be suitable to be seen or read	✓	–	✓	–	–	–	2
Pilgrims want to do things their own way	✓	✓	–	–	–	–	2
Roads being closed or detoured	–	–	✓	–	✓	–	2
Having difficulty reading the signs	✓	✓	–	–	–	–	2
Pilgrims not traveling with the group	✓	✓	–	–	–	–	2
The use of ambiguous descriptions or non-global icons in the wayfinding system	–	–	–	✓	✓	–	2
Being tired and fatigued which makes it harder to focus and travel through places with common sense	–	–	–	–	✓	✓	2

The giant balloons might be moved, turned by the wind or simply, they are too far to see	✓	–	✓	–	–	–	2
Signs at the entrance of the camps require pilgrims to be in front of them to be seen and read	✓	–	–	–	–	✓	2
Pilgrims think they know more than the group leaders	✓	✓	–	–	–	–	2
Pilgrims sleeping illegally on the roads and blocking them (this was common in the past) forcing others to make a detour or take an unknown street to them	–	✓	✓	–	–	–	2
Most streets leading to the camps are parallel	✓	–	–	–	–	–	1
Language and communication barriers	–	–	–	–	–	✓	1
Signs have a similar design, colors, and icons	–	–	–	–	✓	–	1
Signs location is higher than eye-level	✓	–	–	–	–	–	1
Not having access to a map or knowing the layout of the area	–	–	–	✓	–	–	1
Traffic jams might force many pilgrims to get out of vehicles and walk through a street that is designated for vehicular movements only	–	–	✓	–	–	–	1
Trash is everywhere and might block signs, walkways or streets, and makes streets to smell very bad – which might force pilgrims to get frustrated or make a detour from certain streets.	–	–	–	–	✓	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 11

Other Related Comments

Other related comments	Interviewee 1	2	3	4	5	6	Total
Many pilgrims rely on their own strengths in getting through the crowd and might start pushing or shoving others to get to where they want which causes pilgrims getting separated from their groups, falling down, getting hurt, and on some extreme occasions, death by being stepped on.	✓	–	–	–	–	–	1
The few street signs available usually display general information that might not be useful for everyone, such as the street name or number. However, even if you know that the camp is on a specific street, these signs do not display where is the camp location along the street or what other services available there. You must go and explore the entire street by yourself.	✓	–	–	–	–	–	1
Some countries such as Malaysia and Indonesia give their pilgrims courses on how to perform Al-Hajj correctly before coming to Mecca and teach them the map of the areas of Al-Hajj, so they do not get lost during their journey. Usually, these groups of pilgrims are very organized and rarely get lost or separated from their own groups.	✓	–	–	–	–	–	1
No street curbs or walkways near main roads or streets designated for vehicular movements.	–	–	✓	–	–	–	1

Getting stressed that we might be late.	–	–	✓	–	–	–	1
Distributing brochures that have all the maps, locations and services that pilgrims need, and must include all the necessary practices and rituals that pilgrims need to do.	–	–	✓	–	–	–	1
The camp areas must include signs that can be understood and not only displaying a number or a letter. Signs must include the name of the group.	–	–	✓	–	–	–	1
If you went to IKEA, you rarely get lost because of the signs and arrows that tell you where to go. I think if they do something like this in Al-Hajj it will help many pilgrims, and it will make things easier.	–	–	–	✓	–	–	1
The only other way to use a vehicle is to go by motorcycle with one of the locals. They are very expensive, and they take advantage of pilgrims, especially if they are from outside the country and do not understand the language. Additionally, it is very dangerous. These locals drive very fast so they can travel back and forth many times to collect more money. I am not sure if they are legally allowed to work there.	–	–	–	–	✓	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Interview Part 3 – Symbols and Icons Identification Test

In this part, the interviewees were shown eight symbols representing different services during Al-Hajj. Four of these symbols represent four services from the current wayfinding system. While the other four are from the new proposed wayfinding system. Each interviewee was asked to state what does each symbol represents to them. After each given answer, the interviewer mentioned the real meaning of the symbol to the interviewees to hear their reaction. All the answers for this part were audio recorded. Before each symbol, a small thumbnail is presented as a reference. A larger version of all images is available in figures 7 through 14.

The first image (see figure 7) represents a symbol for men's bathrooms used in the current wayfinding system. Three interviewees out of six responded that this is a symbol that represents a men's bathroom. The other interviewees were confused. They said that they know that it is a service that is specific for men. However, they are not sure what the service is. Additionally, two interviewees noted that this symbol represents a man wearing a ghutra, which is a headcover that men usually wear in the Arabian Gulf area and other Arab countries. One interviewee explained the confusion by saying, "The icon could be for bathrooms, lounges, etc. However, its function is ambiguous. It tells you that this is a place for men but does not tell you what kind of service it has" (interviewee 6).

Similar to the first image, three interviewees out of six responded correctly to this image (see figure 8) as a symbol that represents a women's bathroom. Three other interviewees said it is an area for women to gather, but they are confused about the function.

However, the most interesting comment of this symbol was from interviewee 6 when he explained that "The red color means caution or danger. So, it must be telling "niqabies" not to go or pass that area. The icon does not communicate well. It is a funny sign, to be honest." Then he continued by saying that "However, the niqab is forbidden during Al-Hajj, and women must not wear it" (interviewee 6). Accordingly, the interviewer replied, "So, this sign is not suitable in that area because women do not look like this during Al-Hajj?" Interviewee 6 replied: Correct.

Then he continued, “I have never seen this icon before, and I do not think it is used globally either. Also, the icon looks more like a tent that a woman.”

For this image (see figure 9), none of the interviewees knew its correct meaning. However, they unanimously agreed that this symbol represents the Holy Mosque at Mecca. Some of them mentioned that it might refer to any mosque. However, because of the pillars of the Holy Mosque and the symbol is used in Al-Hajj, this must be referring to the Holy Mosque.

After revealing to them the correct meaning of this symbol, many of them got even more confused. Some mentioned that the symbol has no relation to what it means (interviewee 6), or that “it does not work. It is confusing” (interviewee 2). Interviewee 3 and 4 kept trying to figure out what Al-Mesha-er Al-Hara-m Service Center means and whether it is an informational center for pilgrims or a general center that might contain other services such as medical and religious services. While interviewee 5 kept asking more questions such as “do you mean Mina?” and “What is this? What services does this place offer?”.

For this image (see figure 10), no one was able to know or guess the correct meaning of the symbol. All interviewees knew that it is related to the sacrificial rituals. However, their understanding was that this symbol represents either the slaughterhouses or an area to sell animals for slaughter.

After revealing the correct meaning of the symbol, one interviewee expressed that “the icon looks like a slaughterhouse and not a place to buy coupons. So, I would not go there because I understood that this as a slaughterhouse, and I do not need to go there right now. I need to buy a coupon instead” (interviewee 5). While another asked in confusing “coupons?” (interviewee 4). However, only one interviewee seemed to know the idea behind the coupon kiosks. He explained, “Yeah. It is a place that you pay them, and they will take care of the sacrifice for you, and they give you a receipt or a coupon in return” (interviewee 3).

This symbol is designed to replace the “Al-Mashaer Al-Moqadasa Services Center” symbol from the current system. Further, the symbol’s meaning is changed to “Pilgrims Services Center”, to make it more relevant. However, similar to the symbol from the current system, none of the interviewees were able to know the correct meaning of this symbol (see figure 11). This symbol might have been more confusing for some interviewees than the symbol from the current system. Two interviewees said that it might represent a logo of either a university or a religious organization (interviewees 1 and 6). The others mentioned that it might be a library, a place to learn religious practices or a religious center.

After revealing the correct meaning and the purpose of the symbol, none of the interviewees seem to agree with what it is supposed to represent. Most of them did not react, while others expressed that it still does not mean what it supposed to mean. Interviewee 3 mentioned that “to be honest, this icon means Quran mostly.” While Interviewee 6 expressed that “there is nothing in the symbol to point out what you have specified.”

The Informational Center symbol from the new proposed wayfinding system was received correctly by all interviewees (see figure 12).

Four out of six interviewees responded correctly to this symbol (see figure 13) as a symbol for women’s bathrooms. The other two, interviewees 5 and 6, said that this is a symbol for an area that is designated for women. However, they both expressed that the symbol needs an additional signifier to reflect its function.

Only two interviewees were able to know the correct meaning of this symbol (see figure 14). The others mentioned that this looks like a slaughterhouse or an area to sell animals.

However, the responses of the two correct answers were very positive in terms of the design is clearer, more elegant, and communicates better. When first seeing the symbol,

interviewee 4 said immediately, “this is a coupon.”, while interviewee 3 mentioned that “This means coupon. It has lines as if it were text.” Then he followed his comment by saying, “This is better.”

Moreover, after revealing the correct meaning of this symbol, another interviewee expressed that this symbol is cleaner and more beautiful (interviewee 6). “Maybe adding some text would make it clearer. This icon is more elegant” interviewee 6 said.

The following table (table 12) summarizes all the interviewees’ responses to this part of the interview. All the rest of the interview comments are available in the appendix section.

Table 12

Interviewees Responses to the Symbols and Icons Identification Test

	Interviewees						
Meaning of the symbol	1	2	3	4	5	6	Total
Informational center	✓	✓	✓	✓	✓	✓	6
Women's WC / bathroom	✓	✓	✓	✓	–	–	4
Men's bathrooms	✓	–	✓	✓	–	–	3
Women's Bathroom	–	–	✓	✓	✓	–	3
Sacrificial Coupon Sales Offices	–	–	✓	✓	–	–	2
Al-Mesha-er Al-Hara-m Service Center	–	–	–	–	–	–	0
Sacrification coupon kios	–	–	–	–	–	–	0
Pilgrims Services Center	–	–	–	–	–	–	0

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Interview Part 4 – System Comparison Test

In this part, the interviewees were shown four sets of images, each set alone. Each set contains two images. One is for a wayfinding element from the current wayfinding system, while the other is a manipulated image via Photoshop, which is representing a new alternative as part of the new proposed wayfinding system. With each set, they were asked to give their opinion, the advantages, and the disadvantages of each design. By the end of each set, the interviewees were asked to give their preferred design.

Interestingly, all interviewees preferred the new proposed designs over the current wayfinding design through all the sets presented. Additionally, many of them provided excellent feedback on both designs. Whereas, some of them provided further suggestions to improve or solve some of the issues with both designs. Before each set, two thumbnails are presented as a reference. A larger version of all images is available in figures 15 through 18.

 (image A)  (image B)

Set 1 – The pedestrian walkway legend. (see figure 15) When asked to list the advantages of the new proposed wayfinding system (see thumbnails above, and figure 15 for larger images), four interviewees out of six mentioned that the new design is clearer and easier to understand. One interviewee supported her comment by saying, “The icons are easier to understand without a helping text” (interviewee 5).

The second most mentioned advantage was that the new proposed design is. Moreover, the new design gives the users information about the distances along the road and the final destination. Regarding the organization of the sign and the icons, two interviewees were impressed by the grouping and organization of the icons. While another two were favoring the three-sign design. Moreover, one interviewee mentioned that the bigger design might help to make the sign visible from a distance, while another interviewee mentioned that the text in the new design is clearer, and the white background is pleasing to the eye.

That being said, two interviewees mentioned that, since they both wear glasses, they felt that the text and font in the new design might be harder to read. Another interviewee commented on the sign size that “it takes much space” (interviewee 5). While interviewee 6 mentioned that the new design has too much information, and that might require people to stop and stand in front of it in order to be able to read it.

On the other hand, when asked to comment on the current design of the pedestrian walkway legend, none of the interviewees mentioned any advantages that they see in the design. However, they said some disadvantages such as, “it is only bilingual” (interviewee 1) or “the icons are too small” (interviewee 3).

Interestingly, most of the other disadvantages were mentioned by interviewee 6, who is worked as a professional in sign production. First, he stated that he thinks that the blue background of the design is not suitable for pedestrians and is usually used for vehicles. Moreover, he noted that the design is very crowded and challenging to deal with and understand. Lastly, he mentioned that the design is just not visually pleasing.

For the last part, the interviewees were asked if they would like to give additional comments or suggestions. Two interviewees gave some additional suggestions regarding the set in general. Interviewee 1 said that the new design seems to be too crowded. He suggested that by adding a fourth sign, the design will have more space, and the text and icons will be larger for more emphases. While interviewees 6 mentioned that lost people usually would look for something easy to deal with and understand. Additionally, he said that the colors of the design must follow a standard of some sort.

The following tables (13 through 15) show all the comments stated by the interviewees regarding both systems. Moreover, each table contains a scoreboard of how many times the interviewees mentioned each comment.

Table 13

Advantages of the New Proposed Pedestrian Walkway Legend

Advantages of the new proposed design	Interviewees 1	2	3	4	5	6	Score
Clearer – Easier to understand	✓	✓	✓	–	✓	–	4
Multilingual	✓	–	✓	✓	–	–	3
It has information about the distance	✓	–	✓	✓	–	–	3
Services are grouped and organized / More organized	–	✓	–	✓	–	–	2
Colors are more attractive	✓	✓	–	–	–	–	2
The icons are very clear	✓	–	–	–	–	✓	2
It is more elaborate	–	–	–	✓	✓	–	2
Organized into three signs / More than one sign	–	✓	✓	–	–	–	2
The white color is pleasing to the eye	–	–	–	–	–	✓	1
It is quiet	–	–	–	–	–	✓	1
The text is clear	–	–	–	–	–	✓	1
It has more colors	–	–	–	–	✓	–	1
It has more information. More comprehensive	–	–	–	–	✓	–	1
Icons are easier to understand without a helping text	–	–	–	–	✓	–	1
If its goal is for pilgrims to stand in front of it to read it, then its design is perfect	–	–	–	–	–	✓	1
The sign is bigger which might make it more visible from a far distance	–	–	–	–	✓	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 14

Disadvantages of the New Proposed Pedestrian Walkway Legend

	Interviewees						
Disadvantages of the new proposed design	1	2	3	4	5	6	Total
The font is small – maybe because we wear glasses	✓	✓	–	–	–	–	2
For a big sign, it takes a lot of space	–	–	–	–	✓	–	1
Too much information	–	–	–	–	–	✓	1
Might require pilgrims to stop in front of it to read and understand it	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 15

Disadvantages of the Current Pedestrian Walkway Legend

	Interviewees						
Disadvantages of the current design	1	2	3	4	5	6	Total
Only bilingual	✓	–	–	–	–	–	1
Its position and location are not clear	✓	–	–	–	–	–	1
The icons are small	–	–	✓	–	–	–	1
Too much information for one sign	–	–	✓	–	–	–	1
It is not organized	–	–	–	–	–	✓	1
Crowded	–	–	–	–	–	✓	1
Challenging to deal with, read or understand	–	–	–	–	–	✓	1
Not visually pleasing	–	–	–	–	–	✓	1
The blue color is known worldwide for roads designated for vehicular movements, and I do not think it is suitable here	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

 (image C)  (image D)

Set 2 – Women's WC / bathroom signs. (see figure 16) The most mentioned advantages of the new proposed design (see thumbnails above, and figure 16 for larger images) were that the design and colors are more attractive than the current design. Furthermore, since the sign is high and has a distinctive color, it is visible from a distance, which is an essential feature during Al-Hajj.

Another advantage of the design was that it uses a global symbol that many people are familiar with. This was mentioned in an interesting manner by interviewees 3 and 4 when they said that "even if you asked a child, they might recognize it."

Additionally, one interviewee favored the symbol and color design by saying that these two elements make a clear statement that this building is for women's use. Moreover, another interviewee mentioned that the new design gave the building a unique identity.

However, in terms of the disadvantages of the design, only one interviewee provided their opinion on the matter. His most concern was that the sign seemed too large, and it might be very expensive to fabricate, install, and maintain. He suggested that a smaller well-studied design would be more beneficial, especially in terms of it being cost-effective.

On the other hand, when asked about the current design, most interviewees were frustrated that the sign and icons of the current design are not clear at all. Some of them mentioned that this is due to the signs being too small to see from a distance, whereas others stated that such sign requires people to be in front of the building to able to see or read them. Two interviewees even mentioned that the sign design looks similar to the building's windows, which can be very confusing. Many of these remarks are well described by one comment made by one of the interviewees when he said: "You need a guide to tell you where this service is, even if you are very close to it" (interviewee 1).

None of the interviewees stated any advantages regarding the current wayfinding design. Additionally, no further notes or suggestions regarding the set were mentioned. The following tables (16 through 18), show all the comments stated by the interviewees along with a scoreboard regarding both designs.

Table 16

Advantages of the New Proposed Women's Bathrooms

	Interviewees						
Advantages of the new proposed design	1	2	3	4	5	6	Total
Attractive design and colors	–	✓	✓	–	✓	✓	4
The sign is high and can be seen from far – Visible from a distance	✓	✓	✓	–	✓	–	4
The icons are clearer	–	–	✓	✓	✓	–	3
It is trilingual	✓	✓	–	–	–	–	2
The sign size and color are unique	–	–	–	–	✓	✓	2
The icon is globally used. Even if you asked a child, they might recognize it	–	–	✓	✓	–	–	2
The buildings are numbered, which is very crucial to because all the buildings look similar	✓	✓	–	–	–	–	2
The design is better	–	✓	–	–	–	–	1
The design gave it an identity and made it special	–	–	–	–	–	✓	1
It can be read from all sides of the building	–	✓	–	–	–	–	1
The color and the icon make it clear that it is for women	–	✓	–	–	–	–	1
You do not need a guide to tell you where it is. Even if you do, they can quickly tell you to go to that building that has the magenta signs on it	✓	–	–	–	–	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 17

Disadvantages of the New Proposed Women's Bathrooms

	Interviewees						
Disadvantages of the new proposed design	1	2	3	4	5	6	Total
It needs more development	–	–	–	–	–	✓	1
The sign size is huge. Maybe a smaller design would be better	–	–	–	–	–	✓	1
It looks very expensive to install. Unless it was painted and not a fabricated sign, which is a weak and unsuitable choice to do. These areas are used for only a couple of days each year, so this must be evaluated very well.	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 18

Disadvantages of the Current Women's Bathrooms

	Interviewees						
Disadvantages of the current design	1	2	3	4	5	6	Total
The sign and the icon are not clear	✓	✓	✓	✓	–	–	4
Very small and not visible from a far distance	✓	–	–	✓	–	–	2
Pilgrims from outside the Arabian Gulf area might not understand the icon	–	–	✓	✓	–	–	2
You must be in front of the building to see it and know what it is	–	✓	–	–	✓	–	2
From a distance, the sign looks like one of the windows	–	–	✓	✓	–	–	2
It is on one side of the building	✓	–	–	–	–	–	1
It is bilingual only	✓	–	–	–	–	–	1
The signs are very close to the doors of the building	–	–		✓	–	–	1
The color is not clear nor attractive	–	–	✓	–	–	–	1
Pale color	–	–	✓	–	–	–	1
The design is unsuccessful at all	–	–	–	–	–	✓	1
You need a guide to tell you where this service is even if you are very close to it	✓	–	–	–	–	–	1
The sign and the doors have the same color	–	–	–	✓	–	–	1
Even with the signs, the function is ambiguous, and there is nothing that points to what they are exactly	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

 (image E)  (image F)

Set 3 – Camps identification signs. (see figure 17) Four out of six interviewees were very impressed by the color-coding idea for the signs and the tent's tops that was the driving force behind the design. Another three mentioned that they found the explanation of the numbers in the signs to be very useful and a great advantage. Additionally, half of the interviewees found that the new proposed design is more attractive than the current one.

Two interviewees favored the idea of the signs placed on the fences, while the other two liked the idea of having bold and visible signs that are higher than the average person eye-level. The latter two found the new signs of being clearer and more visible during the very bright sunlight and at night. One interviewee further mentioned that "The signs located at the top of the camps are great because they allow pilgrims to have more information, especially if they cannot see the signs located on their eye-level" (interviewee 1).

Furthermore, interviewee 6 praised the new design for being more developed, more professional, and more modern. Whereas interviewee 4 said that an advantage of the new design is that it tells the same information as the current but in a better way. Regarding using Arabic numerals, interviewee 3 mentioned an interesting comment saying that "It makes sense to use the Arabic numerals which are more widely used than the Urdu numerals that are used right now. Additionally, Arabic numerals are widely used in mobile phones and many other applications, which makes them more familiar and more understandable by most people."

That being said, the only disadvantage that the new design received was from interviewee 6. He said that the design could be improved better. The interviewee did not mention any further comments regarding the matter at this point.

Regarding the current design, none of the interviewees mentioned any advantages. However, the most mentioned disadvantage of the design is that the numbers and letters in the signs are challenging and not understandable from a glance. Another disadvantage mentioned by three interviewees was that the current signs are tough to see and that they are not visible from a distance. Two interviewees said that the system does not provide signs on eye-level, such as the signs on the fences of the camps as the new proposed design.

Furthermore, another disadvantage of the current design mentioned by one interviewee was that the signs do not provide information regarding the pilgrims' groups or their category. Another interviewee stated that the current signs display numbers and icons that that only some people might understand. He further suggested that the current signs do not have any information regarding the location of the camps. Additionally, he mentioned that the signs look identical all over the area, and it is very challenging to distinguish a sign from the other.

Two interviewees further proposed additional ideas to help to improve the new design. Interviewee 6 said that he thinks the streets and the fences of the camps should be colored as well. He further suggested that each area must have a different color-coding than the other. Interviewee 3 mentioned that he favored more signs on eye-level. Moreover, he thinks that the numbers and names of the camps must carry on to other provided services to pilgrims such as the pilgrims' bracelets. The following tables (19 through 21), show all the comments stated by the interviewees along with a scoreboard regarding both designs.

Table 19

Advantages of the New Proposed Camps and Tents Identification Signs

	Interviewees						
Advantages of the new proposed design	1	2	3	4	5	6	Total
Color coding is a great idea – The colors are excellent	✓	✓	✓	✓	–	–	4
Very attractive	✓	✓	–	✓	–	–	3
It has many signifiers that can help pilgrims – More helpful / The numbers and letters are explained	–	✓	–	✓	–	✓	3
The signs placed on the fences are a great idea	–	–	–	✓	✓	–	2
The signs are bigger and clearer – clearer especially in bright sunlight or at night	–	–	✓	–	✓	–	2
The information is more organized	–	–	–	✓	–	–	1
It is a better way of telling the same information.	–	–	–	✓	–	–	1
More modern / More developed and professional	–	–	–	–	–	✓	1
The signs located at the top are great because they allow pilgrims to have more information especially if they cannot see the signs located on their eye-level	✓	–	–	–	–	–	1
It makes sense to use Arabic numerals, which are more widely used than the Urdu numerals that are used right now. Additionally, Arabic numerals are widely used in mobile phones and many other applications, which makes them more familiar and more understandable by most people.	–	–	✓	–	–	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 20

Disadvantages of the New Proposed Camps and Tents Identification Signs

	Interviewees						
Disadvantages of the new proposed design	1	2	3	4	5	6	Total
It can be more improved	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 21

Disadvantages of the Current Camps and Tents Identification Signs

	Interviewees						Total
Disadvantages of the current design	1	2	3	4	5	6	
The numbers and letters are not understandable I have to ask about what does it mean	✓	–	✓	✓	–	✓	4
Hard to see from a distance and in bright sunlight	✓	–	✓	–	✓	–	3
Usually, people will look for signs located on their eye level and not high in the sky –no signs on the fence of the camp, only the ones at the top	✓	–	–	–	✓	–	2
The signs have similar colors as the tents	–	–	–	✓	–	–	1
Can be misleading / can cause people to get lost	–	–	–	✓	–	–	1
Using one color. This can cause problems. The only distinctive thing here is the number	–	–	✓	–	–	–	1
The color is not clear	–	–	✓	–	–	–	1
The signs have similar colors as the tents	–	–	–	✓	–	–	1
There are no signs that tell the category of the pilgrims this camp is for	–	–	–	–	✓	–	1
This is a familiar scene for pilgrims. These signs look the same all over the camps area	–	–	–	–	–	✓	1
The signs do not give information regarding the location of the camps and contain very few and ambiguous icons that not everyone can understand	–	–	–	–	–	✓	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

 (image G)  (image H)

Set 4 – Pedestrian walkway signs. (see figure 18) Regarding the advantages of the new proposed design for this set, four out of six interviewees favored the colors of the new proposed design over the current one. Some of them said that the color choices seem more educated and accurate than the current design. Another four mentioned that the new signs are more organized. Further, three other interviewees favored that the new signs provided destination information along with directional arrows.

Additionally, two interviewees said that the new signs have more information, while another two said that the new design is clearer. One of the interviewees even stated, “Its clearer. No need to compare.” Further mentioned advantages included that the new proposed design is better and that the use of colors gave importance to the sign.

That being said, none of the interviewees mentioned any disadvantages regarding the new proposed design. Also, none of them stated any advantages of the current design, either. However, regarding the disadvantages of the current design, two interviewees mentioned that the design is very bad, and it is clear that it was designed by a non-professional or a non-designer. Additionally, two of them said that it is clear that the signs are meant for vehicles and not for pedestrians.

Further, another disadvantage was the lack of information on the signs (interviewee 1), and that the signs did not provide destination and directional information (interviewee 4). Interviewee 3 was concerned about the colors of the signs saying that they are not distinct, nor attractive. He further said that the white color of the background might not be the right choice considering it has no contrast against sunlight. Interviewee 5 was a little frustrated about how the signs were very low maintained, and they look broken. Further, she explained that additionally to the information on these signs being very hard to read, these signs might not be even displayed up-to-date information most of the time. The following tables (22 and 23), show all the comments stated by the interviewees along with a scoreboard regarding both designs.

Table 22

Advantages of the New Proposed Pedestrian Walkway Signs

	Interviewees						
Advantages of the new proposed design	1	2	3	4	5	6	Total
It is more organized	✓	✓	–	–	✓	✓	4
The colors are more clear, distinct and attractive – Color choices are more educated and accurate	–	–	✓	✓	✓	✓	4
It has directional information	✓	–	–	✓	✓	–	3
It has more information	✓	–	–	✓	–	–	2
Clearer – No need to compare	✓	–	–	–	–	✓	2
The design is better	✓	–	–	–	–	–	1
The colors give the feeling that this sign is important	–	–	–	✓	–	–	1
Colors must be unified	–	–	✓	–	–	–	1
More signs make information more organized	–	–	✓	–	–	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Table 23

Disadvantages of the Current Pedestrian Walkway Signs

	Interviewees						
Disadvantages of the current design	1	2	3	4	5	6	Total
It is clear that these are for vehicles	–	–	–	–	✓	✓	2
The design is very bad – It is clear that a non-professional person did the design	–	–	–	–	✓	✓	2
No directional or destination information	–	–	–	✓	–	–	1
I do not know where I am	–	–	–	✓	–	–	1
One sign	–	–	✓	–	–	–	1
The color is not distinct nor attractive	–	–	✓	–	–	–	1
No one notices them – they do not grab attention	–	–	–	–	✓	–	1
The information it displays is not up to date or false	–	–	–	–	✓	–	1
Some of them are broken and not maintained well	–	–	–	–	✓	–	1
Some of them are unreadable and not clear	–	–	–	–	✓	–	1
The signs must tell me what services the road has additional to where the road will take me	✓	–	–	–	–	–	1
The white background is very weak and has no contrast when there is bright light	–	–	✓	–	–	–	1

Note. The symbol "✓" is used to note that the interviewee provided a positive response or is in agreement with the argument presented.

Interview Part 5 – Hypotheses Testing

For this part, the interviewees were asked six questions regarding the hypotheses of this research. Three questions were designed to collect information regarding the current wayfinding system. Whereas the other three were designed for the new proposed system. Each question is answered based on the Likert scale from 5 to 1. This part was filled digitally on the data collection form using a Microsoft word document and was not audio recorded. The following table (table 24) displays a scoreboard for all the results gathered from the interviewees.

Questions Regarding the Current Wayfinding System. When the interviewees were asked to give their opinion on the lack of consistency and design quality of the current wayfinding system design, none of the interviewees disagreed or strongly disagreed with the statement. Four interviewees said that they strongly agree, one interviewee agrees while the last one was neutral.

The second statement was asking if the current wayfinding system can work efficiently on its own without the consistent need for additional help from human guidance. Five interviewees strongly disagreed with the statement whereas one interviewee said that they disagree.

The third statement was asking if the icons and symbols used in the current system are not universal enough for most pilgrims to understand. The results were split in half between strongly agree and agree.

Questions Regarding the New Proposed Wayfinding System. Regarding the new proposed system, all interviewees unanimously strongly agreed with the statement asking if pilgrims will benefit from a more unified, consistent, and well-designed wayfinding system. Additionally, they unanimously strongly agreed with the second statement as well. The statement was asking if pilgrims will benefit from using the same color-coding system in the wayfinding system and other related services, such as pilgrims' tags, bracelets, and accessories, to help in quickly identifying specific camps and services. The last statement asked them if the new proposed wayfinding system presented to them during the interview can be understood and used efficiently by pilgrims without the consistent need for additional help from human guides. Only one interviewee strongly agreed with the statement whereas the other five agreed.

Table 24

Likert Scale Results for the Hypotheses Testing

Hypothesis Testing Questions	5 – strongly agree	4 – agree	3 – neutral	2 –disagree	1 – strongly disagree
The current wayfinding system of Al-Hajj is inconsistent and lacks in design quality?	4	1	1	–	–
The current wayfinding system of Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts or police officers.	–	–	–	1	5
The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand.	3	3	–	–	–
During Al-Hajj, pilgrims will benefit from a more unified, consistent and well-designed wayfinding system.	6	–	–	–	–
Pilgrims will benefit from using the same color-coding in pilgrims' camps, wayfinding system and other related services such as pilgrims' tags / bracelets / accessories to help in easily identifying specific camps and services.	6	–	–	–	–
The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts or police officers.	1	5	–	–	–

Online Surveys

Survey Setting and Participants

The survey questionnaire is designed to give straightforward statistical answers regarding the issues presented. However, along with the quantitative questions, a good percentage of the survey was designed to provide the research with qualitative information. In part three of the survey, the participants were asked to provide at least one positive and one negative comment regarding the question they just answered in order to be able to move to the next question in the survey. Providing at least one comment in each section was mandatory to move forward. Although it was not possible to control what kind of comment the participants might insert. Many participants provided amazing insight and comments regarding each question.

The survey started by providing the participants with a brief explanation of the research, the title of the study, who is supporting it, and some background and contact information about the researcher. The survey questions were divided into four main parts. In the first part, participants were asked to provide some demographic information about themselves. The information included their gender, age, nationality, educational level, and additional specifics about their experiences with Al-Hajj in the past.

The second part was dedicated to the symbols and icons identification Test. In this part, each participant was provided with a collection of eight different symbols. Along with each symbol, a group of phrases that suggest some possible meanings for it was available to the participants. The main quest of the questions is to select all the possible phrases that better explain the meaning of the symbol presented.

The third part was assigned to compare both wayfinding systems, the current and the new proposed system. This part included four sets of images. Each set included two images, one from the current wayfinding system and one from the new proposed wayfinding system. For each set, the participants were asked to provide their preferences regarding the design based on some suggested criteria. For each criterion, the participants were given the option of choosing designs A, B, both designs, and neither. However, they can only provide one choice for each criterion. The criteria suggested comparing the systems included, color contrast with the background, color harmony and balance, font choices and sizes, alignment of design elements, design quality, and others. Since the survey was intended to be distributed to the public user, a simple definition underneath some of the criteria was further provided to the participants.

After each set of images, each participant was asked to provide an overall preferred design of the two presented. Then, each participant was asked to provide an advantage or a positive, and a disadvantage or a negative that they see in their preferred choice. This part was mandatory to answer in order to move to the next part of the survey.

The last part of the survey was designed to test the hypotheses established by the researcher. Each participant was asked to provide their opinion based on a Likert scale from 5 to 1 on six different questions.

After finishing the survey, each participant was asked to provide additional comments and contact information. This part of the survey was entirely optional and did not affect the result given by the participants in case they did not respond to it.

The survey was designed using a web-based survey service called SurveyMonkey (http://www.surveymonkey.com). The cost of hosting the survey was around $32 a month. The survey was published for six months then was taken down by the researcher. The survey was distributed via various internet-based means through email, text messages, and social media platforms such as Facebook, Instagram, Snapchat, and WhatsApp. The survey was available for anybody using a laptop, a desktop PC, a smart mobile phone, a tablet, or any other devices that provide access to the web-based services mentioned during the time of the availability of the survey.

Survey Part 1 – Demographic Information

The total number of people who started the survey was 209. However, only 105 participants completed the entire survey, while 20 other participants completed the first two parts only. Moreover, the researcher eliminated the data from one of the participants who completed the entire survey, yet they were younger than 18 years of age. Although the data provided by this participant was valuable, however, their participation was eliminated because they could not have performed Al-Hajj in the past due to their young age. This resulted in 104 completed usable data entries and 20 partial usable data entries.

Accordingly, the results shown forward will take in respect the number of users who completed each part. That means, for the second part, all 124 participants will be considered, while for the third and last part, the results for only 104 participants will be considered. The following table (table 25) shows some basic information regarding the two different groups.

Table 25

The Number of Participants who Completed the Entire Survey or Some Parts of it

Gender	Participants who completed the entire survey	Participants who partially completed the survey (parts 1 and 2)	Total
Male	66	19	85
Female	38	1	39
Total	104	20	124

Additionally, according to the demographic information gathered, it was worth noticing that many participants had experience in performing Al-Hajj before. These data points are essential to this research topic in terms of providing more information and validity to the area of study. Therefore, the results will be organized with respect to the participants' experience of performing Al-Hajj. Moreover, the participants" gender will be counted in the results as well.

Participants who completed the entire survey. Regarding the participants who completed the entire survey, there were 66 male and 38 female participants. The number of participants who are between 25 and 34 years of age was 33. Participants who mentioned that they are between the ages of 35 and 44 were 30, while another 18 said that they are between the ages of 45 and 54. The youngest participants were between the ages of 18 and 24, and they were 15. Six participants stated that they are between 55 and 64 years of age, whereas one participant mentioned that they are older than 65 years of age.

When asked about how many times they performed Al-Hajj in the past, one participant reported that they performed Al-Hajj 20 times. Thirty-three stated that they completed it once before, while 11 mentioned that they performed Al-Hajj more than five times, whereas the rest of the 25 participants stated that they performed it between 2 and 4 times before.

The participants with an educational level of a college or a bachelor's degree were 68. Moreover, there were 26 who stated that their level is a graduate degree (Master's or Ph.D.), while one mentioned that they have a medical degree. The other 9 participants said that their level of education is high-school or less.

Regarding their nationalities, the highest number of participants was 60, and they were from Saudi Arabia. The second highest was from Jordan, with 21 participants. The others were eight from Palestine, seven from Egypt, three from Yemen, and two from

Kuwait. The rest of the participants were one from each of the following countries: Qatar, UAE, Sudan, and Syria. This variety in nationality resulted in a variation in pilgrims' groups as well. Eighty-nine of the participants stated that they are considered as internal pilgrims, while the others mentioned that they are classified within different groups. Among these others, the data showed that nine classify themselves as GCC pilgrims, three are with the other Arab countries, and one is from The Americas (USA, Canada, and South America), Australia, Europe, and Turkey. However, only three mentioned that they are not sure of their classification. That being said, it is vital to note that this question was designed to be a multiple-choice question. This is because the permits for Al-Hajj are given based on the country issuing the permit, and not the applicant's nationality.

All 104 participants stated that Arabic is their native language. However, for their second language, only 98 mentioned English. The other languages mentioned were French (2 participants), Urdu (2 participants), Pashto (1 participant), and Spanish (1 participant)

Regarding having training on Al-Hajj before, 63 mentioned that they had training in school or took some classes, while 38 others mentioned that they read some books or brochures regarding the matter. Five stated that they learned Al-Hajj when they went with their families before, whereas another five said that they had training online or through 2D or 3D simulations. However, 18 participants stated that they never had training on Al-Hajj before.

When asked to state if they had worked or served pilgrims during Al-Hajj before, seven said that they worked as guides, another seven worked with the scouts, and three in the medical care services. Two of the participants mentioned that they worked on different services that are not mentioned in the choices. One of them worked in the Mashaer train while the other one worked as a guide for their family and friends.

Concerning vision-related medical problems, 68 of the participants mentioned that they do not have problems. Twenty-three mentioned that they wear glasses most of their day, while seven wear glasses for reading or screen use. Two participants mentioned that they are colorblind, whereas 6 said that they have one or more of the following conditions: blurry vision, nearsighted, or farsighted. The following table (table 26) shows the detailed demographic information for the participants who completed the entire survey.

Table 26

Demographic Information for the 104 Participants who Completed the Entire Survey

				Times of performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Demographic information		Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Gender	Male	66	63.5%	1	–	8	–	19	–	18	–	20	–	66	–
	Female	38	36.5%	–	0	–	3	–	6	–	15	–	14	–	38
Age groups	18-24	15	14.4%	0	0	0	0	0	0	2	2	9	2	11	4
	25-34	33	31.7%	0	0	0	1	4	2	6	5	6	9	16	17
	35-44	30	28.8%	0	0	3	1	10	3	6	3	1	3	20	10
	45-54	18	17.3%	1	0	3	1	3	0	4	4	2	0	13	5
	55-64	7	6.7%	0	0	2	0	1	1	0	1	2	0	5	2
	65	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Educational level	High-school or less	9	8.7%	0	0	1	1	1	0	1	0	4	1	7	2
	College Degree (Bachelor's degree)	68	65.4%	1	0	5	0	13	1	16	11	12	9	47	21
	Graduate Degree (Master's or Ph.D.)	26	25.0%	0	0	2	2	5	5	1	4	4	3	12	14
	No Education	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Other (medical degree)	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1

Nationality	Saudi Arabia	60	57.7%	1	0	4	3	13	5	8	9	8	9	34	26
	Jordan	21	20.2%	0	0	2	0	2	0	4	2	9	2	17	4
	Yemen	3	2.9%	0	0	0	0	1	0	2	0	0	0	3	0
	Palestine	8	7.7%	0	0	0	0	1	0	3	1	2	1	6	2
	Egypt	7	6.7%	0	0	1	0	2	1	1	0	1	1	5	2
	Qatar	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
	UAE	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
	Sudan	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
	Syria	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
	Kuwait	2	1.9%	0	0	0	1	0	0	0	1	0	0	0	2
Languages	Native - Arabic	104	100.0%	1	0	8	3	19	6	18	15	20	14	66	38
	2nd - English	98	94.2%	0	0	8	1	19	6	18	14	18	14	63	35
	Native - English	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	2nd - Arabic	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	French	2	1.9%	0	0	0	0	1	0	1	0	0	0	2	0
	Urdu	3	2.9%	0	0	0	0	0	0	0	0	3	0	3	0
	Pashto	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	Spanish	2	1.9%	0	0	0	0	0	0	1	0	0	1	1	1

Pilgrims' groups / category	Internal pilgrims	89	85.6%	1	0	7	2	19	6	17	13	14	10	58	31
	GCC Countries Pilgrims	9	8.7%	0	0	0	0	0	0	1	2	4	2	5	4
	Other Arab Countries Pilgrims	3	2.9%	0	0	0	1	0	0	0	0	0	2	0	3
	Africa Pilgrims (non-Arabic)	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	South Asia Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Southeast Asia Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	The Americas (USA, Canada, and South America Countries), Australia, Europe, and Turkey Pilgrims	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
	Iran Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Not sure / I don't know	3	2.9%	0	0	1	0	0	0	0	0	2	0	3	0
Training before going to Al-Hajj	Never had training before	18	17.3%	0	0	0	1	2	1	3	0	7	4	12	6
	In school or took some classes	63	60.6%	0	0	4	0	11	3	12	11	12	10	39	24
	Online or through 2D or 3D simulations	5	4.8%	0	0	0	0	1	0	1	0	2	1	4	1
	Read some books or brochures	38	36.5%	1	0	5	0	11	2	6	7	4	2	27	11
	Other / hajj with family	5	4.8%	0	0	1	2	0	1	0	1	0	0	1	4

Participation in pilgrims' services	Never worked or served	86	82.7%	0	0	4	2	10	6	16	15	19	14	49	37
	Guide	7	6.7%	1	0	1	2	2	0	0	0	1	0	5	2
	Scout	7	6.7%	0	0	2	0	4	0	1	0	0	0	7	0
	Police officer	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Emergency services	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Group leader	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Medical care	3	2.9%	0	0	0	0	3	0	0	0	0	0	3	0
	Other – a guide to family and friends	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
	Other – worked on the Mashaer Train	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Vision-related medical problems	No problems	68	65.4%	1	0	4	1	13	5	12	12	8	12	38	30
	Colorblind	2	1.9%	0	0	0	0	0	0	1	0	1	0	2	0
	Wears glasses most of day	23	22.1%	0	0	3	1	4	1	5	1	6	2	18	5
	Wears glasses for reading or screen use	7	6.7%	0	0	1	1	1	0	1	1	2	0	5	2
	Blurry vision, nearsighted, or farsighted	6	5.8%	0	0	0	0	1	0	0	1	4	0	5	1
	Dyslexia	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Participants who partially completed the survey. Regarding the participants who partially completed the survey, there were 19 male and one female participants. There were 6 participants between the ages of 25 to 34, 5 between the ages of 35 to 44, and four participants for the two ranges between 45 to 54 and 55 to 64. Whereas, only one participant was between the ages of 18 to 24. For their educational level, 15 participants said that they have a bachelor's degree, four had a graduate degree (master's or Ph.D., and one had an educational level of high-school or less.

The participants' nationality varied, as well. Most participants were from Saudi Arabia, with a total number of 11, whereas the second most registered nationality were 6 participants from Jordan. The other three were from North Macedonia, Yemen, and Egypt. Almost all participants spoke Arabic as their native language except for one who said that Jamaican is their first language, and Arabic is their second. For the others, only 15 mentioned that English is their second language, while the rest did not mention anything.

Through all 20 participants, the data collection showed that there was only one participant who performed Al-Hajj five times or more, while eight participants mentioned that they performed Al-Hajj two to four times in the past. Eight other participants mentioned that they performed Al-Hajj only once before, whereas three said that they never perform. As for their group and category when applying to get permission to perform Al-Hajj, 18 participants mentioned that they are categorized as internal pilgrims, while one said that they are in the other Arab countries group. The last one said that they are not sure what their group would be.

When asked about their training about performing Al-Hajj, five participants mentioned that they never had any training regarding the matter. Nine participants stated that they had some training in school, three had training through online or 2D and 3D simulations, and eight said that they read some books or brochures. Additionally, among the participants, some worked or served pilgrims during Al-Hajj. There was one who worked as a police officer, one in emergency services, one as a group leader, and one in medical care. Two participants said that they worked as guides before, while the other three said that they were part of the scout club serving during Al-Hajj. The rest of the 14 participants have never worked or served pilgrims.

None of the participants mentioned that they had any vision-related problems such as colorblindness or dyslexia. However, four of them said they were glasses most of the day, while two said that they were glasses occasionally. Moreover, two mentioned

that they have blurry visions, and they are nearsighted or farsighted. The rest of the participants did not have any vision-related problems. The following table (table 27) shows detailed demographic information of the participants who partially completed the survey.

Table 27

Demographic Information for the 20 Participants who Partially Completed the Survey

				Times of performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Demographic information		Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Gender	Male	19	95.0%	0	-	1	-	8	-	7	-	3	-	19	-
	Female	1	5.0%	-	0	-	0	-	0	-	1	-	0	-	1
Age groups	18-24	1	5.0%	0	0	0	0	0	0	0	0	1	0	1	0
	25-34	6	30.0%	0	0	0	0	1	0	3	0	2	0	6	0
	35-44	5	25.0%	0	0	0	0	4	0	1	0	0	0	5	0
	45-54	4	20.0%	0	0	0	0	2	0	1	1	0	0	3	1
	55-64	4	20.0%	0	0	1	0	1	0	2	0	0	0	4	0
	65	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Educational level	High-school or less	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	College Degree (Bachelor's degree)	15	75.0%	0	0	1	0	6	0	6	0	2	0	15	0
	Graduate Degree (Master's or Ph.D.)	4	20.0%	0	0	0	0	2	0	0	1	1	0	3	1
	No Education	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Nationality	Saudi Arabia	11	55.0%	0	0	1	0	3	0	4	1	2	0	10	1
	Jordan	6	30.0%	0	0	0	0	4	0	1	0	1	0	6	0
	North Macedonia	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Yemen	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Egypt	1	5.0%	0	0	0	0	1	0	0	0	0	0	1	0

Languages	Native - Arabic	19	95.0%	0	0	1	0	8	0	6	1	3	0	18	1
	2nd - English	15	75.0%	0	0	0	0	7	0	4	1	3	0	14	1
	Native - English	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	2nd - Arabic	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Native - Jamaican	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
Pilgrims' groups / category	Internal pilgrims	18	90.0%	0	0	1	0	7	0	6	1	3	0	17	1
	GCC Countries Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Other Arab Countries Pilgrims	1	5.0%	0	0	0	0	1	0	0	0	0	0	1	0
	Africa Pilgrims (non-Arabic)	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	South Asia Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Southeast Asia Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	The Americas (USA, Canada, and South America Countries), Australia, Europe, and Turkey Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Iran Pilgrims	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Not sure / I don't know	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
Training before going to Al-Hajj	Never had training before	5	25.0%	0	0	0	0	1	0	2	0	2	0	5	0
	In school or took some classes	9	45.0%	0	0	1	0	4	0	2	1	1	0	8	1
	Online or through 2D or 3D simulations	3	15.0%	0	0	0	0	2	0	0	1	0	0	2	1
	Read some books or brochures	8	40.0%	0	0	0	0	3	0	3	1	1	0	7	1

Participation in pilgrims' services	Never worked or served	14	70.0%	0	0	0	0	5	0	5	1	3	0	13	1
	Guide	2	10.0%	0	0	0	0	1	0	1	0	0	0	2	0
	Scout	3	15.0%	0	0	1	0	2	0	0	0	0	0	3	0
	Police officer	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Emergency services	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Group leader	1	5.0%	0	0	0	0	1	0	0	0	0	0	1	0
	Medical care	1	5.0%	0	0	0	0	0	0	1	0	0	0	1	0
Vision-related medical problems	No problems	13	65.0%	0	0	1	0	7	0	3	1	1	0	12	1
	Colorblind	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Wears glasses most of day	4	20.0%	0	0	0	0	1	0	3	0	0	0	4	0
	Wears glasses for reading or screen use	2	10.0%	0	0	0	0	0	0	1	0	1	0	2	0
	Blurry vision, nearsighted, or farsighted	2	10.0%	0	0	0	0	0	0	1	0	1	0	2	0
	Dyslexia	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Survey Part 2 – Symbols and Icons Identification Test

In the second part of the survey, each participant was asked to give their opinion regarding the symbol they will see in the following questions. This part included eight different symbols for all participants to look at and give their opinion. Moreover, to minimize the influence of the other symbols' designs, the online survey was designed to change the symbol's order for each participant. In reporting the results, the first four symbols are from the current wayfinding system, while the last four symbols are from the new proposed wayfinding system. Before each symbol, a small thumbnail is presented as a reference. A larger version of all images is available in figures 7 through 14.

The first symbol (see figure 7) is for "WC/ bathrooms for men" from the current wayfinding system. Ninety-two participants got the meaning of the symbol correct, which was the highest voted response making 74.2% of the total responses. Interestingly, the symbol was recognized by males (64 responses) more than females (28 responses). The other three most selected choices were:

- "Rest area for men" received 25 votes making 20.2% of the total responses, 16 of them were males, and 9 were females.
- "Pilgrimage services center for men" received 23 votes making 18.5% of the total responses, 15 of them were males, and 8 were females.
- "Prayer area (for either men or women)" received 7 votes making 5.6% of the total responses, 4 of them were males, and 3 were females.

The second symbol (see figure 8) is for "WC / Bathrooms for women" from the current system as well. The correct meaning received 53 votes making 42.7% of the total responses, which was the highest voted response. Although the scores for this question were lower than the scores for the previous symbol, WC / Bathrooms for men", however, the number of females who gave a correct response (20 females) was higher with respect to males (33 males) than the previous question. The other three most selected choices for this symbol were:

- "Pilgrimage services center for women" received 46 votes making 37.1% of the total responses, 31 of them were males, and 15 were females.

- “Rest area for women” received 44 votes making 35.5% of the total responses, 28 of them were males, and 16 were females.
- “Prayer area for women” received 26 votes making 21% of the total responses, 20 of them were males, and 6 were females.

The third symbol (see figure 9) is for “Al-Mesha-er Al-Hara-m Service Center” from the current system. Interestingly, the correct meaning only received 6 votes (5 males and one female), making 4.8% of the total responses. This score is ranked fifth from the responses reported by participants. However, the highest scores were for “The Holy Mosque (Mecca),” which received 78 votes (61 males and 17 females). This score makes 62.9% of the total responses for this symbol. The other three most selected choices for this symbol that all were ranked higher than the correct meaning, were:

- “Mosque or Prayer Area” received 37 votes making 29.8% of the total responses, 22 of them were males, and 15 were females.
- “Namera Mosque” received 20 votes making 16.1% of the total responses,
- Eleven of them were males, and 9 were females.
- “Religious Guidance Services” received 7 votes making 5.6% of the total responses, 6 of them were males, and one was female.

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The fourth symbol (see figure 10) was for “Sacrification Coupon Kios” from the current system. Similar to the third symbol, the correct meaning for this symbol did not receive the highest votes from the participants. However, the number of votes was higher than the third. The correct meaning received 28 votes (21 males and 7 females), making 22.6% of the total responses. This score makes it the fourth-ranked between the other responses. The highest scores were for “caution: Animals crossing,” which received 40 votes (24 males and 16 females), making 32.3% of the total responses. The other three most selected choices, other than the correct meaning that is ranked fourth, were:

- “An area to sell livestock” received 35 votes making 28.2% of the total responses, 23 of them were males, and 12 were females.

- “Livestock sales offices or areas” received 34 votes making 27.4% of the total responses, 21 of them were males, and 13 were females.
- “Sacrificial Vouchers Sales Office” received 25 votes making 20.2% of the total responses, 17 of them were males, and 8 were females.

The fifth symbol (see figure 11) was for the “Pilgrims Services Center” from the new proposed wayfinding system. The correct meaning for this symbol was the third-highest voted choice by the participants with a score of 21 votes (17 males and 4 females), making 16.9%. However, the highest score was for “Religious Services”, which received 82 votes (57 males and 25 females), making 66.1% of the total responses. The other three most selected choices, other than the correct meaning that is ranked third, were:

- “Prayer Area or Mosque” received 32 votes making 25.8% of the total responses, 22 of them were males, and 10 were females.
- “Religious Area” received 13 votes making 10.5% of the total responses, 7 of them were males, and 6 were females.
- “Resting Area” received 4 votes making 3.2% of the total responses, 3 of them were males and one female.

The sixth symbol (see figure 12) was for the “Information Center” from the new proposed wayfinding system. Interestingly, this symbol received the highest votes for its correct meaning of all the other symbols in this entire section of the survey. The symbol scored 107 votes (72 males and 35 females), which makes 86.3% of the total responses. The other three most selected choices for the symbol included:

- “Guidance Services Center” received 36 votes making 29% of the total responses, 25 of them were males, and 11 were females.
- “Pilgrims Services Center” received 12 votes making 9.7% of the total responses, 9 of them were males, and 3 were females.
- “Police Station” received one vote from a male participant making 0.8% of the total responses

The seventh symbol (see figure 13) was for the “WC / Bathrooms for women” from the new proposed wayfinding system. The correct meaning of this symbol received the highest votes with respect to other choices. It received 65 votes, which makes 52.4% of the total responses. These were 39 by male participants and 26 by females. The other three most selected choices for the symbol included:

- “Resting Area for women” received 35 votes making 28.2% of the total responses, 24 of them were males, and 11 were females.
- “Pilgrims Services Center for Women” received 10 votes making 8.1% of the total responses, 8 of them were males, and 1 were females.
- “WC / Bathrooms for men” received 5 votes making 4% of the total responses, 3 of them were males, and 2 were females.

The eighth and last symbol (see figure 14) is for the “Sacrificial Vouchers Sales Offices” from the new proposed wayfinding system. The correct meaning of this symbol received the second-highest votes. It scored 29 votes (24 males and 5 females), which makes 23.4%. However, the highest score was for “Slaughterhouses,” which received 50 votes (32 males and 18 females), making 40.3% of the total responses. The other three most selected choices other than the correct meaning that was ranked second included:

- “Sacrificial Vouchers Sales Offices” received 29 votes making 23.4% of the total responses, 19 of them were males, and 10 were females.
- “Livestock sales offices or areas” received 28 votes making 22.6% of the total responses, 19 of them were males, and 9 were females.
- “Caution: Animals crossing” received 16 votes making 12.9% of the total responses, 10 of them were males, and 6 were females.

The following tables (tables 28 through 35) show all the results received by the participants concerning all the symbols in this question. It is crucial to point out that in each table, the choices are ranked based on the number of votes and not as they appeared in the survey.

Table 28

Results for WC / Bathrooms for Men from the Current Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
WC/ bathrooms for men (correct meaning)	92	74.2%	1	0	9	3	22	5	17	10	15	10	64	28
Rest area for men	25	20.2%	0	0	0	0	7	2	4	2	5	5	16	9
Pilgrims services center for men	23	18.5%	0	0	0	0	7	0	4	4	4	4	15	8
Prayer area (for either men or women)	7	5.6%	0	0	0	1	0	0	2	2	2	0	4	3
WC / Bathrooms for women	4	3.2%	0	0	0	0	0	0	3	0	1	0	4	0
Security officer	3	2.4%	0	0	0	0	0	0	2	0	1	0	3	0
Pedestrian services	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Other / not clear	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0

Note. The results reported here are for part 2, question 11 and are gathered from all the 124 participants who completed this part.

Table 29

Results for WC / Bathrooms for Women from the Current Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
WC / Bathrooms for women (correct meaning)	53	42.7%	0	0	2	2	12	4	12	8	7	6	33	20
Pilgrims services center for women	46	37.1%	0	0	3	0	14	2	5	6	9	7	31	15
Rest area for women	44	35.5%	0	0	3	1	10	3	8	5	7	7	28	16
Prayer area for women	26	21.0%	1	0	1	0	7	1	5	1	6	4	20	6
Pilgrims services center for men	3	2.4%	0	0	0	1	0	0	1	0	1	0	2	1
Security officer	3	2.4%	0	0	0	1	0	0	1	1	0	0	1	2
Other / an area specific for women	2	1.6%	0	0	0	1	1	0	0	0	0	0	1	1
Other / icon is vague and holds many meanings	1	0.8%	0	0	0	0	0	0	0	1	0	0	0	1
Other / Women’s to this passage	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0

Note. The results reported here are for part 2, question 12 and are gathered from all the 124 participants who completed this part.

Table 30

Results for Al-Mesha-Er Al-Hara-M Service Center from the Current Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
The Holy Mosque (Mecca)	78	62.9%	1	0	3	0	21	5	20	7	16	5	61	17
Mosque or Prayer Area	37	29.8%	0	0	3	0	5	2	7	5	7	8	22	15
Namera Mosque	20	16.1%	0	0	2	1	6	1	1	3	2	4	11	9
Religious Guidance Services	7	5.6%	0	0	0	0	2	0	2	1	2	0	6	1
Al-Mesha-er Al-Hara-m Service Center (correct meaning)	6	4.8%	0	0	0	0	3	0	1	1	1	0	5	1
Pilgrims Services Center	3	2.4%	0	0	0	1	1	0	0	1	0	0	1	2
Other / I do not know	2	1.6%	0	0	0	1	0	0	0	0	0	1	0	2
Other / has more than one meaning	1	0.8%	0	0	0	0	0	0	0	1	0	0	0	1
Other / nuclear weapons	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Guidance Center	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Note. The results reported here are for part 2, question 13 and are gathered from all the 124 participants who completed this part.

Table 31

Results for Sacrification Coupon Kios from the Current Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Caution: Animals crossing	40	32.3%	0	0	3	0	6	3	9	9	6	4	24	16
An area to sell livestock	35	28.2%	1	0	2	1	7	3	8	5	5	3	23	12
Livestock sales offices or areas	34	27.4%	0	0	0	2	9	2	6	4	6	5	21	13
Sacrification Coupon Kios (correct meaning)	28	22.6%	0	0	2	2	8	0	5	4	6	1	21	7
Sacrificial vouchers sales offices	25	20.2%	0	0	0	0	11	1	2	1	4	6	17	8
Slaughterhouses	16	12.9%	0	0	1	0	5	2	5	1	1	1	12	4
Other / I do not know	2	1.6%	0	0	0	1	0	0	0	0	0	1	0	2

Note. The results reported here are for part 2, question 14 and are gathered from all the 124 participants who completed this part.

Table 32

Results for Pilgrims' Services Center from the New Proposed Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Religious Services	82	66.1%	1	0	6	1	22	6	17	8	11	10	57	25
Prayer Area or Mosque	32	25.8%	0	0	2	0	7	1	5	4	8	5	22	10
Pilgrims' Services Center (correct meaning)	21	16.9%	0	0	1	1	7	0	4	3	5	0	17	4
Religious Area	13	10.5%	0	0	0	0	3	0	3	3	1	3	7	6
Resting Area	4	3.2%	0	0	0	1	0	0	0	0	3	0	3	1
Police Station	1	0.8%	0	0	0	1	0	0	0	0	0	0	0	1
Other / reading Qur'an	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Other / library	1	0.8%	0	0	0	0	0	0	0	1	0	0	0	1
WC / Bathrooms	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Note. The results reported here are for part 2, question 15 and are gathered from all the 124 participants who completed this part.

Table 33

Results for Information Center from the New Proposed Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Information Center (correct meaning)	107	86.3%	1	0	9	1	23	6	18	14	21	14	72	35
Guidance services center	36	29.0%	0	0	0	1	10	1	8	5	7	4	25	11
Pilgrims services center	12	9.7%	0	0	0	1	5	0	2	0	2	2	9	3
Police station	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Other / question mark	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Other / needs more clarification	1	0.8%	0	0	0	0	0	0	1	0	0	0	1	0
Resting area	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Note. The results reported here are for part 2, question 16 and are gathered from all the 124 participants who completed this part.

Table 34

Results for Women WC from the New Proposed Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
WC / Bathrooms for women (correct meaning)	65	52.4%	0	0	2	0	9	2	14	13	14	11	39	26
Resting Area for women	35	28.2%	0	0	0	0	5	0	11	8	8	3	24	11
Pilgrims Services Center for women	10	8.1%	0	0	0	0	2	0	3	1	3	1	8	2
WC / Bathrooms for men	5	4.0%	0	0	0	0	1	0	1	0	1	2	3	2
Other / has more than one meaning	2	1.6%	0	0	0	0	0	1	0	1	0	0	0	2
Pilgrims Services Center	1	0.8%	0	0	0	0	1	0	0	0	0	0	1	0
Mosque / Prayer Area	1	0.8%	0	0	0	0	0	1	0	0	0	0	0	1

Note. The results reported here are for part 2, question 17 and are gathered from all the 124 participants who completed this part.

Table 35

Results for Sacrificial Vouchers Sales Offices from the New Proposed Wayfinding System

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Meaning of symbol	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Slaughterhouses	50	40.3%	1	0	0	2	10	3	11	6	10	7	32	18
Sacrificial Vouchers Sales Offices (correct meaning)	29	23.4%	0	0	1	0	8	2	6	4	4	4	19	10
Sacrification Coupon Kios	29	23.4%	0	0	1	0	7	1	9	1	7	3	24	5
Livestock sales offices or areas	28	22.6%	0	0	4	1	7	1	3	5	5	2	19	9
Caution: Animals crossing	16	12.9%	0	0	1	1	2	0	5	2	2	3	10	6
An area to sell livestock	17	13.7%	0	0	2	1	2	1	3	1	5	2	12	5
Other / something to do with animals	1	0.8%	0	0	0	0	1	0	0	0	0	0	1	0
Other / meaning is not clear	1	0.8%	0	0	0	0	0	0	0	1	0	0	0	1

Note. The results reported here are for part 2, question 18 and are gathered from all the 124 participants who completed this part.

Survey Part 3 – Systems Comparison Test

From this part and going forward, the results will represent only 104 participants who completed the entire survey. In this part of the survey, part 3, the participants are presented with four different wayfinding elements with two different designs each. For each element, the participants have to choose the more appealing design regarding the criteria displayed in each question. Then, they have to compare the two designs and choose their preferred one. Lastly, they must provide the survey with the advantages and disadvantages of their preference.

In each set, one of the designs is from the current wayfinding system, whereas the other is from the new proposed wayfinding system. The new proposed system was photoshopped on the same image of the current wayfinding element. Based on a set of criteria, the participants were asked to choose the more appealing design from their point of view. The participants were free to choose either one design, both, or none of the designs if they felt that neither of them had met the criteria. The criteria presented to the participants for each set of elements are:

- Color contrast
- Color harmony and color balance
- Font Choices
- Font Size
- Alignment of design elements
- Symbols and icons are clear and easy to understand
- Design Quality Information display and clarity
- Sign position and location

Since this question included a written section for participants to add their comments, many participants took the chance to give their opinion regarding both designs, although the question instructed that comments should be made regarding their preferred design only. This unexpected contribution was beneficial in terms of collecting more valuable data about both designs to help in criticizing and designing current and future systems. Before each set, two thumbnails are presented as a reference. A larger version of all images is available in figures 15 through 18.

 (image A)  (image B)

Set 1 – The pedestrian walkway legend. The first set of designs is covered by question 19 to question 22 in the survey. In the first two questions, the participants must compare two designs for a pedestrian walkway legend (see figure 15). The new proposed pedestrian walkway legend (image B) received higher votes by participants than the current design (image A), with 89 votes against 15. This makes 85.6% of the total number of participants.

Regarding the design criteria, the highest number of votes received was:

- For color contrast, the new proposed design was favored by 79 participants (76%) over the current design, which received 18 votes (17.3%).
- For color harmony and color balance, 84 participants (80.8%) favored the new design over the current design which received 13 votes (12.5%)
- For font choices, 64 participants (61.5%) chose the new design over 26 participants (25%) who chose the current design.
- For font size, although the new proposed design received 51 votes (49%) against 41 votes (39.4%) for the current design, however, the results are closer for this criterion than the others.
- For the alignment of design elements, the new proposed design was preferred by 70 votes (67.3%) over 20 votes (19.2%) for the current.
- When asked about if the symbols and icons are clear and easy to understand, the new proposed design was preferred by the participants by 64 votes (1.5%). Interestingly, the second most voted choice was that both designs met the criterion by 21 votes (20.2%). The current design only received 17 votes making 16.3% of the total number of responses.
- For design quality, 82 votes favored the new proposed design making 78.8% of the participants. The current design received only 11 votes (10.6%), while 10 participants (9.6%) stated that both designs had met the criterion.
- When asked about information display and clarity, 65 votes (62.5%) were favoring the new proposed design over 20 votes (19.2%) for the current. Interestingly, 16 participants (15.4%) stated that both designs had met the criterion presented.

- The last criterion asked the participants about the sign's position and location. The new proposed design was favored by 60 votes (57.7%) over the current, which received only 18 votes (17.3%). That being said, 24 participants (23.1%) stated that both designs had met the criterion, which is higher than the votes received for the current design.

The following table (table 36) shows all the results for the design criteria and the preferred design by the participants in questions 19 and 20.

Table 36

Results for the Comparison Test for the Pedestrian Walkway Legends

				Times performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Design Criterion	Choices	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color contrast	A	18	17.3%	0	0	1	0	1	2	6	3	4	1	12	6
	B	79	76.0%	1	0	7	3	15	4	11	11	14	13	48	31
	Both	6	5.8%	0	0	0	0	3	0	1	1	1	0	5	1
	Neither	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Color harmony and color balance	A	13	12.5%	0	0	1	0	1	1	6	1	3	0	11	2
	B	84	80.8%	1	0	7	3	15	5	12	12	15	14	50	34
	both	6	5.8%	0	0	0	0	2	0	0	2	2	0	4	2
	neither	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Font choices	A	26	25.0%	0	0	3	1	7	1	5	2	5	2	20	6
	B	64	61.5%	1	0	5	1	9	5	12	9	13	9	40	24
	both	13	12.5%	0	0	0	1	3	0	1	4	2	2	6	7
	neither	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Font size	A	41	39.4%	0	0	3	1	7	2	9	4	10	5	29	12
	B	51	49.0%	1	0	5	1	8	4	9	7	9	7	32	19
	both	10	9.6%	0	0	0	1	4	0	0	3	1	1	5	5
	neither	2	1.9%	0	0	0	0	0	0	0	1	0	1	0	2
Alignment of design elements	A	20	19.2%	0	0	1	0	2	1	5	2	6	3	14	6
	B	70	67.3%	1	0	7	2	12	5	13	8	13	9	46	24

	both	14	13.5%	0	0	0	1	5	0	0	5	1	2	6	8
	neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Symbols and icons are clear and easy to understand	A	17	16.3%	0	0	1	0	3	1	5	3	4	0	13	4
	B	64	61.5%	1	0	5	3	12	4	10	8	11	10	39	25
	both	21	20.2%	0	0	2	0	3	1	3	4	4	4	12	9
	neither	2	1.9%	0	0	0	0	1	0	0	0	1	0	2	0
Design quality	A	11	10.6%	0	0	0	0	1	1	1	1	7	0	9	2
	B	82	78.8%	1	0	7	3	17	4	16	11	11	12	52	30
	both	10	9.6%	0	0	1	0	1	0	1	3	2	2	5	5
	neither	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Information display and clarity	A	20	19.2%	0	0	2	0	1	1	6	2	7	1	16	4
	B	65	62.5%	1	0	5	3	13	4	11	10	10	8	40	25
	both	16	15.4%	0	0	1	0	5	0	1	3	2	4	9	7
	neither	2	1.9%	0	0	0	0	0	1	0	0	0	1	0	2
Sign’s position and location	A	18	17.3%	0	0	1	0	2	1	5	2	5	2	13	5
	B	60	57.7%	1	0	5	3	10	4	12	7	9	9	37	23
	both	24	23.1%	0	0	2	0	7	0	1	6	6	2	16	8
	neither	2	1.9%	0	0	0	0	0	1	0	0	0	1	0	2
Which design is more appealing and well-designed than the other?	A	15	14.4%	0	0	2	0	1	1	4	3	4	0	11	4
	B	89	85.6%	1	0	6	3	18	5	13	13	16	14	54	35

Note. The results reported here are for part 3, questions 19 and 20 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the new proposed design in set 1.

Question 21 asked the participants about the positives and advantages of their preferred design. It was mandatory to provide a written answer to this question to move forward with the survey. The most five mentioned positives and advantages for the preferred design, in this case, the new proposed design with 88 votes (84.6%), were:

- "It has better and clearer design elements (text and icons)," which was stated by 41 participants, which makes 39.4% of their total number.
- Thirty-two participants (30.8%) mentioned that it is attractive, eye-catching, modern, contemporary, creative, professional, leading, and powerful.
- Twenty-five participants (24%) felt that the new design made it easier to receive information.
- "It has better colors that grab attention" was stated by 16 participants (15.4%).
- "The new proposed design is visually comfortable with calm colors" was mentioned by 15 participants (14.4%).
- "It is more organized than the current design" was made by 13 participants, which makes 12.5% of the total number of participants.

Other mentioned comments stated that the new design is "more informative" (10.6%), it is "visible from a distance" (9.6%), and that it is "multilingual" (6.7%).

The following question, question 22, asked the participants about the negatives and disadvantages of their preferred design. Also, it was mandatory to provide a written answer to this question to move forward. The most five mentioned comments for the preferred design (the new proposed design) were:

- "There is too much information" was mentioned by 23 participants (22.3%).
- "The font is small" and "it needs bigger fonts" were mentioned by 21 participants (20.4%).
- Six participants (5.8%) stated that the new design has too many signs, which makes it bothersome to switch between them.
- Five participants (4.9%) thought that the sign is too big.
- "The height of the sign might result in it being harder for all people to be able to read it" was stated by 4 participants, which makes 3.8% of the total number.

Other interesting comments included that the "sign's background is unsuitable" (1.9%), "it takes longer time to read" or "it is difficult to read" (1.9%), and that the "colors used are not good" (1.9%). The following tables (37 and 38) show all the positives / advantages and negatives / disadvantages of the new proposed design.

Table 37

Advantages of the New Proposed Pedestrian Walkway Legend

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Advantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Better and clearer design elements (text and icons)	41	39.4%	0	0	3	3	8	4	6	5	5	7	22	19
Attractive / eye-catching / modern / contemporary / creative / professional / leading / powerful	32	30.8%	1	0	2	0	5	0	5	6	9	4	22	10
Ease of receiving information	25	24.0%	1	0	2	2	3	0	6	3	4	4	16	9
Better colors / grab attention	16	15.4%	0	0	0	0	3	4	2	2	1	4	6	10
Visually comfortable with calm colors	15	14.4%	0	0	0	0	4	1	3	2	2	3	9	6
More organized	13	12.5%	1	0	0	1	2	0	1	2	3	3	7	6
Color harmony and contrast makes it more recognizable	13	12.5%	0	0	1	3	3	1	1	1	2	1	7	6
More informative	11	10.6%	0	0	0	0	1	0	3	3	0	4	4	7
Visible from a distance / sign location is unique	10	9.6%	0	0	1	1	2	0	0	1	2	3	5	5
Multilingual	7	6.7%	0	0	0	0	3	1	1	1	1	0	5	2
Classification of information	7	6.7%	0	0	1	0	1	1	0	1	0	3	2	5
Bigger display area	5	4.8%	0	0	1	0	0	1	2	0	0	1	3	2
Has information about the distance	5	4.8%	0	0	0	0	1	1	0	2	0	1	1	4
The white background	4	3.8%	0	0	0	0	1	0	0	1	1	1	2	2

Simple	3	2.9%	0	0	0	0	1	0	0	2	0	0	1	2
Can be understood without reading the text	3	2.9%	0	0	0	0	1	0	1	0	0	1	2	1
Clearer language	2	1.9%	0	0	0	0	0	0	1	1	0	0	1	1
Bigger icons	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Using universal icons and symbols	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
The design gives the impression that the information is important	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
The sign allows for more people to receive information when there is a big crowd in the area	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Save time and mental energy especially if it was installed in the right location	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
The design gives the impression that the user is appreciated	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0

Note. The results reported here are for part 3, question 21 and are gathered from the 104 participants who completed this part.

Table 38

Disadvantages of The New Proposed Pedestrian Walkway Legend

			Times of performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Too much information	23	22.3%	0	0	2	1	3	3	3	4	3	4	11	12
The font is small / needs bigger fonts	21	20.4%	0	0	0	1	3	1	4	5	5	2	12	9
Too many signs that require switching between them	6	5.8%	0	0	0	0	0	0	0	4	1	1	1	5
The sign is too big	5	4.9%	0	0	0	1	1	1	1	0	1	0	3	2
The height of the sign might result in it being harder for all people to be able to read it	4	3.8%	0	0	0	0	2	0	0	2	0	0	2	2
Unsuitable background	2	1.9%	0	0	0	0	0	1	0	1	0	0	0	2
It takes longer time to read / difficult	2	1.9%	0	0	0	0	0	0	0	2	0	0	0	2
Colors are not good	2	1.9%	0	0	0	0	0	0	1	0	0	1	1	1
Too much white space (between paragraphs)	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Too much white space (space between text and other design elements (boarders)	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Icons might be a bit harder to understand	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Some of the icons are not well developed	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Multilingual support	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Signs are close to the ground	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Too many colors	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Icons are small	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0

Design organization	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Not clear	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
No directional information	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
The Arabic font is not appealing	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Might not be understood to people with Color blindness	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0

Note. The results reported here are for part 3, question 22 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the current design in set 1. For the participants who preferred the current design over the new proposed design, with 18 votes (14.4%), the five most mentioned positives and advantages mentioned were:

- "The current design is simpler and very familiar" was made by 12 participants (11.5%).
- "It is faster to understand just by looking" was made by 5 participants (4.8%).
- "The current design is clearer" was made by 5 participants (4.8%), as well.
- Four participants (3.8%) stated that "the fonts are large and clearer."
- "It is easier to understand" was made by 4 participants (3.8%)

Other mentioned comments included that there are "not too many colors which make it easier to differentiate between the icons" (2.9%), it is "more attractive" (1.9%), and that it has a "suitable height" (1.9%).

For the negatives and disadvantages stated for the current design, the five most mentioned for their preferred design were:

- "It is an old typical design" was made by 8 participants (7.7%).
- There is "no color contrast" was made by 3 participants (2.9%).
- "It needs more colors" was made by 3 participants (2.9%), as well.
- The sign "placement is a bit high" was made by 3 participants (2.9%).
- The design is "difficult to understand" was made by 3 participants (2.9%), as well.

Other mentioned negatives and disadvantages included that the "design is boring or not attractive" (1.9%), it is "not clear" (1.9%), and the "font size is small or not clear" (1.9%). The following tables (39 and 40) show all the results reported by the participants on the positives / advantages and negatives / disadvantages of the current design.

Table 39

Advantages of the Current Pedestrian Walkway Legend

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Advantages of the current design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Simpler designs – very familiar	12	11.5%	0	0	3	0	2	0	5	2	0	0	10	2
Faster to understand just by looking	5	4.8%	0	0	1	0	0	0	1	2	1	0	3	2
Clearer	5	4.8%	0	0	0	0	0	0	1	2	2	0	3	2
Larger and clearer fonts	4	3.8%	0	0	0	0	0	1	2	0	1	0	3	1
Easier to understand	4	3.8%	0	0	0	0	0	2	0	1	1	0	1	3
Not too many colors, which make it easier to differentiate between the icons	3	2.9%	0	0	0	0	0	0	1	1	1	0	2	1
More attractive	2	1.9%	0	0	0	0	0	0	1	0	1	0	2	0
Suitable height	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
One sign has everything / sign size	2	1.9%	0	0	0	0	0	0	0	2	0	0	0	2
Displays important information	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Explains more	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0

Note. The results reported here are for part 3, question 21 and are gathered from the 104 participants who completed this part.

Table 40

Disadvantages of the Current Pedestrian Walkway Legend

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the current design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Old typical design	8	7.7%	1	0	1	0	1	0	2	1	1	1	6	2
No color contrast	3	2.9%	0	0	0	0	1	0	0	1	1	0	2	1
Needs more colors	3	2.9%	0	0	0	0	0	0	2	1	0	0	2	1
Placement is a bit high	3	2.9%	0	0	1	0	1	0	1	0	0	0	3	0
Difficult to understand	3	2.9%	1	0	0	0	1	0	1	0	0	0	3	0
Design is boring / not attractive	2	1.9%	0	0	0	0	1	0	0	0	0	1	1	1
Not clear	2	1.9%	0	0	1	0	0	0	1	0	0	0	2	0
Font size is small / not clear	2	1.9%	0	0	0	0	0	0	2	0	0	0	2	0
Poor quality icons / design	2	1.9%	0	0	0	0	1	0	0	1	0	0	1	1
The sign size is small	2	1.9%	0	0	0	0	0	0	2	0	0	0	2	0
No distance information	2	1.9%	0	0	1	0	0	0	1	0	0	0	2	0
There is no classification or elaboration on what the icons mean	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
Needs experience	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
The sign location is a bit high, which makes it harder to see	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Too little information	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
No multilingual support	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Icons are not aligned	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1

Needs more icons	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
More suitable for cars because of its blue reflective color	1	1.0%	1	0	0	0	0	0	0	0	0	0	1	0

Note. The results reported here are for part 3, question 22 and are gathered from the 104 participants who completed this part.

 (image C)  (image D)

Set 2 – Women's WC / bathroom signs. The second set of designs was covered by question 23 to question 26 in the survey. In the first two questions, questions 23 and 24, the participants had to compare two designs for a Women's WC / bathroom signs (see figure 16). All 104 participants unanimously favored the new proposed design (image D) over the current. Moreover, many of the design criteria received higher scores favoring the new design. The highest number of votes received for design criteria was:

- For color contrast, the new proposed design was favored by 102 participants (98.1%) over the current design, which received one vote (1.0%).
- For color harmony and color balance, 92 participants (88.5%) favored the new design over the current design, which received three votes (2.9%). Interestingly, five participants (4.8%) thought that neither design met this criterion.
- When asked about the font choices, 101 participants (97.1%) chose the new design over one participant (1.0%) who chose the current design. Two votes (1.9%) were registered for both designs meeting the criterion.
- For font size, although the new proposed design received 102 votes (98.1%) against zero votes for the current design. However, one additional vote was registered for both designs meeting the criterion, and one was stated that neither of them did.
- For the alignment of design elements, the new design was preferred by 98 votes (94.2) over one vote (1.0%) for the current. Five participants (4.8%) stated that both designs met the criterion.
- When asked about if the symbols and icons are clear and easy to understand, the new design was favored by 100 votes (96.2%). The second most voted choice was that both designs met the criterion by 4 votes (3.8%). The current design did not receive any votes for this criterion.
- For design quality, 97 votes (93.3%) favored the new design. The current design received no votes, while 6 votes (5.8%) was supporting that both designs had met the criterion.
- Regarding information display and clarity, 99 votes (95.2%) preferred the new proposed design. Three participants (2.9%) stated that both designs had met the criterion, whereas two thought that neither of the designs did.

- The last criterion asked the participants about the sign's position and location. The new proposed design was favored by 97 votes (93.3%) over one vote (1.0%) for the current. Five participants (4.8%) stated that both designs had met the criterion.

The following table (41) shows all the results for the design criteria and the preferred design by the participants in questions 23 and 24.

Table 41

Results for the Comparison Test for the Women's WC Signs

				Times performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Design criterion	Choices	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color contrast	C	1	1.0%	1	0	0	0	0	0	0	0	0	0	1	0
	D	102	98.1%	0	0	8	3	18	6	18	15	20	14	64	38
	Both	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Color harmony	C	3	2.9%	0	0	0	0	0	0	0	0	2	1	2	1
	D	92	88.5%	0	0	8	3	17	5	17	15	17	10	59	33
	Both	4	3.8%	0	0	0	0	0	1	1	0	1	1	2	2
	Neither	5	4.8%	1	0	0	0	2	0	0	0	0	2	3	2
Font choices	C	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
	D	101	97.1%	1	0	8	3	17	6	17	15	20	14	63	38
	Both	2	1.9%	0	0	0	0	1	0	1	0	0	0	2	0
	Neither	0	0.0%	0	0	0	0	0	0	0	0		0	0	0
Font size	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	102	98.1%	1	0	8	3	18	6	18	14	20	14	65	37
	Both	1	1.0%	0	0	0	0	1	0	0	0		0	1	0
	Neither	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Alignment of design elements	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	98	94.2%	1	0	7	3	17	6	18	14	19	13	62	36
	Both	5	4.8%	0	0	1	0	2	0	0	1	0	1	3	2

	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Symbols and icons are clear and easy to understand	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	100	96.2%	1	0	8	3	18	6	17	15	19	13	63	37
	Both	4	3.8%	0	0	0	0	1	0	1	0	1	1	3	1
	Neither	0	0.0%	0	0	0	0	0	0	0	0		0	0	0
Design quality	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	97	93.3%	1	0	8	3	17	5	18	13	19	13	63	34
	Both	6	5.8%	0	0	0	0	1	1	0	2	1	1	2	4
	Neither	1	1.0%	0	0	0	0	1	0	0	0		0	1	0
Information display and clarity	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	99	95.2%	1	0	8	3	17	5	17	14	20	14	63	36
	Both	3	2.9%	0	0	0	0	0	1	1	1	0	0	1	2
	Neither	2	1.9%	0	0	0	0	2	0	0	0		0	2	0
Sign position and location	C	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
	D	97	93.3%	1	0	8	3	18	5	17	13	19	13	63	34
	Both	5	4.8%	0	0	0	0	1	1	0	1	1	1	2	3
	Neither	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Which design is more appealing and well-designed than the other?	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	104	100.0%	1	0	8	3	19	6	18	15	20	14	66	38

Note. The results reported here are for part 3, questions 23 and 24 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the new proposed design in set 2. The next question, question 25, asked the participants about the positives and advantages of their preferred design. The most five mentioned comments in this question regarding the preferred design, in this case, the new proposed design with 100% votes, were:

- "The Design elements are clearer (icons, colors, and text)" made by 56 participants (53.8%).
- "Colors are more attractive and clearer" stated by 37 participants (35.6%).
- The comment that the design is "attractive, modern, creative, professional, powerful, simple, and efficient" was made by 34 participants (32.7%).
- The signs are "visible from a distance," and the "location is unique and easily spotted" collectively made by 29 participants (27.9%).
- Fourteen participants (13.5%) felt that the new design made it "easier to receive and understand information" and that it is "easy to follow."

Other comments mentioned included that it "tells the function of the building from a glance, and it makes identifying the building easier without asking anyone (5.8%), it "does not need previous experience" (3.8%), and its "multilingual support" (2.9%).

The following question, question 26, asked the participants about the negatives and disadvantages of their preferred design. The most five mentioned comments for the preferred design were:

- "Color choices are very bright" was mentioned by 11 participants, which makes 10.6%.
- "font size is small and not clear" was mentioned by 6 participants (5.8%).
- Four participants (3.8%) stated that they found the "mono-color" to be a disadvantage.
- Two participants (1.9%) said that the sign is "not clear enough."
- Two participants (1.9%) stated that the sign is "only for women" to be a disadvantage.

Other interesting comments included that there are "no signs on the street or eye-level" (1.9%), it "needs more languages" (1.9%), and the "large size" of the sign (1.9%). The following tables (42 and 43) show all the results reported by the participants on the positives / advantages and negatives / disadvantages of the new proposed design.

Table 42

Advantages of the New Proposed Women's WC Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Advantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Design elements are clearer (icons, colors, and text)	56	53.8%	0	0	5	2	13	3	9	10	8	6	35	21
Colors are more attractive and clearer	37	35.6%	1	0	0	3	7	4	8	7	2	5	18	19
Attractive / modern / creative / professional / powerful / simple and efficient design	34	32.7%	0	0	5	1	2	2	4	3	13	4	24	10
Visible from a distance / location is unique / easily spotted	29	27.9%	1	0	1	1	3	2	7	5	3	6	15	14
Ease of receiving and understand information / easy to follow	14	13.5%	0	0	3	1	1	0	2	2	3	2	9	5
Tells the function of the building from a glance / makes identifying the building easier and WITHOUT ASKING ANYONE	6	5.8%	0	0	0	0	1	1	2	1	1	0	4	2
Does not need previous experience	4	3.8%	0	0	0	0	1	0	0	1	0	2	1	3
Multilingual support	3	2.9%	0	0	0	0	1	1	1	0	0	0	2	1
The signs contrast to the background (the building)	3	2.9%	0	0	0	0	1	0	1	0	1	0	3	0
Buildings are numbered	3	2.9%	0	0	0	0	0	1	0	2	0	0	0	3
Font choices and sizes	2	1.9%	0	0	0	0	0	0	0	0	0	2	0	2
Larger sign size	2	1.9%	0	0	0	0	1	0	0	0	1	0	2	0

Added an aesthetic element to the surrounding	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
It has more information	2	1.9%	0	0	1	0	0	0	0	0	0	1	1	1
Color coding	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Aligned and organized with the building	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Using icons in the sign	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
It is visible for people who have visual impairments	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Less confusing	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
The design gives the impression that the workers and users are more friendly	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0

Note. The results reported here are for part 3, questions 25 and are gathered from the 104 participants who completed this part

Table 43

Disadvantages of the New Proposed Women's WC Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color choices are very bright	11	10.6%	0	0	1	0	2	1	3	1	0	3	6	5
Font size is small / not clear	6	5.8%	0	0	1	0	1	0	1	0	2	1	5	1
Mono-color	4	3.8%	0	0	0	0	2	0	0	2	0	0	2	2
It's not clear enough	2	1.9%	0	0	0	0	0	0	0	1	0	1	0	2
Only for women	2	1.9%	0	0	0	1	1	0	0	0	0	0	1	1
No signs on the street / eye level	2	1.9%	0	0	0	0	0	1	0	0	1	0	1	1
Needs more languages	2	1.9%	0	0	0	1	0	0	0	0	1	0	1	1
Large size	2	1.9%	0	0	0	0	2	0	0	0	0	0	2	0
Cost of installment	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Font choices	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Too much information	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Might not be suitable for the culture of the area	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
The durability of color / might fade due to the sun	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Colors are only on the top. Better to the doors colored too or a line going down the building	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Design alignment	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0

Note. The results reported here are for part 3, questions 26 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the current design in set 2. As mentioned, none of the participants voted for the current design as their preferred design. Moreover, there were no positives or advantages provided by any participant regarding the current design. However, the five most mentioned negatives and disadvantages for the current design were:

- The design is “not clear” was made by 8 participants (7.7%).
- There is “not enough information” was made by 5 participants (4.8%).
- The design is “not visible from a distance” was made by 4 participants (3.8%).
- Three participants (2.9%) stated that the design has “boring colors.”
- The “design does not tell that the building’s function is WC women” which was made by 3 participants (2.9%).

Other mentioned comments included that there the design is “boring, depressing and has no effect” (1.9%), the “colors are not harmonized” (1.9%), and that the design is “not attractive” (1.9%). The following table (44) shows all the results reported by the participants on the negatives and disadvantages of the current design.

Table 44

Disadvantages of the Current Women's WC Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the current design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Not clear	8	7.7%	0	0	1	1	0	0	3	1	1	1	5	3
Not enough information	5	4.8%	0	0	1	0	2	0	0	1	0	1	3	2
Not visible from a distance	4	3.8%	1	0	0	1	0	0	1	1	0	0	2	2
Boring colors	3	2.9%	0	0	0	0	1	0	1	1	0	0	2	1
The design does not tell the building's function	3	2.9%	0	0	0	0	0	1	0	1	0	1	0	3
Boring / depressing / no effect	2	1.9%	0	0	0	0	1	0	1	0	0	0	2	0
Colors are not harmonized	2	1.9%	0	0	0	0	1	0	0	1	0	0	1	1
Not attractive	2	1.9%	0	0	0	0	0	0	1	0	0	1	1	1
Sign is small	2	1.9%	0	0	0	1	1	0	0	0	0	0	1	1
Sign's colors are the same as the background building which makes it harder to recognize	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
I didn't know what it is until I saw the other one	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Needs experience	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Old typical design	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Poor quality design	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Bilingual only	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
No icons in signs	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Text is not clear	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1

Note. The results reported here are for part 3, questions 26 and are gathered from the 104 participants who completed this part.

 (image E)  (image F)

Set 3 – Camps identification signs. The third set of designs was covered by question 27 to question 30 in the survey. In the first two questions, questions 27 and 28, the participants had to compare two designs for the camps and tents identification signs (see figure 17). Almost similar to the previous set, 103 participants favored the new proposed design (image F), leaving only one participant favoring the current design. Moreover, many of the design criteria received higher scores favoring the new design. The highest number of votes received for design criteria was:

- For color contrast, the new proposed design was favored by 103 participants (99.0%). The remaining vote was stating that both designs met the criterion.
- Concerning color harmony and color balance, 102 participants (98.1%) favored the new design over one (1.0%) favoring the current. Another participant gave their vote for the fact that both designs had met the criterion.
- When asked about the font choices, 101 participants (97.1%) chose the new design over one participant (1.0%) who chose the current design.
- For font size, the new proposed design received 97 votes (93.3%) against zero votes for the current design. Five votes (4.8%) were registered for both designs meeting the criterion.
- For the alignment of design elements, the new design was preferred by 101 votes (97.1%) over zero votes for the current. Two participants (1.9%) stated that both designs met the criterion.
- When asked about if the symbols and icons are clear and easy to understand, the new design was favored by 103 votes (99.0%), while one vote was registered for that both designs had met the criterion.
- For design quality, all 104 participants unanimously favored the new proposed design over the current.
- Regarding information display and clarity, 103 votes (99.0%) preferred the new proposed design. Only one participant (1.0%) stated that both designs had met the criterion.
- The last criterion asked the participants about the sign's position and location. The new proposed design was favored by 99 votes (95.2%) over zero votes for

the current. The remaining five votes (4.8%) stated that both designs had met the criterion.

The following table (45) shows all the results for the design criteria and the preferred design by the participants in questions 27 and 28.

Table 45

Results for the Comparison Test for the Camps and Tents Identification Signs

				Times performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Design criterion	Choices	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color contrast	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	103	99.0%	1	0	8	3	19	6	18	15	20	13	66	37
	Both	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Color harmony	C	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
	D	102	98.1%	1	0	8	3	18	5	18	15	20	14	65	37
	Both	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Font choices	C	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
	D	101	97.1%	1	0	8	3	18	5	18	15	20	13	65	36
	Both	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
	Neither	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Font size	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	97	93.3%	1	0	8	2	19	4	17	15	19	12	64	33
	Both	5	4.8%	0	0	0	1	0	2	1	0	0	1	1	4
	Neither	2	1.9%	0	0	0	0	0	0	0	0	1	1	1	1
Alignment of design elements	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	101	97.1%	1	0	8	2	19	4	18	15	20	14	66	35
	Both	2	1.9%	0	0	0	1	0	1	0	0	0	0	0	2

	Neither	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Symbols and icons are clear and easy to understand	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	103	99.0%	1	0	8	3	19	6	17	15	20	14	65	38
	Both	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Design quality	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	104	100.0%	1	0	8	3	19	6	18	15	20	14	66	38
	Both	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Information display and clarity	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	103	99.0%	1	0	8	3	19	6	17	15	20	14	65	38
	Both	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Sign position and location	C	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	D	99	95.2%	1	0	8	1	19	6	16	15	19	14	63	36
	Both	5	4.8%	0	0	0	2	0	0	2	0	1	0	3	2
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Which design is more appealing and well-designed than the other?	C	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
	D	103	99.0%	1	0	8	3	19	5	18	15	20	14	66	37

Note. The results reported here are for part 3, questions 27 and 28 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the new proposed design in set 3. The next question, question 29, asked the participants about the positives and advantages of their preferred design. The most five mentioned comments in this question regarding the preferred design, in this case, the new proposed design with 99% votes, were:

- The "design and design elements are clearer (icons, fonts, and colors)" made by 49 participants (47.1%).
- It is "easier to follow without asking, easier to differentiate, remember, and navigate" was mentioned by 32 participants (30.8%).
- The "colors are more attractive and clearer" was made by 19 participants (18.3%).
- The comment that the design is "attractive, simple, modern, creative, professional, and powerful" was mentioned by 17 participants (16.3%).
- Eleven participants (10.6%) considered the new design to be "self-explanatory and more informative."

Other positive comments included that the new design is "visible from a distance especially in crowded situations" and "the sign location is unique" (10.6%), the design use of "color coding" (8.7%), and that the "design is more organized" (7.7%).

The following question, question 30, asked the participants about the negatives and disadvantages of their preferred design. The most five mentioned comments were:

- "A mono-color might result in making the eye losing focus from other important wayfinding elements" was made by 6 participants (5.8%).
- The "text is small and not clear" was mentioned by 5 participants (4.8%).
- Two participants (1.9%) stated that they "preferer the white tent-tops over the colored ones."
- Two participants (1.9%) said that there are "too many signs."
- Two participants (1.9%) stated that the signs are "bilingual only."

Other interesting comments included that the signs are "too far from the ground and eye-level" (1.0%), the signs' "cost of installment" (1.0%), and that the "blue color is also used in traffic signs and might be confusing" (1.0%). The following tables (46 and 47) show all the results reported by the participants on the positives / advantages and negatives / disadvantages of the new proposed design.

Table 46

Advantages of the New Proposed Camps and Tents Identification Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Advantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
The design and design elements are clearer (icons, fonts, and colors)	49	47.1%	1	0	6	1	10	2	10	8	5	6	32	17
Easier to follow without asking / easier to differentiate, remember and navigate	32	30.8%	0	0	3	3	7	2	4	5	5	3	19	13
Colors are more attractive / clearer	19	18.3%	0	0	0	1	2	2	5	1	4	4	11	8
Attractive / simple / modern / creative / professional / powerful	17	16.3%	0	0	1	0	2	0	4	4	2	4	9	8
Self-explanatory and more informative	11	10.6%	0	0	1	1	0	2	1	5	1	0	3	8
Visible from a distance especially in crowded situations / sign location is unique	11	10.6%	0	0	1	0	2	0	1	2	0	5	4	7
Color coding	9	8.7%	0	0	0	0	1	2	1	1	2	2	4	5
Design is more organized	8	7.7%	0	0	1	0	2	0	0	1	3	1	6	2
More signs / signs and icons are in multiple places	5	4.8%	0	0	1	0	1	0	0	0	1	2	3	2
Multilingual support	3	2.9%	0	0	0	0	1	1	0	1	0	0	1	2
The colored tips on top of the tents give an indication of the parameter and the scale of the designated area / gives harmony and works together with the function	3	2.9%	0	0	0	0	0	0	1	0	1	1	2	1

Location identification as if it was a flag or a landmark / icon are used to classify Al-Hajj campaigns	3	2.9%	0	0	0	0	2	0	0	0	1	0	3	0
Saves physical and mental energy	2	1.9%	0	0	0	0	0	1	0	1	0	0	0	2
Bigger signs	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Calm colors	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Has directional information	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Larger numbers	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Using icons in the sign	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Lower the chance of pilgrims going into camps that they don’t belong to	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0

Note. The results reported here are for part 3, questions 29 and are gathered from the 104 participants who completed this part.

Table 47

Disadvantages of the New Proposed Camps and Tents Identification Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
A mono-color might result in making the eye lose focus from other important elements	6	5.8%	0	0	0	0	3	1	0	0	2	0	5	1
Text is small / not clear	5	4.8%	0	0	1	0	0	0	0	1	1	2	2	3
Preferer the white tent-tops	2	1.9%	0	0	0	0	0	0	2	0	0	0	2	0
Too many signs	2	1.9%	0	0	1	0	0	0	0	1	0	0	1	1
Bilingual only	2	1.9%	0	0	1	0	0	0	0	0	1	0	2	0
Too far from the ground / eye level	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
Cost of installment	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
The blue color is also used in traffic signs - might be confusing	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Design durability	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Colors are different	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Too simple	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Needs more signs	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Font choices	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Text is not centralized with icons	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Needs to be bigger	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1

Note. The results reported here are for part 3, questions 30 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the current design in set 3. As mentioned, only one participant preferred the current design over the new proposed design. Further, there were no positives or advantages provided by any participant regarding the current design. However, the five most mentioned negatives and disadvantages for the current design were:

- The design is “not clear” was made by 10 participants (9.6%).
- The “information is not visible and harder to differentiate because of the white color” was made by 6 participants (5.8%).
- “There is no useful information,” and there is “no wayfinding information” collectively were made by the same three participants (2.9%)
- Two participants (1.9%) stated that the design is “not attractive.”
- Two participants (1.9%) mentioned that the design is an “old typical design.”

Other mentioned comments included a “poor quality design” (1.0%), a “dry and lifeless design” (1.0%), and that the “signs are not organized or harmonized” (1.0%). The following table (48) shows all the results reported by the participants on the negatives and disadvantages of the current design.

Table 48

Disadvantages of the Current Camps and Tents Identification Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the current design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Not clear	10	9.6%	1	0	1	0	3	0	1	2	1	1	7	3
Information is not visible and harder to differentiate because of the white color	6	5.8%	0	0	0	1	1	1	0	1	1	1	2	4
There is no useful information / no wayfinding information	3	2.9%	0	0	0	0	0	0	1	2	0	0	1	2
Not attractive	2	1.9%	0	0	0	0	0	0	1	0	0	1	1	1
Old typical design	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
Poor quality design	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Dry and lifeless design	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Signs are not organized or harmonized	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Easy to forget	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0

Note. The results reported here are for part 3, questions 30 and are gathered from the 104 participants who completed this part.

 (image G)  (image H)

Set 4 – The pedestrian walkway signs. The fourth set of designs was covered by question 31 to question 34 in the survey. In the first two questions, questions 31 and 32, the participants had to compare two designs for the pedestrian walkway signs (see figure 18). The new proposed design was favored by 102 participants making 98.1% (image H) over current design (image G), which received only two votes. Moreover, many of the design criteria received higher scores favoring the new proposed design. The highest number of votes received for design criteria was:

- For color contrast, the new proposed design received 98 votes (94.2%), while the current design only received one vote. The remaining five votes (4.8%) stated that both designs met the criterion.
- Regarding color harmony and color balance, 100 participants (96.2%) favored the new design over one participant favoring the current. The other three participants (2.9%) gave their votes for the fact that both designs had met the criterion.
- When asked about the font choices, 95 participants (91.3%) chose the new design over five participants (4.8%) for the current design.
- For font size, the new proposed design received 89 votes (85.6%) against 10 votes (9.6%) for the current design.
- For the alignment of design elements, the new design was preferred by 99 votes (95.2%) over one vote for the current. Four participants (3.8%) stated that both designs met the criterion.
- When asked about if the symbols and icons are clear and easy to understand, the new design was favored by 94 votes (90.4%), while only two votes (1.9%) were registered for the current. However, the remaining 8 votes (7.7%) were given for the fact that both designs had met the criterion.
- For design quality, 101 participants (97.1%) favored the new proposed design over one vote for the current design. The remaining two votes were registered for the other two choices.
- Regarding information display and clarity, the new design received 95 votes (91.3%) against three votes (2.9%) for the current. The six remaining participants (5.8%) stated that both designs met the criterion.

- The last criterion asked the participants about the sign's position and location. The new proposed design was favored by 87 votes (83.7%) over one vote for the current. The remaining 15 participants (14.4%) mentioned that both designs had met the criterion.

The following table (49) shows all the results for the design criteria and the preferred design by the participants in questions 31 and 32.

Table 49

Results for the Comparison Test for the Pedestrian Walkway Signs

				Times performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Design criterion	Choices	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color contrast	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	98	94.2%	1	0	8	3	18	6	16	15	19	12	62	36
	Both	5	4.8%	0	0	0	0	1	0	2	0	0	2	3	2
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Color harmony	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	100	96.2%	1	0	8	3	19	6	16	15	19	13	63	37
	Both	3	2.9%	0	0	0	0	0	0	2	0	0	1	2	1
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Font choices	C	5	4.8%	0	0	0	0	2	0	0	0	3	0	5	0
	D	95	91.3%	1	0	8	2	17	6	16	15	16	14	58	37
	Both	4	3.8%	0	0	0	1	0	0	2	0	1	0	3	1
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Font size	C	10	9.6%	0	0	0	0	3	0	2	0	4	1	9	1
	D	89	85.6%	1	0	8	2	16	6	15	14	15	12	55	34
	Both	5	4.8%	0	0	0	1	0	0	1	1	1	1	2	3
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Alignment of design elements	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	99	95.2%	1	0	8	3	18	6	16	15	19	13	62	37
	Both	4	3.8%	0	0	0	0	1	0	2	0	0	1	3	1

	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Symbols and icons are clear and easy to understand	C	2	1.9%	0	0	0	0	0	0	1	0	1	0	2	0
	D	94	90.4%	1	0	8	3	17	6	14	14	18	13	58	36
	Both	8	7.7%	0	0	0	0	2	0	3	1	1	1	6	2
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Design quality	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	101	97.1%	1	0	8	3	18	6	17	15	19	14	63	38
	Both	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
	Neither	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Information display and clarity	C	3	2.9%	0	0	0	0	1	0	0	0	2	0	3	0
	D	95	91.3%	1	0	8	3	18	6	14	14	18	13	59	36
	Both	6	5.8%	0	0	0	0	0	0	4	1	0	1	4	2
	Neither	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Sign position and location	C	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
	D	87	83.7%	1	0	8	2	15	6	15	14	14	12	53	34
	Both	15	14.4%	0	0	0	1	4	0	2	1	5	2	11	4
	Neither	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Which design is more appealing and well-designed than the other?	C	2	1.9%	0	0	0	0	0	0	1	0	1	0	2	0
	D	102	98.1%	1	0	8	3	19	6	17	15	19	14	64	38

Note. The results reported here are for part 3, questions 31 and 32 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the new proposed design in set 4. The next question, question 33, asked the participants about the positives and advantages of their preferred design. The most five mentioned comments regarding the preferred design, in this case, the new proposed design with 98.1% votes, were:

- "Signs are more attractive and crab attention, more organized and more informative" were collectively made by the same 51 participants making 49.0%.
- The "colors are better and grab the attention more" was mentioned by 46 participants (44.2%).
- The comment that the design is "attractive, simple, modern, creative, professional, and powerful" was mentioned by 21 participants (20.2%).
- Sixteen participants (15.4%) stated that the design makes it easier to receive and follow the information.
- Seven participants (6.7%) noted that the design "has directional and destination information."

Other positive comments included that the new design has "multilingual support" (3.8%), the new proposal has "bigger signs" (2.9%), and that it has clearer text (2.9%).

The following question, question 34, asked the participants about the negatives and disadvantages of their preferred design. The most five mentioned comments were:

- Although, the comment that "the text is clearer" was mentioned as an advantage by 3 participants (2.9%), however, 13 participants (12.5%) stated that the "text is small and not clear".
- Two participants (1.9%) stated that the design has "too much information and too many signs.
- Another two participants (1.9%) thought that the design is "a little confusing."
- One participant mentioned that it has "too many and diverse colors."
- Another mentioned that it "needs icons to describe the different areas."

Other interesting comments included that the design "does not reflect the Hajj identity" (1.0%), the "font choices" of the design (1.0%), and "it needs to be a bit higher from the ground" (1.0%). The following tables (50 and 51) show all the results reported by the participants on the positives / advantages and negatives / disadvantages of the new proposed design.

Table 50

Advantages of the New Proposed Pedestrian Walkway Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Advantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Signs are more attractive and crab attention / more organized / more informative	51	49.0%	0	0	7	2	11	0	7	7	7	10	32	19
Colors are better / grab the attention more	46	44.2%	0	0	1	2	6	5	10	4	8	10	25	21
Attractive / simple / modern / creative / professional / powerful	21	20.2%	1	0	2	2	0	2	4	4	5	1	12	9
Ease of receiving / following information	16	15.4%	0	0	2	2	2	3	2	3	1	1	7	9
Has directional and destination information	7	6.7%	0	0	0	0	1	1	0	1	3	1	4	3
Multilingual support	5	4.8%	0	0	0	0	1	1	2	0	0	1	2	2
Bigger signs	3	2.9%	0	0	0	0	0	1	0	2	0	0	0	3
Text is clearer	3	2.9%	0	0	0	0	1	0	1	0	0	1	2	1
Sign position / location is better	3	2.9%	0	0	0	1	0	1	0	1	0	0	0	3
Organizing multiple old signs in one new design / more signs	3	2.9%	0	0	1	0	1	0	0	0	1	0	3	0
Icons are clearer and explained	2	1.9%	0	0	0	0	1	0	0	1	0	0	1	1
Font size	2	1.9%	0	0	0	0	0	1	0	0	1	0	1	1
Using multi colors make receiving information better	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Ease of receiving and following information	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
Font choices	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0

Does not require knowing a language	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Including icons and text	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Helps in organizing people's movement	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Well-designed icons	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
We need more of this	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1

Note. The results reported here are for part 3, questions 33 and are gathered from the 104 participants who completed this part.

Table 51

Disadvantages of the New Pedestrian Walkway Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the new proposed design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Text is small and not clear	13	12.5%	0	0	1	0	4	1	3	0	3	1	11	2
Too much information and too many signs	2	1.9%	0	0	0	0	1	0	0	0	0	1	1	1
A little confusing	2	1.9%	0	0	1	0	0	0	0	0	0	1	1	1
Too many and diverse colors	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Needs icons to describe the different areas	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Does not reflect the Hajj identity	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Font choices	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
It needs to be a bit higher from the ground	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Colors are different	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Colors have no meaning	1	1.0%	0	0	1	0	0	0	0	0	0	0	1	0
No directional arrows	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Not clear	1	1.0%	0	0	0	1	0	0	0	0	0	0	0	1
Does not belong to the space	1	1.0%	0	0	0	1	0	0	0	0	0	0	0	1
A bit boring	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Design alignment	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0

Note. The results reported here are for part 3, questions 34 and are gathered from the 104 participants who completed this part.

Advantages and disadvantages of the current design in set 4. As mentioned, only two participants preferred the current design over the new proposed design. Further, there were no positives or advantages provided by any participant regarding the current design. However, the five most mentioned negatives and disadvantages for the current design were:

- The design is “not clear” was made by 11 participants (10.6%).
- The “directional information is minimal” was made by 5 participants (4.8%).
- The design is “not attractive” was stated by three participants (2.9%).
- Another three participants (2.9%) stated that the design has “poor color choices.”
- Two participants (1.9%) considered the “sign size” a disadvantage.

Other mentioned comments included that the signs’ design is old and typical (1.9%), the design is “very short and brief” (1.9%), and that it has “no contrast with the surrounding” (1.9%). The following table (table 52) shows all the results reported by the participants on the negatives and disadvantages of the current design.

Table 52

Disadvantages of the Current Pedestrian Walkway Signs

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Disadvantages of the current design	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Not clear	11	10.6%	1	0	1	0	2	0	1	3	0	3	5	6
Directional information is minimal	5	4.8%	0	0	0	0	1	1	1	1	1	0	3	2
Not attractive	3	2.9%	0	0	0	0	0	0	1	1	0	1	1	2
Poor color choices	3	2.9%	0	0	0	0	0	0	2	1	0	0	2	1
Sign size	2	1.9%	0	0	0	0	1	0	0	1	0	0	1	1
Old typical design	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
Very short and brief	2	1.9%	0	0	0	0	0	0	1	1	0	0	1	1
No contrast with the surrounding	2	1.9%	0	0	0	0	0	0	0	0	1	1	1	1
Design is weak	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Single language	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Simple	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0

Note. The results reported here are for part 3, questions 34 and are gathered from the 104 participants who completed this part.

Survey Part 4 – Hypotheses Testing

This part of the survey was covered by questions 35 to question 40. In this part, the participants are asked to answer six different questions regarding the research hypotheses. The first three questions, question 35, 36, and 37, asked the participants to give their opinion regarding the current wayfinding systems. On the other hand, the last three questions, question 38, 39, and 40, asked about the new proposed wayfinding systems. Each participant must choose their answers based on a Likert scale rating system from 5 to 1, which 5 means “strongly agree”, 4 means “agree”, 3 means “neutral”, 2 means “disagree,” and 1 means “strongly disagree.” The results of each question were as follows:

- Question 35 asked the participants to state their opinion regarding the following statement: “the current wayfinding system of Al-Hajj is inconsistent and lacks in design quality.” Thirty-five participants (33.7%) stated that they agree with the statement, which was the highest number of responses in this question. The second-highest response received 32 votes (30.7%) from participants who felt neutral. The third highest response was made by 31 participants (29.8%), who mentioned that they strongly agree with the statement.
- Question 36 stated that “the current wayfinding system of Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts, or police officers.” The highest number of responses was made by 32 participants (30.8%) who disagreed with the statement. The second highest received 27 votes (26.0%) from participants who strongly disagreed. The third highest response was made by participants who felt neutral. It received 25 votes (24%).
- In question 37, the participants were asked to give their opinion regarding the statements “the icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand.” The highest score was stated by participants who agree with the statement. They were 39 participants making 37.5% of the total number of responses. The second highest was made by 29 participants (27.9%) who strongly agreed with the statement, while 16 (15.4%) felt neutral.
- Question 38 proposed that “during Al-Hajj, pilgrims will benefit from a more unified, consistent, and well-designed wayfinding system.” The participants who

strongly agreed with the statement were 51 (49.0%), which is almost half of the total number of participants. The second highest was made by 39 participants (37.5%) who agreed with the statement. Twelve (11.5%) felt neutral, while, interestingly, no one strongly disagreed with the statement.

- In question 39, the participants were presented with the statement that says, “pilgrims will benefit from using the same color-coding in pilgrims’ camps, wayfinding system and other related services such as pilgrims’ tags, bracelets, accessories, etc., to help in easily identifying specific camps and services.” Sixty-nine participants (66.3%), which makes more than half of the total number of participants, responded that they strongly agree, while 30 (28.8%) responded that they agree with the statement. The remaining five stated that they felt neutral. Interestingly, none of the participants felt that they disagree or strongly disagree with the statement.
- The last question, question 40, suggested that “the new proposed wayfinding system presented earlier can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts or police officers.” The highest response was made by more than half of the participants, which was 63 participants (60.6%), who felt that they strongly agree. The second highest was made by 36 participants (34.6% who agreed with the statement. Four other participants (3.8%) felt neutral.

The following table (50) shows all the results for part 4 – questions 35 to 40 reported by the participants.

Table 53

Likert Scale Results for the Hypotheses Testing

				Time performing Al-Hajj											
				20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Hypotheses testing questions		Total	%	M	F	M	F	M	F	M	F	M	F	M	F
The current wayfinding system of Al-Hajj is inconsistent and lacks in design quality.	5 – strongly agree	31	29.8%	1	0	0	0	6	3	5	5	2	8	14	16
	4 – agree	35	33.7%	0	0	6	2	7	3	6	2	6	3	25	10
	3 – neutral	32	30.7%	0	0	2	0	6	0	5	7	9	2	22	9
	2 – disagree	4	3.8%	0	0	0	1	0	0	1	0	1	1	2	2
	1 – strongly disagree	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
The current wayfinding system of Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts or police officers.	5 – strongly agree	3	2.9%	0	0	0	1	0	0	0	1	0	1	0	3
	4 – agree	17	16.3%	1	0	1	0	2	1	5	4	2	1	11	6
	3 – neutral	25	23.1%	0	0	2	1	3	3	2	4	5	4	12	12
	2 – disagree	32	30.8%	0	0	2	1	7	0	6	4	9	3	24	8
	1 – strongly disagree	27	26.0%	0	0	3	0	7	2	5	2	3	5	18	9

The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand.	5 – strongly agree	29	27.9%	0	0	2	1	6	3	4	1	4	8	16	13
	4 – agree	39	37.5%	1	0	2	1	10	1	8	7	6	3	27	12
	3 – neutral	16	15.4%	0	0	4	0	0	1	2	3	5	1	11	5
	2 – disagree	12	11.5%	0	0	0	1	2	0	1	3	2	2	5	6
	1 – strongly disagree	8	7.7%	0	0	0	0	1	1	3	1	2	0	6	2
During Al-Hajj, pilgrims will benefit from a more unified, consistent, and well-designed wayfinding system.	5 – strongly agree	51	49.0%	0	0	2	2	10	5	11	5	9	7	32	19
	4 – agree	39	37.5%	1	0	5	1	7	1	6	7	6	5	25	14
	3 – neutral	12	11.5%	0	0	1	0	1	0	1	3	3	2	6	5
	2 – disagree	2	1.9%	0	0	0	0	1	0	0	0	1	0	2	0
	1 – strongly disagree	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
Pilgrims will benefit from using the same color-coding in pilgrims' camps, wayfinding system and other related services such as pilgrims' tags, bracelets, accessories, etc., to help in easily identifying specific c amps and services.	5 – strongly agree	69	66.3%	0	0	2	2	13	6	13	6	15	12	43	26
	4 – agree	30	28.8%	1	0	4	1	6	0	5	8	3	2	19	11
	3 – neutral	5	4.8%	0	0	2	0	0	0	0	1	1	0	3	1
	2 – disagree	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
	1 – strongly disagree	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts or police officers	5 – strongly agree	63	60.6%	0	0	2	1	13	6	11	9	13	8	39	24
	4 – agree	36	34.6%	1	0	6	2	5	0	5	5	6	6	23	13
	3 – neutral	4	3.8%	0	0	0	0	1	0	2	1	0	0	3	1
	2 – disagree	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
	1 – strongly disagree	0	0.0%	0	0	0	0	0	0	0	0	0	0	0	0

Note. The results reported here are for part 4, questions 35 through 40 and are gathered from the 104 participants who completed this part.

Further Comments and Suggestions

After the questions in part 4, the participants were thanked and asked if they have any additional comments or suggestions regarding the topic of the research. Although this part was optional, interestingly, many of the participants made several comments and suggestions that are beneficial to the research and future related studies. The ten most frequent stated comments and suggestions were as follows:

- "Color-coding in general and different for each area" was made by 8 participants (7.7%)
- "Adding additional wayfinding elements on the sidewalks, the ground, or streets that are lit so they can be visible at night." This suggestion was made by 5 participants (4.8%).
- Four participants (3.8%) thought that "the wayfinding system would work better if there were previous training for pilgrims on it."
- Another 4 (3.8%) felt that the system should "use icons instead of texts."
- Three participants (2.9%) recommended "integrating the system and colors with google maps."
- "Font size needs to be bigger in all signs." was made by another three participants (2.9%)
- Two (1.0%) felt that "using many colors could be either a plus or a negative."
- Another two (1.9%) thought that "using tracking chips that link between pilgrims' bracelets and wayfinding elements" can be beneficial.
- Two (1.9%) suggested "using QR codes for smartphones."
- "Developing an app that displays the same system and helps people in understanding it" was made by two participants (1.9%), as well.

The following table (51) shows all the comments and suggestions made by the participants at the closing section of the survey.

Table 54

Comments and Suggestions Provided by The Participants

			Times performing Al-Hajj											
			20 times		5+ times		2 – 4 times		1 time		Never		Score for each gender	
Comments and Suggestions	Total	%	M	F	M	F	M	F	M	F	M	F	M	F
Color coding in general – different for Each area	8	7.7%	1	0	0	0	0	2	2	0	2	1	5	3
Adding additional wayfinding elements on the sidewalks, the ground or streets that are lit so they can be visible at night	5	4.8%	0	0	1	0	0	0	0	1	2	1	3	2
The wayfinding system would work better if there were previous training for pilgrims on it	4	3.8%	0	0	1	0	1	0	1	0	0	1	3	1
Use icons instead of texts	4	3.8%	0	0	0	0	0	0	1	1	0	2	1	3
Integrating the system and colors with Google maps	3	2.9%	0	0	1	0	1	0	1	0	0	0	3	0
Font size needs to be bigger in all signs	3	2.9%	0	0	0	0	1	0	0	1	0	1	1	2
Using many colors could be either a plus Or a negative	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
Using tracking chips that link between pilgrims' bracelets and wayfinding elements	2	1.9%	0	0	0	0	1	0	1	0	0	0	2	0
Using QR codes for smartphones	2	1.9%	0	0	1	0	0	0	1	0	0	0	2	0
Developing an app that displays the same system and helps people in understanding it	2	1.9%	0	0	0	0	0	1	1	0	0	0	1	1
Color choices must be according to	2	1.9%	0	0	0	0	0	0	0	0	0	2	0	2

Universal standards														
Must include a map of the areas – or A You–Are–Here maps	2	1.9%	0	0	0	0	0	1	0	1	0	0	0	2
Including all languages	2	1.9%	0	0	0	0	0	0	1	0	1	0	2	0
Making the system easier for old people	2	1.9%	0	0	0	0	0	1	0	0	1	0	1	1
Including a multilingual brochure that explains the system	2	1.9%	0	0	0	0	0	0	0	1	1	0	1	1
There is a general feeling of good contrast between background (environment) and foreground (design) element	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Adding vocal-based signs with Multilingual support	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Design a specific font for Mecca	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Signs must display precise information	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Using multiple font sizes	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Use unique colors that are not used in other wayfinding systems such as (blue for traffic) and so on	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Using colored tops for the tents is expensive and might not be a good idea	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
Better use unified colored icons	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Efficient and well-designed systems save physical and mental energy and help in assessing pilgrims along their journey	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Making smaller signs in multiple places is better than making multiple signs in one place	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1

Needs lighting	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Using electronic signs	1	1.0%	0	0	0	0	0	0	0	1	0	0	0	1
Reflectors to grab attention	1	1.0%	0	0	0	0	0	0	0	0	1	0	1	0
Better for the design to be inspired by crowd management procedures and techniques	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Designs must be more culturally sensitive (respect different cultures)	1	1.0%	0	0	0	0	0	1	0	0	0	0	0	1
Make the wayfinding system available on the web	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Using more clearer icons	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Adding Hajj campaigns' logos to the camps signs to differentiate them more	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Size is so much important for old age and long-distance	1	1.0%	0	0	0	0	0	0	0	0	0	1	0	1
Adding more signs	1	1.0%	0	0	0	0	1	0	0	0	0	0	1	0
These designs will lower pilgrims' dependence on guides and officers, lower pilgrims' questions, and will lower chances of getting lost	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0
Wayfinding for illiterate people	1	1.0%	0	0	0	0	0	0	1	0	0	0	1	0

Note. The results reported here are from the 104 participants who completed this part.

CHAPTER FIVE –– DISCUSSION

As mentioned earlier, the primary goal of this research is to develop a wayfinding system that pilgrims can rely on and use independently during their journey of Al-Hajj without the consistent need for additional guidance. Accordingly, to achieve this goal, a secondary goal is established to evaluate, examine, and document the efficiency of the current wayfinding system. This process will be performed by, first, applying a set of design theories and principles, and then, through user preferences. This secondary goal will be a significant asset in improving and designing the new wayfinding system proposed by this research and future systems, as well.

The first step, which is evaluating and examining some elements of the current wayfinding system, is presented in "Phase 1: The Analysis of the Current Wayfinding System" in chapter three. The second phase, which is developing the new proposed system based on design theories and principles, is presented in "Phase 2: The Design of the New Proposed Wayfinding System" in chapter three, as well.

The following step is to evaluate and examine both systems based on user preferences. User preferences are collected using the mix-methodology proposed in chapter three. However, since user preferences solely may not constitute a cohesive and convincing argument, the data collected through the methodology of this research is further analyzed based on some of the literature presented earlier under the "wayfinding and disorientation challenges in crowded areas" section in chapter two. By doing so, the research is hoping to create robust and convincing evidence that supports its primary goals and answer all the research questions presented earlier in chapter one.

Since both data collection methodologies were designed to examine, evaluate, and compare specific wayfinding elements from both systems, it is logical first to discuss and study the results for each system independently. Then, the outcomes generated from each independent discussion will be compared with the other. This process will help in organizing all the user preferences data gathered for each specific wayfinding element precisely, and the entire system as a whole.

Interview Part 2 – Assessment of the Current Wayfinding System

Previous Experiences with the System

While answering this question, it was evident that many of the interviewees were frustrated by the lack of wayfinding elements needed to help them explore the complex

environment of some of the areas in Al-Hajj. Whether it was a communication issue or a design issue, it is clear that the wayfinding elements in the current system checked many points towards being inadequate and week according to the results gathered.

This was apparent from the interviewees' reports of the most wayfinding strategies used by pilgrims (see table 8). Alarmingly, the top six strategies (based on a score of two or more) only included a single mention of using the assistance of a wayfinding element, which is using the "giant balloons" as a reference point. Although most of them acknowledge their awareness and recollection of some existing wayfinding elements (see table 9), five interviewees indicated that one of the top possible reasons why pilgrims might get lost is the lack of wayfinding elements, especially signs (see table 10). This result can only suggest that the interviewees did not find the wayfinding system to be reliable enough to use, or they found that other strategies such as "asking others," or even "going all the way back from Arafat to Mecca then traveling from Mecca to Mina" (see table 8), are more effective than trying to use the wayfinding system. Accordingly, this leads to the belief that the wayfinding system lacks proper communication and has issues concerning signs and message display, which are characters of an inadequate wayfinding system.

Another alarming sign was some of the interviewees' views on getting lost during Al-Hajj to be very common and normal. Along with the number of stories of people getting lost and viewing a comment such as "of course we got lost" (interviewee 5), it is only logical to assume that the wayfinding system has lost its credibility to most people. Especially, when all interviewees performed Al-Hajj more than once and yet, they still feel that the wayfinding system is at fault and keep relying on other sources of information to help them. This might be because, during Al-Hajj, all pilgrims must complete several rituals at specific times and in specific areas, which might indicate that relying on sources other than the wayfinding system is more effective in terms of saving time and understanding the surroundings clearly. This is illustrated explicitly in the literature. Many scholars indicate that when people think they might lose their chance of reaching a specific destination in time, they will feel that they are losing control, threatened, stressed, anxious, feel disoriented, frustrated, and angry (Baum, Singer, & Baum, 1982, p. 24, Hidayetoglu, Yildirim, & Akalin, 2012, p. 50). Moreover, dealing with a complex environment or a complicated system also leads to stress and, consequently, wayfinding challenges (Passini, 1996, p. 330).

All these findings show that the most used wayfinding technique by the interviewees is asking others for directions, which is, first, not a wayfinding technique by itself according to (Allen, 1999, p.48-51). Second, it indicates that there is a high dependency on others, whether other pilgrims or official guides, to help along the way. This can further support the claims that the current wayfinding system is inadequate to work on its own and is in a constant need of personal guides.

That being said, since using landmarks is a significant wayfinding technique mentioned by the interviewees, designing wayfinding elements, such as large signs, maps, and informational legends, specifically to work as landmarks to be placed in critical decision points, will help the user in developing a correct and logical wayfinding plan. Moreover, it will help in minimizing the feeling of stress, which will help in creating an easily understandable system by the user.

Recollection of Existing Wayfinding Elements

Another interesting finding is the interviewees' recollection of existing wayfinding elements used in Al-Hajj. Most interviewees mentioned that they recall some specific landmarks, giant balloons on top of the camps, or large billboard sign at the beginning or end of each area. However, looking at the broad areas of Al-Hajj, and to how many years ago they were built, the use of landmarks can be beneficial to a certain point. Also, not many new landmarks can be added easily. Further, the giant balloons' drawbacks were evident in the interviews as they are not always reliable. "The giant balloons might be moved, turned by the wind or simply, they are too far to see." mentioned by interviewees 1 and 3 (see table 10). Lastly, the large billboard signs that only tell pilgrims one specific piece of information, which is the beginning or the end of a particular area. Unfortunately, these signs display information that might not be very helpful to many pilgrims and can only be used at the borders of different areas.

These findings can lead to the belief that the existing wayfinding elements were not properly designed to serve as significant features that work with the surrounding environment and create landmark-like aspects for the benefit of the user. Also, this leads to the belief that the existing wayfinding system did not use a proper hierarchy of elements or take advantage of choice and decision points. This is supported by what the literature indicated earlier as one of the challenges that users might face during wayfinding while commuting through the complex areas of Al-Hajj is that the arrangement of the spatial elements is too complicated for them to understand (Arthur, &

Passini, 1992, p. 39). The literature also indicates that the wayfinding system must provide sequential and straightforward decision plans to decrease stress, work in harmony with the surrounding environment, and must be easy to understand and use (Zimring, 1982, p. 157-163, 161and Passini, 1996, p. 330-331).

Possible Reasons for Getting Lost or Disoriented

The most mentioned reason for getting lost was the intense crowd of pilgrims during the season of Al-Hajj. Many interviewees said that it is harder and more challenging to notice, see, or read some of the wayfinding elements, such as signs, because of the intense crowd, whereas others mentioned that the crowd sometimes forces them to change their initial plan and go in a different direction. Moreover, some suggested that being unfamiliar with the areas of Al-Hajj or being undereducated about the different areas and rituals of Al-Hajj can be a reason for getting lost. However, this last reason was somehow contradicting the fact that two of the interviewees who performed Al-Hajj more than 18 times and were locals to the areas of Al-Hajj, also got lost, and found it challenging commuting the areas. Also, most interviewees had previous training and knowledge about Al-Hajj before they went to perform, and yet, they still got lost at one point or another.

That being said, although, since it is the nature of Al-Hajj to be crowded, it is worthy to note that the intense crowd is not a result of the inadequacy of the current wayfinding system. However, having an adequate, well-thought-out, and educated wayfinding system in such a situation is definitely believed to help with reducing the chaos that might be resulting from this situation, or at least minimizing the stress that might be related to it. This is further supported by the literature indicating that in crowded environments, people need constant feedback on where they are and where to go next. Consequently, wayfinding elements must have the names and numbers of streets, junctions, intersections, and buildings. Also, since Al-Hajj areas are active during day and night, important wayfinding information must be visible and legible at all times (Arthur, & Passini, 1992, p.15).

Interview Part 3, Survey Part 2 – Symbols and Icons Identification Test

Symbols and Icons from the Current Wayfinding System

The symbols under discussion being the men’s bathroom, the women’s bathroom, the Al-Mashaer Al-Moqadasa Services Center, and the Sacrificial coupon kios

(see figures 7 through 10). Although some symbols received higher scores than others in both the interviews and the survey, however, the overall score was not strong enough to indicate that these symbols are adequate wayfinding elements according to some of the measures used in this research. Most of these symbols lack proper communication, displaying ambiguous messages, have a deficiency in displaying information, inaccurate, or, sometimes, unreliable. According to Arthur and Passini, all these are some of the possible reasons why signs and message display during wayfinding can be confusing to the user (Arthur, & Passini, 1992, p. 184-185).

For the men's bathroom symbol, 92 of the participants in the survey, plus 3 of the interviewees identified the symbol accurately. On the other hand, some interviewees stated that they knew it is a symbol for a service that is meant for men; however, they are not confident what it is. This is further supported by the survey results, with a total of 55 votes thinking that this symbol represents a different service for men other than bathrooms. The 55 score is a result of 25 who believed the symbol meant "rest area for men," 23 thought it meant "pilgrimage services center for men." and 7 thought it might be a "prayer area for either gender." (see table 28).

That being said, some interviewees indicated that the symbol might not be suitable in Al-Hajj because it represents a male figure from the Arabian Gulf area who has a specific image that might not be recognizable by all pilgrims, especially first-timers. This further illustrates an issue with the symbol being unclear or not simplified enough for the user (Shalabi, Mariya, & Qndeel, 2013), or not easy to recognize or understand, as well (Zimring, 1982, p. 157-163, 161and Passini, 1996, p. 330-331).

Similar results with different scores were gathered for the women's bathroom symbol. The symbol was recognized correctly by 3 of the interviewees and 53 of the participants in the survey. However, the score of participants thinking that this symbol is representing different services for women other than bathrooms was much higher, with a total of 119 votes as a total of five entries (see table 29).

Moreover, this symbol was criticized by one of the interviewees who had experience in sign fabrication in the past. He mentioned that he never saw this symbol before in any other place. Also, he stated, "However, the niqab is forbidden during Al-Hajj, and women must not wear it." This indicates that the symbol represents false information about women's image in Al-Hajj, which leads to the assessment that this symbol is inaccurate and lacks proper communication, as well. This is strongly supported by what Hall refers to as the contextual meaning of the sign, which indicates

that for a sign to mean the same thing for most people, it has to be in the right context (Hall, 2012, p. 10, 14).

The results for the Al-Mashaer Al-Moqadasa Services Center were alarming since only 6 of the participants in the survey recognized its correct meaning, and none of the interviewees did. The number of votes gathered for the symbol meaning a mosque of some sort (The Holy Mosque, a prayer area, or Namera Mosque), were 135 votes from a total of three entries. Furthermore, during the interviews, even after explaining to the interviewees the symbol's correct meaning, many of them were more confused about the actual meaning of the symbol. This can only lead to the conclusion that not only the symbol itself is ambiguous and confusing, but the explanation given to the user for its meaning is also vague and confusing. Since neither the symbol nor its meaning make sense and do not send or display a proper message to the user, these issues with the symbol present a more significant problem with the wayfinding system of being unreliable (Arthur, & Passini, 1992, p. 184-185).

The results for the last symbol out of the four from the current wayfinding system were a little bit better than the previous one. The symbol representing the sacrificial coupon kios received 28 votes from the survey. However, none of the interviewees knew its correct meaning. The other results were in favor of either an animal crossing symbol (40 votes) or a service that has to do with selling livestock (96 votes as a total for two entries).

Interestingly, during the interviews, the service itself was not recognized and confusing to y many interviewees since they are not aware of a kiosk that sells coupons for sacrificial animals. Some of them were confused by the meaning of the service itself. However, only one interviewee recognized the service and knew what exactly it meant after hearing its correct meaning. Similar to the previous symbol, this can lead to the assumption that the wayfinding system is using ambiguous and confusing explanations and symbols (Arthur, & Passini, 1992, p. 184-185), which is raising concerns regarding the choices made with this wayfinding system.

In conclusion, these four results can indicate that these symbols are not properly communicating the meaning intended, their message display is ambiguous and not clear, or they lack design consistency to tie them together. Consequently, this can easily lead to these elements being unreliable and inadequate, which might result in the entire system to be unreliable and inadequate, as well.

Symbols and Icons from the New Proposed Wayfinding System

The symbols under discussion are the Pilgrims Services Center, the Informational Center, the women's WC, and the Sacrificial Vouchers Sales Offices (see figures 11 through 14). These symbols received better scores than the symbols from the current wayfinding system. However, the overall score still does not indicate that these symbols are strong enough to indicate that they are adequate wayfinding elements.

The Pilgrims Services Center (see figure 11) had better scores than the symbol it is was developed to replace, which is the "Al-Mesha-er Al-Hara-m Service Center" from the current system. Although none of the interviewees knew its correct meaning, while only 21 participants in the survey did, the symbol registered a total of 82 votes for the meaning "religious services," which is a very positive indication comparing it to the previous symbol.

However, the results gathered still do not support that the symbol will communicate well to most pilgrims. By referring to table 32, it is clear that the symbol had scores in almost all of the choices presented, which is a clear sign of confusion and uncertainty. Further, the symbol was not received well by the interviewees since it was considered more confusing than the one from the current system. Some interviewees thought it represents a logo for a university, a library of some sort, or a religious learning center. Moreover, even after telling them its correct meaning, none of the interviewees seem convinced. One of them expressed their opinion by saying, "there is nothing in the symbol to point out what you have specified" (interviewee 6). All these issues indicate that the symbol needs to be more precise and accurate to be able to communicate correctly to the user and avoid any misleading or messages deficiencies that might lead them to lose their way.

The results for the Informational Center symbol (see figure 12) is the best example of a clear, precise, and adequate design that most people will find easy to understand and follow. In both the interviews and the survey, the symbol received very high scores. All interviewees knew its correct meaning, while 107 participants out of 124 voted for its exact meaning. The other significant votes were for "guidance center" and "Pilgrims Services Center," which received collectively, 48 votes.

That being said, it is worthy to note that even with a clear symbol like this, some users might find it challenging to understand. Although the scores were very low, however, one vote was registered to each of the following meanings: "Police Station,"

“Other / Question mark,” and “Other / needs more clarification” (see table 33). The reason behind these choices is still ambiguous and needs further investigation.

The new proposed women’s WC symbol (see figure 13) also received better scores than the women’s bathroom symbol from the current system. Four interviewees and 65 participants knew its correct meaning, which is a very positive reaction. On the other hand, two interviewees and 45 participants (see table 34) indicated that it is a symbol for a service specifically for women. This indication leads to the belief that using a simplified and somewhat an interpretation of a well-known symbol, such as the WC symbol, might not be received very well by many users.

In general, the results from these last two new proposed symbols, the Informational Center and the Women’s WC, indicate that even better interpretations or designs cannot solely force users to receive better information. However, some of the results indicate that by using somewhat a standard reference to develop the symbols, might change the perception of the symbol to the benefit of the user. This is well supported in the literature by Hund, Schmettow, and Noordzij, who indicate that there must be a standard reference for both users and wayfinding system designers or developers to minimize any confusion in the process (Hund, Schmettow, and Noordzij, 2012).

The last new proposed symbol is the “Sacrificial Vouchers Sales Offices symbol (see figure 14), which is developed to replace the “Sacrificial Coupon Kios” symbol from the current system. Similar to the symbol from the current system, the symbol was not received well, nor its correct meaning register high votes. Only two interviewees and 29 participants knew its correct meaning, while the others thought it meant slaughterhouses (50 votes), or an area to sell livestock (28 votes). Also, the meaning “Sacrificial Coupon Kios” received 28 votes, which is a very close score to the one registered for this symbol.

However, on a positive note, since the service of the “Sacrificial Coupon Kios” itself was not understood by many interviewees nor they knew what the coupons are for or what they refer to, one interviewee said immediately after seeing this new proposed symbol, “This is a coupon.” (interviewee 4), while another said, “This means coupon. It has lines as if it were text. This is better.” (interviewee 3). This positively indicates that with some smaller clarifications or tweaks, the symbol can translate better to the users.

Interview Part 4, Survey Part 3 – Systems Comparison Tests

Set 1 – The Pedestrian Walkway Legend

In general, the new proposed pedestrian walkway legend was preferred by the majority of the interviewees and participants in the survey than the current wayfinding legend. The most mentioned advantages of the new proposed design were that it is clearer and easier to understand, its icons and symbols can be understood without reading the text, it has better design elements, and it is multilingual. Moreover, the new proposed designs received high praise for being attractive, eye-catching, modern, contemporary, creative, professional, leading, and powerful. Additionally, in the survey question about design criteria, the new proposed design received higher scores overall than the current design (see table 37).

On the other hand, the new proposed design received its fair share of disadvantages that need to be addressed and solved. The most crucial weakness of the new design that it displays too much information and takes a longer time to read, it has too many signs that require switching between them, and the signs are too big (see table 38). All these issues might result in creating confusion, design clutter, and information overload that the users might find disrupting and challenging (Berger & Grieshaber, 2009, p.41). Also, since pilgrims must complete several rituals at specific times, some of these issues might result in them spending a significant amount of time trying to read and understand such an intricate design. This will definitely lead many of them to feel that they are losing control, stressed and anxious, frustrated, and angry (Baum, Singer, & Baum, 1982, p. 24, Hidayetoglu, Yildirim, & Akalin, 2012, p. 50).

At the same time, interestingly, the current design was praised for having simpler and very familiar designs, being faster to understand just by looking, having larger and clearer fonts, and that one sign has everything (see table 39). This might be related to what Passini refers to as “directed perception,” which he further explains that people will rely on scanning for the information they know where to find rather than learning the system all over again (Passini, 1996, p. 329). However, the current system also received multiple critiques for being only bilingual, has small icons, not organized, crowded, and not visually pleasing (see tables 15). Also, it was weak in terms of being an old and typical design, has no color contrast, boring and not attractive, and has poor quality icons and design (see table 40). Yet, although any other participant did not mention it, one of the most significant comments is made by one of the interviewees who worked in

sign production, indicating that the blue color of the background is known worldwide for roads designated for vehicular movements and not pedestrian use. He further explains because of this inappropriate use of color, this design is not suitable to be a pedestrian legend. This might be related to what is suggested in the literature concerning using a standard reference to help reduce any difficulty in the process of wayfinding (Hund, Schmettow, and Noordzij, 2012).

That being said, although the new design scored better in general, a good number of participants felt that both systems are similar in delivering some of the design criteria such as the sign's position and location, symbols, and icons clearness and ease of understanding, and information display and clarity. This indicates that although the current system did not receive high scores, there are indeed some successful elements and features that some participants felt are very strong. This also indicates that the decision to carry through some of the current wayfinding features to the new design, such as the location and positioning of the sign, and the size of the sign, can be perceived very well by the participants.

Set 2 – The Women's WC Signs

For this design set, none of the interviewees nor the participants in the survey voted for the current women's bathroom signs, which lead to a perfect score in favor of the new proposed design overall, and a majority of scores in it delivering the different design criteria. This might be due to the fact that the current women's bathroom signs are not clear, are very small and not visible from a distance, display very little or not enough information, boring, none attractive, depressing, and unsuccessful at all. Further, as mentioned in the previous discussion, it was noted that pilgrims might not understand the icon and it represents an incorrect interpretation of what women look like in Al-Hajj. Other comments said the icon looks like one of the windows of the building, while another mentioned that even if you are very close to the sign or building, you need a guide to tell you where the service is (see tables 18 and 44). All these issues point to the belief that the current design display ambiguous messages have a deficiency in displaying information, sometimes unreadable and unreliable, and its location causes obstructions and confusions, which all are elements that can cause challenges to users during the wayfinding process (Arthur, & Passini, 1992, p. 184-185). Therefore, it is only logical to conclude that the current women's bathroom sign does not fulfill its purpose of being an adequate wayfinding element.

On the opposite side, the new design was praised for having more attractive and clearer design and colors, is visible from a distance, is trilingual, and its size and color are unique. Also, many participants believed that it is more modern, creative, professional, powerful, simple, and efficient. It is also received praise for ease of receiving and understand information and for it being easy to follow. Concerning its location, many felt the new design's location is unique and easily spotted, especially that it can be seen from all sides of the building (see tables 16 and 42).

However, one of the most significant advantages mentioned was that the icon used is globally known that even children might recognize. Other interviewees said that the design gives an identity to the building, and the numbering of the building helps in differentiating between the buildings. Further, others mentioned it does not require a guide to tell where or what the services are, and it tells the function of the building from a glance, which makes identifying the building easier without asking anyone (see tables 16 and 42).

All these mentioned comments and advantages positively indicate that the new proposed design is providing a well-thought-out wayfinding system that implements a straightforward decision plan, which helps in minimizing stress and make the system easier to understand and use. This is what the literature suggests in terms of achieving proper communication when designing wayfinding systems in crowded areas (Zimring, 1982, p. 157-163, 161, and Passini, 1996, p. 330-331). Additionally, the outcome of the positive tone of the comments can suggest that the new design made the users feel appreciated and respected, which, based on the literature, will help in reducing the amount of stress and anxiety (Shumaker, & Reizenstein,1982, p. 212).

On the other hand, the huge size of the sign, and its manufacturing and installment cost were two of the most significant mentioned disadvantages of the new proposed design. Other concerns were about the appropriateness of the material of the signs and the more subtle colors since the "magenta" is a bit too bright. Also, there was a concern regarding the design being inappropriate for the context of Al-Hajj, which is believed to be due to the bright magenta color, as well (see table 17 and 43). Although the new design did not consider any budget or manufacturing specifications, these comments will be implemented in the future phases of the development and modification of the design.

Set 3 – The Camps and Tents Identification Signs

Similar to the previous set, the new proposed camps and tents identification sign design scored almost a perfect score being the preferred design in the comparison test with only one vote for the current design. This is because the current design was received as being not clear, has no useful information nor wayfinding information, not attractive, and is a typical old design with poor quality. Also, it was described as a dry and lifeless design and easy to forget (see table 48). Further, during the interviews, some interviewees mentioned that the information displayed is hard to understand, and the signs are very difficult to be seen in sunlight because of the white background. Some stated that one of the disadvantages of the system is that it only provides signs on top of the tens and not on most people's eye-level. Others mentioned that the signs might be misleading and will cause people to get lost, which is further explained by some interviewees when they said, "This is a familiar scene for pilgrims. These signs look the same all over the camps area." This persistent issue with the sign being unclear and the white-colored background is a well-documented problem in the literature that can lead to many challenges in the wayfinding process. Since color can be used for identifying spatial elements, color-coding, and as an indication of symbolism, each color must have enough contrast for it to be noticeable and communicate information adequately (Hutchings, 2003, p. 64). Further, since the areas of Al-Hajj are active all day and night during the season, the literature indicates explicitly that all primary wayfinding information must be visible and legible during all times (Arthur, & Passini, 1992, p.15), which is a problem that the current wayfinding system suffers from due to the use of the white-colored background.

On the opposite side, the new proposed design is favored for the use of color-coding and excellent and distinct colors, is very attractive, has many signifiers, more helpful, and that the numbers and letters are explained. Further, the signs are praised for their placement on the fences, for having a bigger size and being clearer, especially in bright sunlight or at night, and the information is more organized. Other advantages included that the design is easier to follow without asking, easier to differentiate, remember and navigate, self-explanatory, and more informative, and that is visible from a distance, especially in crowded situations (see table 19 and 46).

Furthermore, there were several individual interesting observations made to support the new design even more. One was made by one interviewee concerning using Arabic numerals in the new proposed design instead of the Urdu numerals that are used

in the current design. He stated that it makes sense to use Arabic numerals since they supposedly are more familiar and more understandable by most people because they frequently use them in mobile phones and many other applications. Another comment concerning the colored tips on top of the tents stated that the colored tips help in defining a parameter for the camp or the designated area. Another participant noted that the signs could operate as a flag, or a landmark, which will help to distinguish and classify the various Al-Hajj campaigns, while another mentioned that the design helps in saving physical a mental energy (see table 19 and 46).

Undoubtedly, the advantages mentioned above positively point out that the new proposed design is easier to read, understand and follow, which is a very powerful indication to what some of the literature considers what good wayfinding must be (Zimring, 1982, p. 157-163, 161and Passini, 1996, p. 330-331). Also, the use of color-coding can be crucially beneficial in the process of cognitive mapping, which will improve the performance of problem-solving during wayfinding (Kumoğlu, & Olguntürk, 2016).

That being said, however, the new proposed design received multiple disadvantages from several participants. Some of these disadvantages were concerning the text size and choice, cost of installment, and design durability. Others were more conflicting since some mentioned that the new proposal had too many signs, while another participant said that it needs more signs. However, this might be because there are too many signs at the top in comparison to people's eye-level. Although these last issues were not significant in terms of the number of participants who stated them, yet they are well-documented problems that might cause design clutter and information overload on the users (Berger & Grieshaber, 2009, p.41).

Other concerns were regarding the use of color and color-coding in the design. Some said that the mono-color might result in making the eye lose focus from other elements, while some mentioned that the colors are different. Another concern was made regarding the use of the blue color. They said that the color is also used in traffic signs, which might be confusing. Additional comments included some preferences towards the white tent-tops over the colored ones. Nevertheless, since the complete concept of the color-coding and its implementation in the new proposed design is not fully presented to the participants due to the nature of this research (see "wayfinding elements used in phase 2"), these last comments are believed to have different results otherwise.

Set 4 –The Pedestrian Walkway Signs

Similar to the previous two sets, the new proposed pedestrian walkway signs scored the majority of votes with almost a perfect score. On the other hand, the current design only scored two votes for being more preferable. These results are based on the current design's disadvantages that included mentioning that the design is very bad, designed by a non-professional, and clearly is meant for vehicles. Also, some said that the design did not include destination information, display outdated or incorrect information, is sometimes unreadable and not clear. Other comments added that the design is weak, not attractive, does not grab attention, and uses a single language (see tables 23 and 52). From issues of the ambiguity of messages, unreadability, deficiency in displaying information, and displaying inaccurate information, many of these disadvantages of the current design were clearly indicated by Arther and Passini as some of the main reasons signs and messages display might cause challenges during wayfinding (Arthur, & Passini, 1992, p. 184-185).

On the other hand, in general, the new proposed design was favored for being more attractive, simple, modern, creative, professional, and powerful. Additionally, it is recognized for being more organized, more informative, and made it easier to receive and follow information. Also, on the contrary to the current system, it supports multi-languages, has clearer text, and has bigger and multiple signs (see table 22 and 50). However, it is worth mentioning since the new proposed design used almost the same location as the current signs, several participants voted that both designs achieved the design criterion concerning "sign position and location" (see table 49).

While it is true that the new proposed design was more preferable, several participants felt that it displays too much information, has too many signs, and it a bit confusing, which are clear issues in terms of clutter and information overload as noted in the literature earlier (Berger & Grieshaber, 2009, p.41). Other concerns were made regarding the font choices in the signs, the small size of text, and the signs' height and location from the ground. Although the design is not yet implemented in real life and is only evaluated through virtual means, these comments are very beneficial to the design process and development of the new proposed system.

Further, interestingly, some mentioned that the new design does not reflect the Hajj identity, nor it belongs to the space. These remarks are significant since it was believed that Al-Hajj's identity is somewhat vague and lost through the initial assessment of some of the current wayfinding elements completed in previous sections. However,

these comments can clearly point to the areas' hidden identity that got lost over the years through the different stages of development and improvements.

Interview Part 5, Survey Part 4 – Hypotheses testing

As stated earlier in the methodology, this part of the interviews and survey had six questions. The first three questions were testing the hypotheses about the current wayfinding system, while the last three were testing the theories concerning the new proposed wayfinding system. Interestingly though, unlike previous questions, many participants provided a neutral answer, which cannot be considered a supporting or a contradicting result. This left some concerns regarding the structure of the questions and whether it was understood correctly by the participants. Although this assumption cannot be proven, the previous tests conducted through the research methodology can clearly support the claims made by the hypotheses presented**.** All the results presented below can be found in tables 24 and 53.

Hypotheses Concerning the Current Wayfinding System

In general, based on the majority of the participants, all the hypotheses built by the research regarding the current wayfinding system were found to be true. The first hypothesis indicates that, yes, the current wayfinding system used in Al-Hajj is agreed upon to be inconsistent and lacks design quality. This claim is supported by participants who either agree or strongly agree with the statement resulting in a total of 70 votes.

The second hypothesis states that the current wayfinding system cannot help people efficiently on its own throughout their wayfinding journey without the consistent need for additional help from guides, scouts, or police officers. The hypothesis was found to test the adequacy of the current wayfinding system and was supported by 65 votes. Interestingly, 20 participants were in support of the contradictory statement despite some of the results discussed earlier that prove the inadequacy of the current wayfinding to work on its own.

The third hypothesis assumed that the icons and symbols used in the current system are not universal enough for pilgrims to understand. Although this claim was supported by the discussion presented earlier in the "Interview Part 3, Survey Part 2 – Symbols and Icons Identification Test" section, the claim was supported by 74 votes against 19 votes in the hypothesis testing.

Hypotheses Concerning the New Proposed Wayfinding System

Likewise, all the hypotheses established regarding the new proposed wayfinding system were proven to be true. The first hypothesis assumed that, during Al-Hajj, pilgrims would benefit from a more unified, consistent, and well-designed wayfinding system. This hypothesis was constructed to test the validity of the idea that the wayfinding system is a significant part of pilgrims' experiences and fixing it could actually help them. Positively, 96 votes supported this claim against 2.

The second hypothesis suggests that using color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags, bracelets, accessories, etc., to help in easily identifying specific camps and services will be beneficial to pilgrims. This hypothesis was constructed to test the validity of utilizing colors and color-coding into the various services during Al-Hajj. One hundred and five votes supported this hypothesis against no contradictory results.

The third hypothesis stated that the new proposed wayfinding system could be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts, or police officers. This hypothesis was built to test the adequacy and efficacy of the new proposed design and was supported by 105 votes against two.

Summary and Research Questions

As the previous findings indicate, the current wayfinding system exhibited in this research was found by most interviewees, participants, and pieces of literature to be inadequate, inconsistent, and unreliable. Further, the results suggest that for many, the mostly used wayfinding strategies were asking others, landmarks-based piloting, or going back to a place they know how to navigate from (i.e., habitual locomotion) (Allen, 1999, p.48-51).

Furthermore, the results confirmed that the elements of the current wayfinding system mentioned by the interviewees or examined through the other methods are exhibiting various factors of wayfinding and disorientation challenges in crowded areas. On many occasions, the results revealed that the current wayfinding system lacks proper communication and showed various issues in terms of ambiguous message display, deficiency in displaying information, unreadability, inaccuracy, obstructions, and unreliability (Arthur, & Passini, 1992, p. 184-185). Further, some of the system's elements proved to have difficulties in terms of conveying proper contextual meanings

and cultural interpretations, while others showed that they could cause people to waste time and might cause overcrowding.

On the other hand, the new proposed wayfinding system proved to be the preferable choice for the majority of the users. Although some of the symbols presented did not receive high scores in terms of conveying proper messages, however, they scored relatively better when compared to the current system. On many occasions, the new proposed system communicated messages correctly displayed clear, accurate, and readable messages, and used universally-known components such as symbols or numbers. Also, the new system was praised for its utilization of color and color-coding, creating landmarks-like features, and multilingual support.

Answering the Research Questions

All the issues presented, along with what the hypotheses testing showed, can clearly point out valid answers to the research questions. The answers to these questions are based on the interviewees' experiences and remarks, survey answers, and comments, and the hypothesis testing questions presented lastly. The primary two research questions this research is investigating are:

1. *Can the current wayfinding system of Al-Hajj help people find their way efficiently and successfully without the constant need for additional help?*

As most of the previous results and discussion showed, evidently, no, it cannot work on its own.

2. *Will the use of a new well-designed, and unified wayfinding system help pilgrims to efficiently and successfully find their way throughout the journey of Al-Hajj without the constant need for additional help?*

As the majority of the results and discussion discussed previously, the answer is yes, the new proposed system can help pilgrims to efficiently and successfully find their way.

Moreover, the research investigated multiple supporting questions related to the topic. These questions include:

3. *Is the current wayfinding system used in Al-Hajj inconsistent and lacks in design quality?*

Yes, it is. This was proven on multiple occasions throughout the presentation of the results and the discussion.

4. *Are the icons and symbols used in the current wayfinding system universal enough for pilgrims to understand?*

   The second section of the discussion clearly indicates that, no, they are not.

5. *Will pilgrims benefit from using color-coding in pilgrims' camps, wayfinding system, and other related services such as pilgrims' tags, bracelets, accessories, etc., to help in easily identifying specific camps and services?*

   Based on the high praises received for the new system's utilization of colors and color-coding through its various alternatives, the answer to this question is yes; they will.

6. *Can previous training on wayfinding systems minimize people getting lost during their journey in Al-Hajj?*

   The answer to this question is undetermined. Although the literature and the results indicated that some of the pilgrim's groups are engaged in some training before coming to Al-Hajj, however, there was no proper way to test the theory, nor a significant justification for verifying it. Further, two of the most experienced interviewers who are not only locals to the areas, but also performed Al-Hajj more than 40 times collectively (interviewee 1 performed 18+ times, and interviewee 2 performed 25), reported that even they got lost on some occasions. Not to mention that most interviewees reported that they had previous training in the past. However, these later issues contradict what the literature and some of the results show, which only indicates that such a topic needs further and thorough investigation.

CHAPTER SIX — CONCLUSION

This research focuses on investigating the difficulties of wayfinding that pedestrian pilgrims might encounter during their journey of Al-Hajj with the primary goal of developing a new, well-designed, and sufficient wayfinding system that can help in minimizing and solving some of these challenges. Also, the new proposed wayfinding system aims to help in reducing the high and persistent dependence on human guides during the season of Al-Hajj. The new system is developed after a thorough analysis of the current wayfinding system existing to pilgrims at the time of writing this research, along with an extensive investigation of the literature on topics related to wayfinding, Al-Hajj and design theories and principles.

Then, the research carries on examining specific elements and features from both the current and the new proposed wayfinding systems based on user preferences. User preferences are gathered through a mixed-method approach that consists of qualitative and quantitative-based data collection methodologies that use both personal interviews with a selected number of experienced pilgrims, and more widely distributed online surveys.

Each question in the data collection methodologies was designed to test for specific factors and features in each system. The qualitative-based questions provided the research with a tremendous amount of useful input along with comments and suggestions to future developments, while the quantitative-based questions provided a statistical base that the research needs to move forward. Further, some specific questions in the personal interviews helped in documenting some of the incidences and experiences of some pilgrims who performed Al-Hajj more than once, the most remembered wayfinding elements in the current system, and some assumptions about the most common reasons for getting lost during Al-Hajj.

In conclusion, the investigation and examination conducted in this research show that, first, the current wayfinding system is proven to be inadequate and in a persistent need for human guides for it to function. Second, the new proposed wayfinding system was determined to be the more preferred system by the users (both in the interviews and the survey). Additionally, it was concluded that a good and well-designed wayfinding system could work sufficiently on its own without the persistent need for human guides and can increase the efficiency of wayfinding and navigation performances for pedestrian pilgrims during Al-Hajj.

Limitations and Challenges

Participants with similar demographic information. This issue might harm the study validity and reliability since the results might be focused on a specific type of user. During this study, all the interviewees were internal pilgrims, and they spoke Arabic as their first language. This limited the study to deal with experiences and comments that are governed by specific cultural backgrounds. Further, although the online survey was more widely spread to participants, the majority of participants were also from Arabic speaking countries who might share similar cultural backgrounds. This also could have affected the results. Accordingly, having a more diverse group of interviewees and participants is believed to have more significant and different input.

Relying on an online service to run the study. Although many online services are reliable and very useful in spreading information faster than paper-based methods, however, this factor limited the participants to those who use electronic devices only. Also, some participants face some technical issues while taking the survey, which might have affected their performance.

Virtual testing. Since it is nearly impossible to test both systems using a real-life test, the use of screen-based or virtual testing was implemented. Unfortunately, this method left the study with some uncertainty in terms of some of the features that both systems offer. Some of these differences are due to the vast difference in scale between both situations, which affected features such as signs sizes, font sizes, material, and durability. Others are due to the nature of users receiving a virtual design in comparison to experiencing a real-life design placed in a real environment, which might affect issues related to the use and choice of colors, font choices, and amount of text. Not to mention that a virtual design could never replicate or simulate what these users might experience during Al-Hajj, which will impact their input significantly.

Providing choices. Although it might be common to provide participants with multiple choice questions in a survey, however, this might lead many to guess the correct meaning rather than trying to give an honest answer of what they think the answer is. An open-ended question is believed to be more beneficial.

Limited literature on Al-Hajj. Although there was a great amount of literature to review on this topic, however, the amount of literature that was found specifically on the topic of Al-Hajj, while conducting this research, was not significant. This might have left some uncovered gaps and unturned stones in terms of covering this vast topic of research.

Future Comments and Suggestions

The qualitative parts of the interviews and survey helped in gathering many useful and interesting comments and remarks regarding the research topic, the systems in question, and the future of the study. To help in categorizing them, these comments are divided into three parts:

A. Supporting comments

- Using universally-known components, such as symbols, icons, and numbers.
- Using design components of clear and straightforward meaning that can be understood by children or without asking others.
- Utilizing colors and color-coding for the different areas of Al-Hajj.
- Multilingual support.
- Larger signs with larger text.
- Signs are visible from a distance.
- Displaying more information.
- Elaborating on what some elements (such as camp's numbers) actually mean.
- Displaying distance and directional information.
- If the goal is for pilgrims to stand in front of the signs to read them, then its design is perfect
- Less confusing.
- There is a general feel of good contrast between background (environment) and foreground (design) element.
- Efficient and well-designed systems save physical and mental energy and help in assessing pilgrims along their journey

B. Contradicting comments

- Too many signs.
- Too much information.
- The design does not reflect the identity of Al-Hajj.
- Colors are a bit too bright or inappropriate.
- Text is too small and font choices are not good.
- Cost of installment and design durability such as large WC signs and colored tents-tops.

C. Comments for future consideration

- Introducing educational or training programs to pilgrims before they come to perform Al-Hajj. This is believed to have significant impacts on not only wayfinding experiences but also, on how pilgrims behave and deal with the customs of Al-Hajj.
- Signs should display the camp's location and other services available along specific streets or within certain areas.
- Introducing more street curbs or walkways near main roads or streets designated for vehicular movements to help in situations of people getting out of their vehicles in the middle of traffic jams.
- Develop and distribute multilingual brochures and handouts that include all maps, locations, and services available in the areas, along with all the necessary practices and rituals that pilgrims need to complete.
- The camp areas must include signs that convey useful information and can be understood easily. Signs must include the name of the pilgrims' group or the camp name and not only displaying a number or a letter.
- Symbols must be accompanied with complementary text explaining.
- Introducing a special typeface and identity design for Al-Hajj.
- Adding additional wayfinding elements on the sidewalks, the ground or streets that are lit so they can be visible at night.
- Integrating the system and colors with Google maps.
- Using tracking chips that link between pilgrims' bracelets and wayfinding elements.
- Using QR codes for smartphones.
- Developing an app that display the same system and helps people in understanding it.
- Must include a map of the areas or A YAH maps.
- Adding Multilingual voice-based signs.
- Making smaller signs in multiple places is better than making multiple signs in one place.
- Adding lights.
- Using electronic signs.

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Appendix A —- IRB form

UNIVERSITY OF MINNESOTA

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NOT HUMAN RESEARCH

April 30, 2019 Barbara Martinson 612-624-4239

bmartins@umn.edu

Dear Barbara Martinson:

On 4/30/2019, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Wayfinding Systems Design for Crowded Areas: How Can the Wayfinding System Increase the Efficiency of Pilgrims' Wayfinding Performance During their Journey of the Islamic Pilgrimage (Al-Hajj).
Investigator:	Barbara Martinson
IRB ID:	STUDY00006393
Sponsored Funding:	None
Grant ID:	None
Internal UMN Funding:	None
Fund Management Outside University:	None
IND, IDE, or HDE:	None
Documents Reviewed with this Submission:	study protocol - Amer.docx, Category: IRB Protocol; Interviews _ Consent Form _ bilingual - Amer.docx, Category: Consent Form; Focus Groups _ Consent Form _ bilingual - Amer.docx, Category: Consent Form; Online Survey _ Consent Form _ bilingual - Amer.docx, Category: Consent Form; Data Collection Forms - Amer.docx, Category: Recruitment Materials;

Since this project is designed to help in creating a comprehensive understanding of how users perceive and prefer systems in crowded areas the IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations. To arrive at this determination, the IRB used “WORKSHEET: Human

Research (HRP-310).” If you have any questions about this determination, please review that Worksheet in the HRPP Toolkit Library and contact the IRB office if needed.

You do not need to use the consent documents as submitted. If you do, please remove all references to IRB review/approval including the contact information.

Ongoing IRB review and approval for this activity is not required; however, this determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether IRB review is required, please submit a Modification to the IRB for a determination.

Sincerely,
Jeffery P Perkey, CIP, MLS IRB Analyst

We value feedback from the research community and would like to hear about your experience. The link below will take you to a brief survey that will take a minute or two to complete. The questions are basic, but your responses will help us better understand what we are doing well and areas that may require improvement. Thank you in advance for completing the survey.

Even if you have provided feedback in the past, we want and welcome your evaluation. https://umn.qualtrics.com/SE/?SID=SV_5BiYrqPNMJRQSBn

Appendix B –– Interviews Data Collection Form

Participant name: _____ Code #: _____

الجزء الأول – المعلومات الديموغرافية

PART 1 – DEMOGRAPHIC INFORMATION

1. Gender / الجنس
   - Male / ذكر
   - Female / أنثى
   - Rather not say / فلأضل عدم القول
2. Age / العمر
   - Under 18 أقل من
   - 18 – 25
   - 25 – 35
   - 35 – 45
   - 45 – 55
   - 55 – 65
   - Older than 65 أكبر من
3. Nationality / الجنسية

_____

4. Language / اللغة
   - Tongue or Native Language / اللغة الأم_____
   - Second Language / اللغة الثانية_____
   - Other, please specify / إجابة أخرى _____
5. Educational Level (choose one) / المستوى التعليمي
   - High-school or less / مرحلة ثانوية أو أقل
   - College Degree (Bachelor's degree) / (درجة البكالوريوس) جامعي
   - Graduate Degree (Master's or PhD) / (الدراسات العليا) ماجستير أو دكتوراه
   - No Education (illiterate) / (بدون تعليم) أمي
   - Other, please specify / إجابة أخرى _____
6. كم عدد المرات التي أديت فيها فريضة الحج؟

   How many times have you performed Al-Hajj?
   - 1 time / مرة واحدة

- 2 – 4 times / من ٢ -٤ مرات
- 5+ times / أكثر من ٥ مرات
- Never performed Al-Hajj before / لم أؤدي فريضة الحج مسبقاً
- Other, please specify / إجابة أخرى _____

7. لأي من مجموعات التصاريح التالية تنتمي؟ (ستعتمد مجموعات الحجاج على الدولة التي صدرت منها تصاريح الحج الخاصة بك)

Which group of pilgrims do you identify with / belong to? (your group will be depending on the place that issued your Hajj permit / authorization / license)

- حجاج الداخل (التصاريح الصادرة من داخل السعودية)
  Internal Pilgrims (permit issued from inside Saudi Arabia)
- حجاج دول مجلس التعاون الخليجي (التصاريح الصادرة من أحد الدول التالية: الإمارات، البحرين، قطر، الكويت وعُمان)
  G.C.C Countries Pilgrims (The Gulf Cooperation Council) *(United Arab Emirates (UAE), Saudi Arabia, Qatar, Kuwait, Oman, and Bahrain)*
- حجاج الدول العربية الأخرى (التصاريح الصادرة من أي دولة عربية غير مذكورة سابقاً)
  Other Arab Countries Pilgrims (other than the countries mentioned above)
- حجاج دول أفريقيا غير الناطقين بالعربية
- Africa Pilgrims (non-Arabic)
- حجاج جنوب آسيا
  South Asia Pilgrims
- حجاج جنوب شرق آسيا
  Southeast Asia Pilgrims
- حجاج دول الأمريكيتان (الولايات المتحدة، كندا، دول أمريكا الجنوبية)، حجاج أستراليا، حجاج أوروبا و حجاج تركيا
  The Americas (USA, Canada and South America Countries), Australia, Europe and Turkey Pilgrims
- حجاج إيران
  Iran Pilgrims
- ليست متأكداً / لا أعرف تصريف مجموعتي
- Not sure / I don't know

8. هل حصلت على تدريب أو أي معرفة مسبقة عن كيفية أداء فريضة الحج؟

Have you ever had previous training / knowledge regarding how to perform Al-Hajj?

- لا - لم أحصل على تدريب أو أي معرفة مسبقة

- No – Never had training before
- نعم في المدرسة أو عن طريق دروس أو محاضرات خصوصية
  Yes – in school or took some classes
- نعم - أونلاين أو عن طريق الإنترنت أو عن طريق المحاكاة ثنائية أو ثلاثية الأبعاد
  Yes - online or through 2D or 3D simulations
- نعم - قرأت بعض الكتب أو المنشورات
  Yes – read some books or brochures
- Other, please specify / إجابة أخرى _____

9. هل سبق وأن عملت أو خدمت الحجاج خلال أحد مواسم الحج في المناطق المخصصة للحج؟
   Have you ever worked with or served pilgrims during Al-Hajj season at the areas of Al-Hajj?
   - لا - لم يسبق لي العمل أو خدمة الحجاج
     Never worked with or served pilgrims
   - نعم - عملت كدليل أو مرشد عام
   - Yes – As a Guide
   - نعم - عملت في الكشافة أو الجوالة
   - Yes – As a Scout
   - نعم - عملت كضابط شرطة أو ضمن السلك العسكري
     Yes – As a police officer
   - نعم - عملت في خدمات الطوارئ الإسعاف، الإنعاش، إطفاء حريق، عمليات الهبوط الاضطراري، الخ)
   - Yes – As an emergency services (EMT, fireman, evacuation units, etc...)
   - نعم - عملت كقائد مجموعة حجاج أو مطوف
   - Yes – As a pilgrims group leader or Mutawaf
   - نعم - عملت في أحد الخدمات الصحية (طبيب عام، طبيب طوارئ، جرَّاح، الخ)
     Yes – As a medical care personnel, a doctor or a paramedic
   - Other, please specify / إجابة أخرى _____

10. هل لديك أو تعاني من أحد الحالات الطبية التالية التي قد تؤثر على مستوى نظرك أو مستوى الرؤية لديك؟
    Do you have any of the following medical conditions that might affect your sight / eye performance?
    - لا - لا أعاني من أي حالات طبية قد تؤثر على مستوى النظر أو الرؤية لدي
      No – I do not have problems or medical conditions that might effect might eye sight

- نعم – أنا مصاب بعمى الألوان
- Yes, I am color blind
- نعم - ألبس النظارات أو العدسات معظم ساعات اليوم / لا أستطيع الرؤية بشكل واضح بدون لبس نظارات أو عدسات
- Yes, I wear glasses on a regular basis / most of the day
- نعم - ألبس النظارات أو العدسات أحياناً فقط / أحتاج النظارات أو العدسات عند القراءة أو لرؤية الأجسام البعيدة
- Yes, I wear glasses occasionally / specifically for reading or screen use
- نعم - نظري مشوش / لدي قصر نظر أو بعد نظر
- Yes, I have blurry vision / I am near or far sided
- نعم – أعاني من مرض الديسلكسيا / مرض عسر القراءة
  Yes, I have dyslexia
- Other, please specify / إجابة أخرى ________________________

الجزء الثاني – تقييم نظام الإرشاد والتوجيه الحالي (سيتم تسجيل هذا القسم صوتياً)

PART 2 – ASSESMENT OF THE CURRENT WAYFINDING SYSTEM (this part will be audio recorded)

11. خلال أدائك فريضة الحج، هل تستطيع أن تتذكر أمر حدث أو تجربة لها علاقة بنظام الإرشاد والتوجيه الحالي يتطلب أنك أو أحد من تحب من عائلتك أو معارفك احتجتم مساعدة لمعرفة الطريق، ضللتم الطريق، أو انفصلتم عن مجموعتكم، عائلتكم أو حملتكم؟ وكيف تعاملتم مع الموضوع حينها؟

    During your journey of Al Hajj, can you recall an incident / experience with the current wayfinding system where you or a loved one needed help to find your/their way, got lost or separated from your/their group/family? And how you/they handled it?

12. خلال أدائك فريضة الحج، هل تستطيع أن تتذكر أمر حدث أو تجربة لها علاقة بنظام الإرشاد والتوجيه الحالي حدثت لأحد الحجاج الذين قد تعرفهم أو الذين تعاملت معهم بشكل عرضي تطلبت مساعدة لمعرفة الطريق، ضل الطريق، أو انفصل عن مجموعته، عائلته أو حملته؟ وكيف تعاملتم وتعامل هو/هي/هم مع الموضوع حينها؟

    During your journey of Al Hajj, can you recall an incident / experience of a pilgrim (or pilgrims) who you might just met or encountered who needed help to find their way, got lost or separated from their groups/families? And how they handled it?

13. خلال أدائك فريضة الحج، هل تستطيع أن تتذكر عنصر من عناصر الإرشاد التابعة للوحات ارشادية مميزة، خرائط "أنت هنا"، منشورات، ملصقات، مباني مميزة، الخ... (التي تستخدم للتمييز بين المكان والآخر) إذا واجهتك مشكلة معينة او أردت معرفة الطريق أو الاتجاه؟

    During your journey of Al Hajj, can you recall a wayfinding element (map, YAH map,

a group of signs, brochure, landmark, etc…) that you used or turned to frequently whenever you encountered a problem navigating the areas or wanted to find your way?

14. برأيك، ما هي الأسباب التي قد تؤدي إلى ضياع الحجاج أو فصلهم عن مجموعاتهم أو عدم معرفتهم طريقهم خلال وجودهم في أماكن الحج المختلفة؟

In your opinion, what are the reasons that might result in pilgrims lose their way, get lost or get separated from their groups or families during their journey of Al-Hajj?

الجزء الثالث: اختبار تحديد الرموز والإشارات (هذا الجزء سيتم تسجيله صوتياً)

PART 3 – SYMBOLS AND ICONS IDENTIFICATION TEST (this part will be audio recorded)

برأيك، ماذا تعني الإشارات التالية؟

In your opinion, what does the following symbol represent?

15. Image (A) 

هذه الصورة تعني حمامات أو دورات مياه للرجال، ما رأيك؟

This image means WC/ bathrooms for men, do you have an opinion regarding that?

16. Image (B) 

هذه الصورة تعني حمامات أو دورات مياه للنساء، ما رأيك؟

This image means WC/ bathrooms for women, do you have an opinion regarding that?

17. Image (C) 

هذه الصورة تعني مركز خدمات المشاعر الحرام، ما رأيك؟

This image means Al-Mesha-er Al-Hara-m Service Center, do you have an opinion regarding that?

18. Image (D) 

هذه الصورة تعني أكشك الكوبونات لهدي أو الأضاحي، ما رأيك؟

This image means Scarification Coupon Kiosk, do you have an opinion regarding that?

19. Image (E) 

هذه الصورة تعني مركز خدمات حجاج، ما رأيك؟

This image means Pilgrims Services Center, do you have an opinion regarding that?

20. Image (F) 

هذه الصورة تعني مركز المعلومات، ما رأيك؟

This image means Information Center, do you have an opinion regarding that?

21. Image (G) 

هذه الصورة تعني حمامات أو دورات المياه النساء، ما رأيك؟

This image means WC/ bathrooms for women, do you have an opinion regarding that?

22. Image (H) 

هذه الصورة تعني مكتب بيع قسائم الأضاحي، ما رأيك؟

This image means Sacrificial Vouchers Sales Offices, do you have an opinion regarding that?

الجزء الرابع اختبار مقارنة أنظمة الإرشاد والتوجيه (سيتم تسجيل هذا القسم صوتياً)

PART 4 – WAYFINDING SYSTEMS COMPARISON TEST (this part will be audio recorded)

23. برأيك، أي الصور التالية تفضل؟ وما هي إيجابيات وسلبيات كل تصميم؟

 In your opinion, which image below do you prefer? Can you mention the positives and negatives of each design?

24. Pedestrian walkways legend / خدمات طريق المشاة

Image (A)

Image (B)

25. Bathrooms / WC

Image (C)

Image (D)

26. The camps and tents identification signs and elements

Image (E)

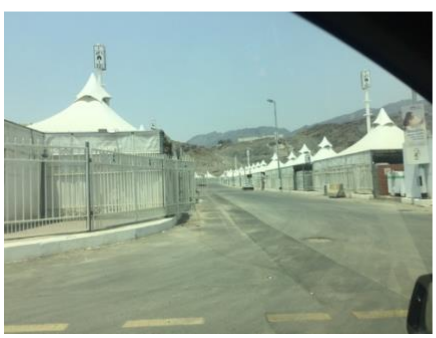


Image (F)

27. Pedestrian walkway signs

Image (G)

Image (H)

الجزء الخامس – اختبار فرضيات البحث

PART 5 - HYPOTHESES TESTING

باستخدام مقياس التفضيل من ١ إلى ٥ حيث (١ = لا أوافق بشدة و ٥ = أوافق بشدة) هل توافق او لا توافق مع العبارات التالية:

On a scale from 1 to 5; 1 being strongly disagree and 5 being strongly agree, do you agree/disagree with the following statements:

28. نظام معرفة الطريق الحالي المستخدم في الحج يتعارض عن بعضه مع بعض ويفتقر للانسجام والتصميم الجيد؟

    The current wayfinding system of Al-Hajj is inconsistent and lacks in design quality?

    1 – Strongly disagree / لا أوافق بشدة

    2 – Disagree / لا أوافق

    3 – Neutral / محايد

    4 – Agree / أوافق

    5 – Strongly agree / أوافق بشدة

29. نظام ايجاد الطريق الحالي يمكنه العمل لوحده بدون الحاجة الملحة إلى مساعدة إضافية من الكشافة، المرشدين او ضباط الشرطة؟

    The current wayfinding system of Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guides, scouts or police officers?

    1 – Strongly disagree / لا أوافق بشدة

    2 – Disagree / لا أوافق

    3 – Neutral / محايد

    4 – Agree / أوافق

    5 – Strongly agree / أوافق بشدة

30. الأدلة والشعارات المستخدمة في نظام الارشاد الحالي ليست عالمية او عامة بالشكل المناسب لكي يستوعبها الحجاج وخاصة الذين لم يحجوا مسبقاً ولا يعرفون المناطق الخاصة بالحج؟

    The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand?

1 – Strongly disagree / لا أوافق بشدة

2 – Disagree / لا أوافق

3 – Neutral / محايد

4 – Agree / أوافق

5 – Strongly agree / أوافق بشدة

31. خلال فترة الحج، سوف يستفيد الحجاج من نظام ارشادي يتعامل مع عناصر مباشرة ومتناسقة أكبر ومصمم بطريقة متقنة؟
During Al-Hajj, pilgrims will benefit from a more unified, consistent and well-designed wayfinding system?

1 – Strongly disagree / لا أوافق بشدة

2 – Disagree / لا أوافق

3 – Neutral / محايد

4 – Agree / أوافق

5 – Strongly agree / أوافق بشدة

32. سوف يستفيد الحجاج من استخدام نظام ألوان موحد يربط المخيمات والخدمات الأخرى (البطاقات وأساور الحجاج وبعض الإكسسوارات الخ...) والتي قد تساعد في تسهيل الربط والتعرف على الخدمات والمخيمات الخاصة بمجموعات الحجاج؟
Pilgrims will benefit from using the same color coding in pilgrims' camps, wayfinding system and other related services such as pilgrims' tags / bracelets / accessories to help in easily identifying specific camps and services?

1 – Strongly disagree / لا أوافق بشدة

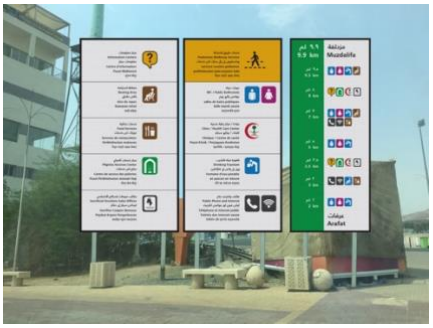
2 – Disagree / لا أوافق

3 – Neutral / محايد

4 – Agree / أوافق

5 – Strongly agree / أوافق بشدة

33. النظام الإرشادي المعروض يمكن أن يكون واضحاً بصورة كافية للمساعدة في فهمه وسهولة استخدامه للحجاج بدون الحاجة الملحة للمساعدة الإضافية من الكشافة، المرشدين او ضباط الشرطة؟
The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guides, scouts or police officers?



1 – Strongly disagree / لا أوافق بشدة

2 – Disagree / لا أوافق

3 – Neutral / محايد

4 – Agree / أوافق

5 – Strongly agree / أوافق بشدة

Appendix C –– Online Survey Data Collection Form

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج
Wayfinding Systems for Pedestrians in Crowded Areas During the Islamic Pilgrimage (Al-Hajj).

مقدمة عن موضوع البحث
Research Introduction

Title of Study / عنوان الدراسة

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج: كيف تساهم أنظمة معرفة الطريق في زيادة فاعلية معرفة الحجاج المشاة للطريق خلال موسم الحج.

Wayfinding Systems for Pedestrians in Crowded Areas During the Islamic Pilgrimage (Al-Hajj): How Can Wayfinding System Designs Increase the Efficiency of the Wayfinding Performance for Pedestrian Pilgrims During the Islamic Pilgrimage (Al-Hajj).

Supported By / الدعم

كلية التصميم، جامعة مينيسوتا – المدينتين التوأم
College of Design, University of Minnesota – Twin Cities

Background Information / خلفية عن البحث

تهدف الدراسة البحثية لجمع معلومات ديموغرافية (مثل الجنس، العمر، الجنسية، عدد مرات الحج، وتفضيلات المستخدمين فيما يتعلق بأنظمة معرفة الطريق في الأماكن المزدحمة أثناء موسم الحج.. الخ). ستساعد هذه المعلومات في توثيق وتقييم بعض المشكلات الموجودة في أنظمة معرفة وإيجاد الطريق والاتجاه، وكذلك ستساعد في عمل التصاميم المستقبلية لمثل هذه الأنظمة في الأماكن المزدحمة بشكل عام.

This research study intends to gather demographic information and user preferences regarding wayfinding systems in the crowded areas of Al-Hajj. The information gathered will help in documenting and evaluating some of the problems of the current wayfinding systems, and will help in designing future wayfinding systems for crowded areas in general.

Participants / المشاركون

أنت جزء من عينة بحث عشوائية عبر شبكة الإنترنت. يهدف هذا الاستبيان عبر الإنترنت إلى جمع المعلومات المتعلقة بتفضيلات المستخدم بخصوص عناصر بصرية تصميمية. قد يستغرق هذا الاستبيان حوالي ٣٥ - ٤٥ دقيقة في المتوسط. يحتوي البحث على أربعة أجزاء رئيسية، ومع بداية كل جزء، سيظهر شرح خاص به على الشاشة لمساعدتك. قد تتطلب منك بعض أجزاء الاستطلاع كتابة بعض التعليقات أو شرح خياراتك بشكل أكبر، يرجى القيام بذلك. وشكراً لتعاونك.

You are part of a random online research sample. This online survey aims to collect information regarding user preferences on designed elements. This survey might take around 35-45 minutes on average. The research will contain four main parts. At the beginning each part, an explanation for that specific part will appear in the screen for your assistance. Some parts of the survey might require you to write some comments or further explain your choices, please do so. Thank you for your cooperation.

Compensation / المكافأة

عند إكمالك كامل الاستبيان، سجل معلومات التواصل الخاصة بك وستحصل على فرصة دخول سحب للفوز ببطاقة بقيمة ٢٠ دولار من خدمة أمازون.

If you complete all survey questions, you will be eligible to enter a raffle to win a $20 gift card from Amazon.

Confidentiality / السرية والخصوصية

لن تتضمن التقارير النهائية أو العروض التقديمية أي معلومات تحدد هوية أي من المشاركين.

Final reports and presentations will not include any information that would identify any participant.

Researcher info / معلومات الباحث
عامر الخروبي
مرشح للدكتوراه في جامعة مينيسوتا / طالب دكتوراه مبتعث من كلية تصاميم البيئة بجامعة الملك فهد للبترول والمعادن

Amer Alkharoubi
PhD candidate at University of Minnesota / A PhD scholarship student from CED at KFUPM

kharoubi@kfupm.edu.sa
alkha046@umn.edu

Thank you / شكراً

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج
Wayfinding Systems for Pedestrians in Crowded Areas During the Islamic Pilgrimage (Al-Hajj).

الجزء الأول - المعلومات الديموغرافية
PART 1 – DEMOGRAPHIC INFORMATION

*** 1. Gender / الجنس**

- ◯ Male / ذكر
- ◯ Female / أنثى
- ◯ Rather not say / أفضل عدم القول

*** 2. Age /العمر**

- ◯ Under 18
- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65+

*** 3. Educational Level / مستوى التعليم**

- ◯ High-school or less / مرحلة ثانوية أو أقل
- ◯ College Degree (Bachelor's degree) / (جامعي (درجة بكالوريوس
- ◯ Graduate Degree (Master's or PhD) / (دراسات عليا (ماجستير أو دكتوراه
- ◯ No Education (illiterate) / أميِّ

Other (please specify) / إجابة أخرى

*** 4. Nationality / الجنسية**

*** 5. Language / اللغة**

Tongue or Native Language / اللغة الأم	
Secondary Language / اللغة الثانية	
Others	

*** 6. كم عدد المرات التي أديت فيها فريضة الحج؟**
How many times have you performed Al-Hajj (The Islamic Pilgrimage)?

- ◯ 1 time / مرة واحدة
- ◯ 2 – 4 times / من ٢ - ٤ مرات
- ◯ 5+ times / ٥ مرات فأكثر
- ◯ Never performed Al-Hajj before / لم أؤدي فريضة الحج مسبقاً

Other (please specify) / إجابة أخرى

*** 7. لأي من مجموعات تصنيفات الحجاج تنتمي؟**
(تصنيف مجموعات الحجاج يعتمد على الدولة التي صدر منها تصريح الحج الخاص بك)
[حدد كل الخيارات الممكنة]
Which group of pilgrims do you identify with / belong to?
(your group will be depending on the place that issued your Hajj permit / authorization / license)
[choose all applicable answers]

- ☐ حجاج الداخل (التصريح صادر من داخل السعودية)
  Internal Pilgrims (permit issued from inside Saudi Arabia)
- ☐ حجاج دول مجلس التعاون الخليجي (التصريح صادر من أحد الدول التالية: الإمارات، البحرين، قطر، الكويت وعُمان)
  G.C.C Countries Pilgrims (The Gulf Cooperation Council) (United Arab Emirates (UAE), Saudi Arabia, Qatar, Kuwait, Oman, and Bahrain)
- ☐ حجاج الدول العربية الأخرى (التصريح صادر من أي دولة عربية غير مذكورة سابقاً)
  Other Arab Countries Pilgrims (other than the countries mentioned above)
- ☐ حجاج دول أفريقيا غير الناطقين بالعربية
  Africa Pilgrims (non-Arabic)
- ☐ حجاج جنوب آسيا
  South Asia Pilgrims
- ☐ حجاج جنوب شرق آسيا
  Southeast Asia Pilgrims
- ☐ حجاج دول الأمريكيتان (الولايات المتحدة، كندا، دول أمريكا الجنوبية)، حجاج أستراليا، حجاج أوروبا و حجاج تركيا
  The Americas (USA, Canada and South America Countries), Australia, Europe and Turkey Pilgrims
- ☐ حجاج إيران
  Iran Pilgrims
- ☐ غير متأكد / لا أعرف تصنيف مجموعتي
  Not sure / I don't know

*** 8. هل حصلت على تدريب أو لديك معرفة مسبقة عن كيفية أداء فريضة الحج؟**
[حدد كل الخيارات الممكنة]
Have you ever had previous training / knowledge regarding how to perform Al-Hajj?
[choose all applicable answers]

- [ ] لا - لم أحصل على تدريب وليس لدي معرفة مسبقة
No - Never had training before
- [ ] نعم - في المدرسة أو عن طريق دروس أو محاضرات متخصصة
Yes – in school or took some classes
- [ ] نعم - أونلاين / عن طريق الانترنت أو عن طريق التقنيات الثنائية أو الثلاثية الأبعاد
Yes - online or through 2D or 3D simulations
- [ ] نعم - قرأت بعض الكتب أو المنشورات
Yes - read some books or brochures

Other (please specify) / إجابة أخرى

*** 9. هل سبق وأن قمت بخدمة الحجاج أو العمل في خدمتهم في المناطق المخصصة للحجاج خلال أحد مواسم الحج؟**
[حدد كل الخيارات الممكنة]
Have you ever worked with or served pilgrims during Al-Hajj season at the areas of Al-Hajj?
[choose all applicable answers]

- [ ] لا - لم يسبق لي الخدمة أو العمل
No, I have never worked with or served pilgrims
- [ ] نعم - عملت كدليل أو مرشد عام
Yes, as a guide
- [ ] نعم - عملت ضمن فريق الكشافة أو الجوالة
Yes, as a scout
- [ ] نعم - عملت كضابط شرطة أو ضمن السلك العسكري
Yes, as a police officer
- [ ] نعم - عملت كمسعف، أو في خدمات الطوارئ (الاسعاف، الانعاش، إطفاء حريق، عمليات التفويج الاضطراري، الخ)
Yes, in emergency services (EMT, fireman, evacuation units, etc..)
- [ ] نعم - عملت كقائد مجموعة حجاج أو مطّوف
Yes, as a pilgrims group leader or Mutawaf
- [ ] نعم - عملت في أحد الخدمات الصحية (طبيب عام، طبيب طوارئ، جرّاح، الخ)
Yes, as a medical care personnel / a doctor / a paramedic / etc.

Other (please specify) / إجابة أخرى

*** 10. هل لديك أو تعاني من أحد الحالات الطبية التالية التي قد تؤثر على مستوى نظرك أو مستوى الرؤية لديك؟**
[حدد كل الخيارات الممكنة]
Do you have any of the following medical conditions that might affect your sight / eye performance?
[choose all applicable answers]

- [ ] لا - لا أعاني من أي حالات طبية تؤثر على مستوى النظر والرؤية لدي
No, I don't have problems or medical conditions that might effect my eye sight
- [ ] نعم – أنا مصاب بعمى الألوان
Yes, I am color blind
- [ ] نعم - ألبس النظارات أو العدسات معظم ساعات اليوم / لا أستطيع الرؤية بشكل واضح بدن لبس نظارات أو عدسات
Yes, I wear glasses on a regular basis / most of the day
- [ ] نعم - ألبس النظارات أو العدسات أحياناً فقط / أحتاج للنظارات أو العدسات عند القراءة أو لرؤية الأجسام البعيدة
Yes, I wear glasses occasionally / specifically for reading or screen use
- [ ] نعم - نظري مشوش / لدي قصر نظر أو بعد نظر
Yes, I have blurry vision / I am near or far sided
- [ ] نعم – أعاني من مرض الديسليكسيا / مرض عُسر القراءة
Yes, I have dyslexia

Other (please specify) / إجابة أخرى

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج
Wayfinding Systems for Pedestrians in Crowded Areas During the Islamic Pilgrimage (Al-Hajj).
الجزء الثاني - اختبار تمييز ومعرفة الشعارات والرموز
PART 2 – SYMBOLS AND ICONS IDENTIFICATION TEST

(برأيك، ماذا تعني الشعارات التالية: (حدد كل الخيارات الممكنة

In your opinion, what does the following symbol represent? (choose all applicable answers)

*

11. 

- [ ] Security officer / ضابط شرطة
- [ ] Pedestrian services / خدمات مشاة
- [ ] WC / Bathrooms for women / حمامات أو دورات مياه للنساء
- [ ] Rest area for men / استراحة للرجال
- [ ] Pilgrims services center for men / مركز خدمات حجاج للرجال
- [ ] WC/ bathrooms for men / حمامات أو دورات مياه للرجال
- [ ] Prayer area (for either men or women) / مصلى (إما للرجال أو النساء)

Other, please specify / أخرى

7

12. 

- [ ] The Holy Mosque (Mecca) / المسجد الحرام (مكة)
- [ ] Mosque or Prayer Area / مصلى أو مسجد
- [ ] Pilgrims Services Center / مركز خدمات الحجاج
- [ ] Al-Mesha-er Al-Hara-m Service Center / مركز خدمات المشعر الحرام
- [ ] Guidance Center / مركز إرشاد
- [ ] Namera Mosque / مسجد نمرة
- [ ] Religious Guidance Services / خدمات توجيه دينيه
- [ ] Other, please specify / أخرى

*

13. 

- [ ] Slaughter Houses / المجازر
- [ ] Sacrification Coupon Kiosk / أكشاك بيع كوبونات الهدي أو الأضاحي
- [ ] Sacrificial Vouchers Sales Offices / مكاتب بيع قسائم الأضاحي
- [ ] Livestock sales offices or areas / مكاتب أو مناطق بيع الأضاحي
- [ ] caution: Animals crossing / انتبه: مرور حيوانات
- [ ] An area to sell livestock / مكان لبيع المواشي

Other, please specify / أخرى

*

14.

- [ ] Religious Services / خدمات دينيه
- [ ] WC / Bathrooms / حمامات أو دورات مياه
- [ ] Resting Area / منطقة استراحة
- [ ] Pilgrims Services Center / مركز خدمات حجاج
- [ ] Prayer Area or Mosque / مصلى أو مسجد
- [ ] Police Station / مركز شرطة
- [ ] Religious Area / منطقة دينية

Other, please specify / أخرى

*

15.

- [ ] Information Center / مركز استعلامات
- [ ] Resting Area / منطقة استراحة
- [ ] Pilgrims Services Center / مركز خدمات حجاج
- [ ] Guidance Services Center / مركز خدمات إرشادية
- [ ] Police Station / مركز شرطة

Other, please specify / أخرى

*

16.

- [ ] Resting Area for women / منطقة استراحة للنساء
- [ ] WC / Bathrooms for men / حمامات أو دورات مياه للرجال
- [ ] Pilgrims Services Center / مركز خدمات الحجاج
- [ ] Mosque / Prayer Area / مصلى أو مسجد
- [ ] WC / Bathrooms for women / حمامات أو دورات مياه للنساء
- [ ] Pilgrims Services Center for women / مركز خدمات حجاج للنساء

Other, please specify / أخرى

*

17.

- [ ] Slaughter Houses / المجازر
- [ ] Sacrification Coupon Kiosk / أكشاك بيع كوبونات الهدي أو الأضاحي
- [ ] Sacrificial Vouchers Sales Offices / مكاتب بيع قسائم الأضاحي
- [ ] Livestock sales offices or areas / مكاتب أو مناطق بيع الأضاحي
- [ ] Caution: Animals crossing / انتبه: مرور حيوانات
- [ ] An area to sell livestock / مكان لبيع المواشي
- [ ] Other, please specify / أخرى

* 18. 

- [ ] WC / Bathrooms for women / حمامات أو دورات مياه للنساء
- [ ] Rest area for women / استراحة للنساء
- [ ] Pilgrims services center for men / مركز خدمات الحجاج للرجال
- [ ] Pilgrims services center for women / مركز خدمات الحجاج للنساء
- [ ] Security officer / ضابط شرطة
- [ ] Prayer area for women / مصلى للنساء

Other, please specify / أخرى

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج
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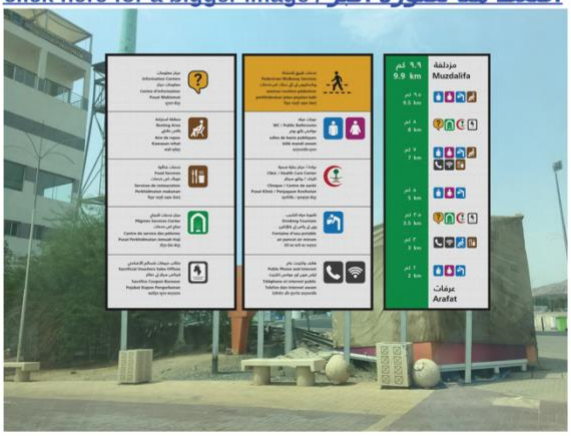
PART3 - WAYFINDING SYSTEMS COMPARISON TEST

*** 19. برأيك، لأي الصور التالية (أ) أو (ب) تميل أكثر أو تفضل بالنسبة للخصائص المذكورة في كل سؤال**
In your opinion, which image below (A) or (B) do you prefer or find more appealing regarding the criteria displayed in each question

Image (A) / أ) الصورة)
click here for a bigger image / اضغط هنا لصورة أكبر

Image (B) / ب) الصورة)

click here for a bigger image / اضغط هنا لصورة أكبر



تعريف بعض المصطلحات الواردة في السؤال

Definitions of some of the terms in this question

تباين الألوان هو تمايز او القدرة على تمييز الألوان المجاورة عن بعضها البعض

Color Contrast is the difference in luminescence between two adjacent colors or overlaid colors

تناسق و تناغم الألوان هو انسجام الألوان مع بعضها البعض مما ينتج عنه توازن في التصميم

Color Harmony refers to the property that certain aesthetically pleasing color combinations have.

Color Balance is the global adjustment of the intensities of the colors.

المحاذاة في التصميم هي ترتيب العناصر ضمن خطوط محددة واضحة او شبكة تصميمية محددة

Alignment is the arrangement in a straight line, or in a correct or appropriate relative positions.

	Image (A) / أ) صورة)	Image (B) / ب) صورة)	Both (A) and (B) / ينطبق على كليهما	Neither (A) nor (B) / لا ينطبق على أي منهما
تباين ألوان النصوص والرموز مع خلفية التصميم **Color contrast of texts and pictograms with the design background**	○	○	○	○
تناسق وتناغم الألوان **Color harmony and color balance**	○	○	○	○
اختيارات الخطوط **Font Choices**	○	○	○	○

15

	Image (A) / (صورة أ)	Image (B) / (صورة ب)	Both (A) and (B) / ينطبق على كليهما	Neither (A) nor (B) / لا ينطبق على أي منهما
أحجام الخطوط Font size (from a pedestrian point of view)	◯	◯	◯	◯
محاذاة عناصر التصميم مع بعضها Alignment of design elements	◯	◯	◯	◯
الرموز والشعارات واضحة وسهلة الفهم Symbols and icons are clear and easy to understand	◯	◯	◯	◯
جودة وإتقان واحترافية التصميم حيث يتبع قوانين وقواعد واضحة Design Quality - the design is professionally designed and follows clear rules and guidelines	◯	◯	◯	◯
عرض ووضوح المعلومات Information display and clarity	◯	◯	◯	◯
مكان اللوحات وموضعها (ارتفاعها عن الأرض، موضعها على المبنى أو المنشأة، الخ) Sign position and location	◯	◯	◯	◯

20. برأيك، بشكل عام، لأي من الصور السابقة (أ) أو (ب) تميل أو تفضل من ناحية جاذبية وإتقان التصميم؟
In your opinion, in general, which image of the above, (A) or (B) do you prefer in terms of it being more appealing and well-designed than the other?

◯ Image (A) / (صورة أ)

◯ Image (B) / (صورة ب)

* 21. برأيك، ماهي إيجابيات التصميم الذي قمت بتفضيله مسبقاً سواء (أ) أو (ب)؟
In your opinion, what are the positives/advantages of the preferred design that you chose either (A) or (B)?

1.
2.
3.
4.
5.
6.

* 22. برأيك، ماهي سلبيات التصميم الذي قمت بتفضيله مسبقا سواء (أ) أو (ب)؟
In your opinion, what are the negatives/disadvantages of the preferred system that you chose either (A) or (B)?

1.
2.
3.
4.
5.
6.

* 23. برأيك، لأي الصور التالية (ج) أو (د) تميل أكثر أو تفضل بالنسبة للخصائص المذكورة في كل سؤال
In your opinion, which image below (C) or (D) do you prefer or find more appealing regarding the criteria displayed in each question

Image (C) / ج) الصورة)
click here for a bigger image / اضغط هنا لصورة أكبر

Image (D) / د) الصورة)

click here for a bigger image / اضغط هنا لصورة أكبر

تعريف بعض المصطلحات الواردة في السؤال

Definitions of some of the terms in this question

تباين الألوان هو تمايز او القدرة على تمييز الألوان المجاورة عن بعضها البعض

Color Contrast is the difference in luminescence between two adjacent colors or overlaid colors

تناسق و تناغم الألوان هو انسجام الألوان مع بعضها البعض مما ينتج عنه توازن في التصميم

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Color Balance is the global adjustment of the intensities of the colors.

المحاذاة في التصميم هي ترتيب العناصر ضمن خطوط محددة واضحة او شبكة تصميمية محددة

Alignment is the arrangement in a straight line, or in a correct or appropriate relative positions.

	Image (C) / صورة (ج)	Image (D) / صورة (د)	Both (C) and (D) / ينطبق على كليهما	Neither (C) nor (D) / لا ينطبق على أي منهما
تباين ألوان النصوص والرموز مع خلفية التصميم Color contrast of texts and pictograms with the design background	○	○	○	○
تناسق وتناغم الألوان Color harmony and color balance	○	○	○	○
اختيارات الخطوط Font Choices	○	○	○	○

	Image (C) / صورة (ج)	Image (D) / صورة (د)	Both (C) and (D) / ينطبق على كليهما	Neither (C) nor (D) / لا ينطبق على أي منهما
أحجام الخطوط Font size (from a pedestrian point of view)	◯	◯	◯	◯
محاذاة عناصر التصميم مع بعضها Alignment of design elements	◯	◯	◯	◯
الرموز والشعارات واضحة وسهلة الفهم Symbols and icons are clear and easy to understand	◯	◯	◯	◯
جودة وإتقان واحترافية التصميم حيث يتبع قوانين وقواعد واضحة Design Quality - the design is professionally designed and follows clear rules and guidelines	◯	◯	◯	◯
عرض ووضوح المعلومات Information display and clarity	◯	◯	◯	◯
مكان اللوحات وموضعها (ارتفاعها عن الأرض، موضعها على المبنى أو المنشأة، الخ) Sign position and location	◯	◯	◯	◯

24. برأيك، بشكل عام، لأي من الصور السابقة (ج) أو (د) تميل أو تفضل من ناحية جاذبية وإتقان التصميم؟
In your opinion, in general, which image of the above, (C) or (D) do you prefer in terms of it being more appealing and well-designed than the other?

◯ Image (C) / صورة (ج)

◯ Image (D) / صورة (د)

* 25. برأيك، ماهي إيجابيات التصميم الذي قمت بتفضيله مسبقاً سواء (ج) أو (د)؟
In your opinion, what are the positives/advantages of the preferred design that you chose either (C) or (D)?

1.
2.
3.
4.
5.
6.

* 26. برأيك، ماهي سلبيات التصميم الذي قمت بتفضيله مسبقا سواء (ج) أو (د)؟
In your opinion, what are the negatives/disadvantages of the preferred system that you chose either (A) or (B)?

1.
2.
3.
4.
5.
6.

* 27. برأيك، لأي الصور التالية (هـ) أو (و) تميل أكثر أو تفضل بالنسبة للخصائص المذكورة في كل سؤال
In your opinion, which image below (E) or (G) do you prefer or find more appealing regarding the criteria displayed in each question

Image (E) / الصورة (هـ)
click here for a bigger image / اضغط هنا لصورة أكبر

Image (G) / (و الصورة)

click here for a bigger image / اضغط هنا لصورة أكبر

تعريف بعض المصطلحات الواردة في السؤال

Definitions of some of the terms in this question

تباين الألوان هو تمايز او القدرة على تمييز الألوان المجاورة عن بعضها البعض

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المحاذاة في التصميم هي ترتيب العناصر ضمن خطوط محددة واضحة او شبكة تصميمية محددة

Alignment is the arrangement in a straight line, or in a correct or appropriate relative positions.

	Image (E) / (صورة (هـ	Image (G) / (صورة (و	Both (E) and (G) / ينطبق على كليهما	Neither (E) nor (G) / لا ينطبق على أي منهما
تباين ألوان النصوص والرموز مع خلفية التصميم Color contrast of texts and pictograms with the design background	○	○	○	○
تناسق وتناغم الألوان Color harmony and color balance	○	○	○	○
اختيارات الخطوط Font Choices	○	○	○	○

21

	Image (E) / (صورة (هـ	Image (G) / (صورة (و	Both (E) and (G) / ينطبق على كليهما	Neither (E) nor (G) / لا ينطبق على أي منهما
أحجام الخطوط Font size (from a pedestrian point of view)	○	○	○	○
محاذاة عناصر التصميم مع بعضها Alignment of design elements	○	○	○	○
الرموز والشعارات واضحة وسهلة الفهم Symbols and icons are clear and easy to understand	○	○	○	○
جودة وإتقان واحترافية التصميم حيث يتبع قوانين وقواعد واضحة Design Quality - the design is professionally designed and follows clear rules and guidelines	○	○	○	○
عرض ووضوح المعلومات Information display and clarity	○	○	○	○
مكان اللوحات وموضعها (ارتفاعها عن الأرض، موضعها على المبنى أو المنشأة، الخ) Sign position and location	○	○	○	○

28. برأيك، بشكل عام، لأي من الصور السابقة (هـ) أو (و) تميل أو تفضل من ناحية جاذبية وإتقان التصميم؟

In your opinion, in general, which image of the above, (E) or (G) do you prefer in terms of it being more appealing and well-designed than the other?

○ Image (E) / (صورة (هـ

○ Image (G) / (صورة (و

* 29. برأيك، ماهي إيجابيات التصميم الذي قمت بتفضيله مسبقاً سواء (هـ) أو (و)؟
In your opinion, what are the positives/advantages of the preferred design that you chose either (E) or (G)?

1.
2.
3.
4.
5.
6.

* 30. برأيك، ماهي سلبيات التصميم الذي قمت بتفضيله مسبقا سواء (هـ) أو (و)؟
In your opinion, what are the negatives/disadvantages of the preferred system that you chose either (A) or (B)?

1.
2.
3.
4.
5.
6.

* 31. برأيك، لأي الصور التالية (ز) أو (ط) تميل أكثر أو تفضل بالنسبة للخصائص المذكورة في كل سؤال
In your opinion, which image below (H) or (J) do you prefer or find more appealing regarding the criteria displayed in each question

Image (H) / ز) الصورة)
click here for a bigger image / اضغط هنا لصورة أكبر

Image (J) / ط) الصورة)

click here for a bigger image / اضغط هنا لصورة أكبر

تعريف بعض المصطلحات الواردة في السؤال

Definitions of some of the terms in this question

تباين الألوان هو تمايز او القدرة على تمييز الألوان المجاورة عن بعضها البعض

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Alignment is the arrangement in a straight line, or in a correct or appropriate relative positions.

	Image (H) / (صورة (ز	Image (J) / (صورة (ط	Both (H) and (J) / ينطبق على كليهما	Neither (H) nor (J) / لا ينطبق على أي منهما
تباين ألوان النصوص والرموز مع خلفية التصميم Color contrast of texts and pictograms with the design background	○	○	○	○
تناسق وتناغم الألوان Color harmony and color balance	○	○	○	○
اختيارات الخطوط Font Choices	○	○	○	○
أحجام الخطوط Font size (from a pedestrian point of view)	○	○	○	○

	Image (H) / (صورة (ز	Image (J) / (صورة (ط	Both (H) and (J) / ينطبق على كليهما	Neither (H) nor (J) / لا ينطبق على أي منهما
محاذاة عناصر التصميم مع بعضها Alignment of design elements	○	○	○	○
الرموز والشعارات واضحة وسهلة الفهم Symbols and icons are clear and easy to understand	○	○	○	○
جودة وإتقان واحترافية التصميم حيث يتبع قوانين وقواعد واضحة Design Quality - the design is professionally designed and follows clear rules and guidelines	○	○	○	○
عرض ووضوح المعلومات Information display and clarity	○	○	○	○
مكان اللوحات وموضعها (ارتفاعها عن الأرض، موضعها على المبنى أو المنشأة، الخ) Sign position and location	○	○	○	○

32. برأيك، بشكل عام، لأي من الصور السابقة (ز) أو (ط) تميل أو تفضل من ناحية جاذبية وإتقان التصميم؟

In your opinion, in general, which image of the above, (H) or (J) do you prefer in terms of it being more appealing and well-designed than the other?

○ Image (H) / (صورة (ز

○ Image (J) / (صورة (ط

* 33. برأيك، ماهي إيجابيات التصميم الذي قمت بتفضيله مسبقاً سواء (ز) أو (ط)؟
In your opinion, what are the positives/advantages of the preferred design that you chose either (H) or (J)?

1.
2.
3.
4.
5.
6.

* 34. برأيك، ماهي سلبيات التصميم الذي قمت بتفضيله مسبقا سواء (ز) أو (ط)؟
In your opinion, what are the negatives/disadvantages of the preferred system that you chose either (A) or (B)?

1.
2.
3.
4.
5.
6.

أنظمة معرفة الطريق للمشاة في الأماكن المزدحمة أثناء موسم الحج
Wayfinding Systems for Pedestrians in Crowded Areas During the Islamic Pilgrimage (Al-Hajj).
الجزء الرابع – اختبار فرضيات البحث
PART 4 - HYPOTHESES TESTING

باستخدام مقياس التفضيل من ٥ إلى ١ حيث (٥ = أوافق بشدة و١ = لا أوافق بشدة) هل توافق أو لا توافق مع الحالات التالية:

On a scale from 5 to 1; 5 being strongly agree and 1 being strongly disagree, do you agree/disagree with the following statements:

35. نظام معرفة الطريق الحالي المستخدم في الحج تتعارض عناصره مع بعض ويفتقر للانسجام والتصميم الجيد؟
The current wayfinding system used in Al-Hajj is inconsistent and lacks in design quality?

- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

36. نظام إيجاد الطريق الحالي يمكنه العمل لوحده بدون الحاجة الملحة إلى مساعدة إضافية من الكشافة، المرشدين او ضباط الشرطة؟
The current wayfinding system used in Al-Hajj can work fine on its own efficiently without the consistent need for additional help from guidance, scouts or police officers?

- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

37. الأدلة والشعارات المستخدمة في نظام الارشاد الحالي ليست عالمية او عامة بالشكل المناسب لكي يستوعب معانيها الحجاج وخاصة الذين لم يحجو مسبقاً ولا يعرفون المناطق الخاصة بالحج؟
The icons and symbols used in the current wayfinding system are not universal enough for pilgrims who are not familiar with the areas of Al-Hajj to understand?

- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

38. خلال فترة الحج، سوف يستفيد الحجاج من نظام ارشادي تعمل عناصره بانسجام وتناسق أكبر ومصمم بطريقة متقنة؟
During Al-Hajj, pilgrims will benefit from a more unified, consistent and well-designed wayfinding system?

- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

39. سوف يستفيد الحجاج من استخدام نظام ألوان موحد يربط المخيمات والخدمات الأخرى (كبطاقات وأساور الحجاج، بعض الإكسسوارات الخ...) والتي قد تساعد في تسهيل الربط والتعرف على الخدمات والمخيمات الخاصة بمجموعات الحجاج؟
Pilgrims will benefit from using the same color coding in pilgrims' camps, wayfinding system and other related services such as pilgrims' tags / bracelets / accessories to help in easily identifying specific camps and services?

- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

40. النظام الإرشادي المقترح في هذا البحث (توجد صور تالية للتذكير) يمكن فهمه بسهوله وسيساعد الحجاج كثيراً بدون الحاجة الملحة للمساعدة الإضافية من الكشافة، المرشدين او ضباط الشرطة؟

The new proposed wayfinding system presented in the images below can be understood and used efficiently by pilgrims without the consistent need for additional help from guidance, scouts or police officers?

click on images to enlarge / اضغط الصور للتكبير




- ◯ 5) Strongly agree / أوافق بشدة
- ◯ 4) Agree / أوافق
- ◯ 3) Neither agree nor disagree / محايد
- ◯ 2) Disagree / لا أوافق
- ◯ 1) Strongly disagree / لا أوافق بشدة

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الجزء الأخير - نهاية الاستبيان
THE FINAL PART - THE END OF THE SURVEY

41. هل لديك أي اقتراحات أوتعليقات اضافية؟

Do you have any additional comments or suggestions?

1.
2.
3.
4.
5.
6.

42. شكراً لإنهائك هذا الاستبيان ومساعدتنا في الحصول على معلومات قيمة.

إذا أحببت أن تحصل على فرصة للدخول في سحب على بطاقة بقيمة ٢٠ دولار من أمازون،

أو كنت ترغب في أن يتواصل معك فريق البحث بخصوص أي مستجدات أو أسئلة تخص البحث في المستقبل

تفضل بتسجيل معلومات التواصل بك في الخانة التالية.

شكراً لك لقد ساعدتنا كثيراً

Thank you for completing this survey and helping us get valuable insights.

If you like to get a chance to get into a draw on a $ 20 card from Amazon,

Or you would like the research team to communicate with you about any future research questions or findings

please register your contact information in the boxes below.

Thank you for helping us a lot

Email:
Phone:
Others: