Environmental Communication: A Case Study of Wayfinding in a Hospital Environment in Kenya.

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DECLARATION

I, Steve Njoroge Gachie do hereby declare that this thesis is my original work and has not been presented for a degree in any other University

Signed: ..... Date: 18th AUGUST, 2015

This thesis has been submitted for examination with our approval

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ABSTRACT

Environmental communication refers to information that is embedded in the built environment in the form of physical elements, architectural features, and other communication devices such as signage and color separations. Users of that environment interprate and use this information to enable them live, work, and play in that environment. Wayfinding as investigated in this study is the environment user's utilization of this information to enable them navigate the environment with the desire to reach a destination within the same environment. This interraction between the physical built environment and the users' human behavior provides the backdrop against which this study on wayfinding is grounded. Coming from the environmental-design disciplines of design, architecture, and urban & regional planning, there is a convergance with aspects from the social sciences of psychology, sociology and geography. This is an environment-behavior (E-B) research that is applied to a real-world problem of wayfinding. Wayfinding, the task of getting from an origin to a destination, is one of the primary spatial activities that human beings encounter in everyday life. In so doing, they act and behave in the environment based on the structure and features of that environment, set against a background of knowledge that has visual characteristics.

The main research issues of this study revolved around a person's ability to successfully navigate their way to a desired destination in a hospital. The impact that the legibility of the physical environment had on this process formed the lens through which this was investigated. The selection of the hospital envrionment was based on conversations with the general public about their experiences of "getting lost" in hospitals. Subsequent review of the literature further identified hospitals as being heavily prone to users getting lost. The Kenyatta National Hospital (KNH), located in the city of Nairobi, was purposively selected as the principal case study site due to its' status of being the largest referral hospital in Kenya. From an epistemological standpoint, this study adopted an interpretivist paradigm in its investigation of wayfinding in a hospital. A mixed-method research design using exploratory, observational, and descriptive study within a case study framework was devised. The aim was to identify the main factors that affect how people find their way successfully to destinations within the the hospital. In order to achieve this aim, four specific objectives were formulated that evaluated the wayfinding information in the built environment of the hospital, investigate how wayfinders use wayfinding information to find their way to their destinations, establish the influence of wayfinding information upon wayfinding behavior of the user, and assess the level of user satisfaction with the use of wayfinding information in the hospital.

The findings from the study indicated that the state of environmental communication relating to wayfinding was inadequate to facilitate a successful wayfinding experience for users of the hospital environment. From the findings, the study concluded that the existing system of wayfinding present at the hospital required to be reviewed to make it more user friendly and responsive to the requirements of the standards of universal access . The recommendations were that further work in this area need to be undertaken with the involvement of stakeholders in order to create a user friendly wayfinding environment.

DEDICATION

To God, the Ultimate Designer, Architect, and Waymaker,

my parents Gachie wa Njoroge and Wanjiku wa Gachie

my wife Wachuka wa Njoroge,

and my children

Melissa Wanjiku, Alvin-Jon Gachie and Isaac Wangombe.

All wayfinders in this space and time.

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I do not forget a special thanks due to Dr. Isabella Njeri Wachira, Professor Chrispin Ochieng, Professor Robert Rukwaro, Dr. Samuel Maina Mwituria, and Dr. Lilac Osanjo. They have been true friends and mentors during various stages of the journey.

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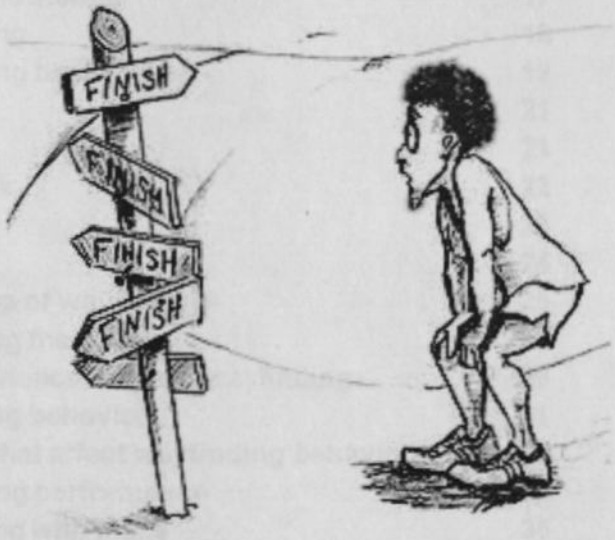
Finally, I cannot forget to thank all my students in the various courses that I teach at the University for their tolerance, understanding and cooperation during my "Wayfinding adventures".



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OPERATIONAL DEFINITION OF TERMS

Environmental communication and wayfinding research is a multi-disciplinary study that brings together input and interest from diverse fields of research. A definition of operational terms as used in this thesis is presented.

Accessibility - the extent to which a product, system or environment can be used by a variety of people, especially those with disabilities (M'Rithaa, 2009).

Accessible Design - design focused on the principles of extending standard design to people with some form of performance limitation to maximise the number of potential customers who can readily use a product, building or service (ISO, 2001:2).

Architecture - refers to the profession of designing buildings, open areas, communities, and other artificial constructions and environments, usually with some regard to aesthetic effect. Architecture often includes design or selection of furnishings and decorations, supervision of construction work, and the examination, restoration, or remodeling of existing buildings (Directory.com).

Architectural wayfinding design - design of the built components of wayfinding, including spatial planning, articulation of form-giving features, circulation systems,and environmental communication (Hunter, 2010).

Atrium - A central hall in a modern building, typically rising through several stories and having a glazed roof (Oxford dictionary).

Braille and Tactile Lettering - braille letters/words and 1/32" raised lettering used for ADA public identification and destination signs. Preferably grade two Braille as defined by the Braille Institute. Braille Bullets, small beads that are inserted into sign faces to accommodate Braille information as required by the ADA. Can be clear, plastic or metal (Beneicke et al., 2003).

Built Environment - refers to the manmade surroundings that provide the setting for human activity, ranging from the large-scale civic surroundings to the personal places.

Cognitive map - A term first used by Tolman to describe a mental representation of spatial information used for navigation (Tolman, 1948). Still poorly understood, a cognitive map, also referred to as a *mental map*, is a mental representation of an environment (Darken & Peterson, 2001).

Circulation Path - The physical path(s) used to reach a destination; may be either vehicular or pedestrian and may contain features such as curves, bends, T's, branches or crossing paths; has directionality (primary & secondary) (Brandon, 2000).

Design - a profession that is concerned with the creation of products, systems, communications and services that satisfy human needs, improve people's lives and do all this with respect for the welfare of the natural environment. Design involves problem finding, problem solving, analysis, invention and evaluation guided by a deep sensitivity to environmental concerns and human-centered aesthetic, cultural and functional needs (Owen, 2004).

Designer - a broad term for a person who designs any of a variety of things. Designers generally work objectively on teams (sometimes as individuals) to create the products, systems, communications and services needed by society. They are outer-directed, work for others, and use a wide range of design and planning tools to collect and organize information in the process of developing the things people need and want to improve their quality of life.

Product designers work primarily with artifacts, systems and hardware; communications designers work mostly with messages, information systems and software. Both frequently work with professionals from other disciplines in the development of complex systems requiring broad expertise (Owen, 2004).

Destination - A physical location in the built environment which is the goal of the wayfinding process; can be a building, area, room, or other designated point (Brandon, 2000).

Direction-giving - The verbal and printed advice offered to the user to help them navigate the built environment; consists of visual and auditory types and manifests in signage, brochures, and spoken directions (Brandon, 2000).

Environmental Communication - a term introduced by Arthur and Passini (1990) as the transfer of orientation, wayfinding (direction), and other communications devices or architectural features to enable people to reach destinations. The argument being that the built environment and its parts should function as a comminication device.

Environmental Graphic Design - is a design profession embracing many design disciplines including graphic design, architecture, industrial design and landscape architecture. Practitioners in this field are concerned with the visual aspects of wayfinding, communicating identity and brands, information design, and shaping a sense of place (ref. Wikipedia, the free encyclopedia. Accessed Jan. 2007).

Environmental information - has a broad definition generally. For this study it is any written, visual, aural, electronic or any other material form, in any form, that facilitates wayfinding, including graphics, signage, and audible and tactile signals (Hunter, 2010).

Graphic Design - is the activity that organizes visual communication in society. It is concerned with the efficiency of communication, the technology used for its implimentation, and the social impact it effects, in other words, with social responsibility. The need for communicative efficiency is a response to the main reason for the existence of any piece of graphic design: someone has something to communicate to someone else. This involves, to a greater or lesser extent, a perceptual and a behavioral concern (Frascara, 1988).

Information wayfinding design - the design of environmental information systems, including graphics, signage, and audible and tactile signals (Hunter, 2010).

Landmarks - point-like spatial features, serving as spatial references (Lynch, 1960). Simple physical elements which may vary widely in scale, are singularity, unique or memorable, and become easily identifiable (Passini, 1977).

Legibility of an environment - the extent to which the environment facilitates the process of way-finding." It has significant behavioral consequences, for example its effects on the happiness of elderly residents in group housing settings (Weisman, 1981).

Motion - the motoric element of navigation. A reasonable synonym for motion is *travel* as used by Bowman et al., (1997).

Navigation - the aggregate task of wayfinding and motion. It inherently must have both the cognitive element (wayfinding), and the motoric element (motion) (Darken & Peterson, 2001). In this study, this term is used to imply the aggregate task and not merely a part. The literature is replete with references to "navigation" that are only interested in novel motion techniques.

Pictograph - word pictures that serve as a means of communication to provide information beyond written language (Hablamos Juntos, 2010).

Quality Management System - the system you use to manage the quality of your services or products, so that your customers get what they want reliably and consistently. Quality Management System is often shortened to just QMS (Bennett, 2013).

Sense of the place - a feeling of being in differentiated space and a feeling of spatial orientation and understanding. (Szymanski, 2010)

Signage - any kind of graphics created to display information to a particular audience, typically wayfinding information on streets, outside and inside of buildings (ref. Wikipedia, the free encyclopedia. Accessed Jan. 2007).

Spatial Orientation - refers to knowlegde about spatial relationships of objects or places in an environment, relative to each other and relative to one's location in space (Long,1990).

Typography - The use of letterforms, of any language/s, used to communicate a message to an audience. Also referred to as Includes fonts, lettering, alphabets and typefaces (Beneicke et al 2003).

Visual access - the ease to visually separate one functional zone from another

Wayfinding - the cognitive element of navigation. Wayfinding refers to the ways in which people and animals orient themselves within an environment. It does not involve movement of any kind but only the tactical and strategic parts that guide movement (Darken & Peterson, 2001).

Used in the context of architecture it refers to the user experience of orientation and choosing a path within the built environment. It also refers to the set of architectural and/or design elements that aids orientation (ref. Wikipedia, the free encyclopedia).

Wayfinding design - design of built spaces and products that facilitate the movement of people through urban settings and individual buildings (Hunter, 2010).

CHAPTER 1

INTRODUCTION

"Let the mishap of disorientation once occur, and the sense of anxiety and even terror that accompanies it reveals to us how closely it is linked to our sense of balance and well being. The very word "lost" in our language means much more than simple geographical uncertainty; it carries overtones of utter disaster."

Kevin Lynch, (1960)

1.0 Introduction

This chapter introduces the topic for research by firstly giving a pragmatic motivation for the research presented in this thesis. This is followed by the background for the study, leading to the formulation of the problem statement. The significance of the study is then outlined followed by it's relevance and expected outputs. Within the research perspective, research questions are posed as well as the study assumptions. Lastly the aims and objectives for the study are stated. The proposed research methodology to undertake the study is then outlined. The chapter concludes by stating the scope and delimitations of the study, defining some specific terms used in the thesis, and finally by giving a brief profile of the overall organization of the entire thesis.

1.1 Motivation

The source of this research idea on the topic of people getting lost stems from the researcher listening to a personal narrative of a friend explaining how he ended up sleeping in his car at one time because he got lost in a residential area in Nairobi. By following the house numbering system in place he was always ending up at a dead end and finally parked on a pavement and slept for the remaining hours of the night until morning where he "asked his way out". The researcher recalled a personal experience of also getting lost. In this particular case It was the experience of "getting lost" in a previously visited hospital where it may be taken for granted that familiarity with the hospital would not lead to such an experience. It was probably the set of circumstances that culminated in this situation or maybe something else. It happened that while rushing to donate blood to an in-patient in the hospital he got lost and ended up in being late, finding the laboratory technicians gone and being kindly requested to return on the following day. This experience lead to a personal feeling of extreme frustration that

was both humiliating and humbling. "How can I get lost, yet I know this place?" was the question that rung so loudly in the mind. The "I" in this instance may be significant because it represents a "well educated graduate in the discipline of Design, with a supossedly well developed mental and visual aptitude". An experience such as this (as the researcher was to find out later) leads to 'self blame for lacking the acumen to navigate complex environments'. At such a time many self examination questions are posed in the mind such as "How could I get lost?", " Am I such a fool to get lost?" etc. After a period of self mortifying, eventually the question posed is that of "If an "***educated***" person can get lost in this hospital environment, how about an "***ordinary***" person who may not be too well educated or who may be here for the first time?" Subsequently, other broader based questions emerged such as:- Is it because of the ***person*** that one gets lost or is it beacause of the ***place*** that one gets lost? Do people get lost more in some environments than in others, and if so why? Could my experience be unique to this particular hospital or is it also evident in other hospitals in the city and other parts of the country? By simply voicing some of these questions randomly to some of the people present, various interesting responses begun to emerge in conversation. Some expressed similar experiences and frustrations at this and other hospitals. Of particular interest was the presence of a fellow academician in the form of a Professor of Geography at the University of Nairobi. He, too narrated his experience of getting lost, musing emphatically that "someone should do something!" It appeared like "everyone" has been lost in this and other hospitals at one time or another". Could this be a reality? This gave rise to the possibility of an interesting research topic on "getting lost" and thus formed the genesis of this study. It led to the researcher delving into literature relating to "getting lost" and subsequently to concepts of orientation and wayfinding.

The motivation was, therefore, is to study wayfinding and orientation in complex buildings that are accessed by the general public. The focus being the hospital environments in Kenya. The primary concern relates to the question of how people get lost or find their way in the built environment the hospital. In other words, examine the factors that affect wayfinding behaviour of individuals in a hospital environment. The secondary concern relates to the influence that the built environment of the hospital has on the wayfinding process.

1.2 Research Perspective

According to Rooke (2012) most studies on wayfinding, when highlighting the costs of poor wayfinding, appear to focus on the impact on the wayfinder on the one hand and the organization on the other. Zimring (1990), Arthur and Passini (1992), Carpman and Grant (2001), and Huelat (2004), for example, unanimously agree that stress related problems such as: raised blood pressure, headaches, increased physical exertion, and fatigue are linked to wayfinding in complex environments. They identify additional costs such as: lost staff time; reduced staff concentration caused by the need to provide directions or other interventions; lost business and dissatisfaction due to frustration and ill-will of users; costly missed appointments or delayed meetings; additional security staff and traffic management costs; compensatory environmental communications systems; potential law suits surrounding lack of safety and accessibility; danger to users wandering into limited access areas of buildings; and injury and death during emergency. From this, it becomes obvious that wayfinding may be studied from many perspectives depending on the aspect being investigated.

Carpman and Grant (2003) call for people-centred methodologies and techniques which should allow the effective study of how wayfinders find their way. According to Rooke (2012), evidence suggests that people often blame themselves for lacking the acumen to navigate complex environments (Arthur and Passini 1992, Department of Health (DOH) 2005, Rooke et al. 2009, 2010a, 2010b). However, several scholars (e.g. Arthur and Passini (1992); Butler et al., (1993); Haq and Zimring (2003); Baskaya et al., (2004) shift the blame away from the wayfinder. They assert that getting lost is an indication of either a poorly designed environment or wayfinding systems/ strategies designed to guide people and not inadequacy on the part of the wayfinder. Arthur and Passini (1992) observe that society is increasingly becoming less tolerant of the idea that people's inability to find their way in the built environment is either trivial or unimportant. It is therefore in order to position the user or the wayfinder in the correct perspective.

The research perspective adopted for this study, therefore, emphasises user-centered methodology and technique to study how wayfinders find their way and also how the environment or wayfinding system influences the behaviour of the wayfinders in order to propose better wayfinding design.

The unit of analysis of the study is the complex hospital environment. The large complex hospital environment of Kenyatta National Hospital located in the city of Nairobi

is used as the main case study.

1.3 The Research Problem in context

Everyday thousands of people interact with the hospital environment as workers, patients or visitors. As they have to find their way to various destinations within the hospital depending on their individual needs, many times they have a hard time navigating the building complexes. In most cases, both patients and visiting relatives are already burdened mentally and physically by health concerns and uncertainty. Experiencing difficulty in navigating provides an additional stress factor that if possible would best be avoided. This interaction between a user, wishing to reach a targeted destination, and the environment is refered to as wayfinding behavior. Successful wayfinding happens when the user reaches their desired destination with ease. Failure or difficulty of the user reaching their destination leads to disorientation or "getting lost". The hospital environment is particularly prone to disorientation (Carpman, 1993; Grover, 1971; Huelat, 2007). Disorientation may lead to growing levels of anxiety, depression, stress, agitation, emotional exhaustion, among others, and can occur if the surroundings are not appropriate (Codinhoto et al, 2009). This is accentuated if the environment is badly or insensitively designed. Because a hospital's primary function is to provide healing, it is crucial to investigate and understand factors that may adversely impact this noble function with the aim of making corrections. Spatial orientation and wayfinding are identified as aspects that have noted contribution to the wellbeing and healing of the hospital patients and visitors (Horsburgh,1995).

A review of the literature reveals a body of literature which explores how people find their way in both physical and virtual environments . Whereas much of the research has been carried out in the United States of America (USA) and in Europe, it is unfortunate that almost none has been done in Kenya. This apparent gap in knowledge on wayfinding is what this study aims to make a contribution to by building on empirical data on wayfinding in the physical built environment of hospitals in Kenya.

The problem statement is stated as follows:

Despite the impressive developments in wayfinding research and application, hospital users continue to be frustrated by wayfinding systems designed to assist them in finding their way. This may be due to a number of factors, chief among them being illigibility of the system. This leads to the inability of the intended user to interact and respond to the wayfinding information presented in the system. Since the ease of

wayfinding has been shown to contribute positively to wellbeing and healing, whereas difficulty in wayfinding (or getting lost) leads to frustration and anxiety, the problem identified for this study is to interrogate the legibility of the hospital environment and its influence upon user wayfinding behavior. In Kenya, difficulty in wayfinding is evident from conversations with the general public about their experiences of interacting with the hospital environment. In addition to this, evidence from extensive literature reviewed for this study revealed the lack of wayfinding research in Kenya. This gap in knowledge impedes the formulation of meaningful interventions by stakeholders in the delivery of effective wayfinding systems.

1.4 Research Questions

The research questions posed for this study are:

1. What wayfinding information is present in the built environment of the hospital?
2. How do wayfinders use wayfinding information present in the hospital to find their way to their destinations?
3. How does wayfinding information present in the hospital influence wayfinding behavior of the user?
4. What is the level of user satisfaction with the wayfinding information in the hospital?

1.5 Research aim and objectives

The aim of this research was to to establish how people visiting the built environment of the hospital navigate the site to reach their intended destination. They either find their destinations or they get lost. The study had to evaluate the wayfinding system or strategy at the site, establish how this influences the behavior of users, and assess the level of user satisfaction with their wayfinding experience.

The objectives for this study are:

1. Evaluate legibility of the built environment of the hospital with regard to wayfinding information.
2. Investigate how wayfinders use wayfinding information to find their way to their destinations in the hospital.
3. Establish the influence of legibility upon wayfinding behavior of the user in the hospital.
4. Assess the level of user satisfaction with the use of wayfinding information in the hospital.

1.6 Hypothesis of the Study;

The research questions posed for this study interrogate the relationship between the availability of wayfinding information in the built environment of the hospital and the user's utilization of this information to facilitate wayfinding. The ease with which the user is able interprate and utilize this information for their wayfinding determines the legibility of the environment. The hypothesis tested by this study was that "*The legibility of the hospital environment facilitates ease of wayfinding for the users of the hospital.*" The hypothesis enabled analysis of the legibility of the hospital environment within which wayfinding took place, the ease with which the users undertook this activity, and the satisfaction of users with their wayfinding experience.

1.7 Overview of research methodology

The research methodolgy is the lens through which the framework of a study is selected. For this study a mixed-method approach research design was adopted. Within a case study framework the data was collected through structured questionnaires, observation, experimentation, and the review of relevant literature. The selection of a case study strategy was particularly appropriate because it gave an opportunity for the wayfinding aspect of environmental communication to be studied in some depth within a limited time scale. Data relating to user's perception was collected through a survey research method using a set of two questionnaires developed to obtain data on demographics, educational level, sign recognition, ease of navigation using wayfinding information and satisfaction with the hospital wayfinding system. Though observation and interviews are most frequently used in case study, the inclusion of a route survey test was deemed useful to enriching the study with further insight to the interraction of the wayfinder and the the wayfinding information in the environment.

1.8 Significance of the Research

In a hospital a good wayfinding system or strategy contributes positively towards healing. To create such a system should be the desire of any hospital management administration, architect and healthcare designer. This study is intended to commence the journey towards awakening awareness to the importance of wayfinding to good management. The findings from this study will furnish hospital environment designers, planners, builders and otherstakeholders with evidence based guidelines on how to realise effective wayfinding systems. Highly motivated by the statement by Hunter (2010) that states that ---"*Despite it's demonstrated importance to building use, costs,*

and safety, wayfinding recieves less than its due in planning, reserach and building evatuation. Often the investment in wayfinding systems is less than that devoted to amenities like art and furnishings."

The results from this study will augment the government's efforts to provide easily accessible health care service towards achieving the goal of equitable health services for all Kenyans. It is expected that by benchmarking hospital wayfinding with a best practice exemplar of wayfinding implementation, other hospitals in Kenya would benefit from lessons learnt.

1.9 Structure of the Thesis

The thesis is structured into seven chapters as follows;

Chapter 1 - Introduction

The topic of the research is introduced in this chapter. It provides an overview of the topic under investigation. This covers the motivation, background, research focus that leads to the statement of the research problem. Subsequently, a brief description of the research perspective is presented within which the research questions, study assumptions, aims and objectives are discussed. Finally the operational terms used in the study are defined. It concludes with a summary for the chapter.

Chapter 2 - Enviromental communication

The literature of previous research on wayfinding from the prespective of environmental communication was reviewed. Beginning with the definition and positioning of the term environmental communication as the framework upon which the study was anchored, the various topics related to wayfinding were discussed. These included space, wayfinding, the wayfinder and behavior, and finally, the environment within which this activity of wayfinding takes place.

Chapter 3 - The hospital environment

The built environment of the hospital was discussed by tracing the history from the early hospital to the modern hospital. The design of the physical built structure, including the functional layout was explained. Finally the influence of the environment upon the user wayfinding behavior and performance was illuminated with the mention of the concept of universal access.

Chapter 4 - The Kenyatta National Hospital

The largest national referral hospital in Kenya was purposely selected as case study for this research. By tracing the historical background in relation to the overall development of Nairobi, its' growth over a period of over 100 years, its' present state and condition is explained. The wayfinding system in place is interrogated against best practices in healthcare perimeters.

Chapter 5 – Research design and methodology

This chapter discussed the theoretical, conceptual and analytical frameworks used in this study. The research design and methodology applied were presented. The research aims and objectives were outlined. In addition, the methods of data collection, capture and analysis were explained.

Chapter 6 – Data presentation and analysis

The data collected from the field were presented and analysed in this chapter. By using various tools of analysis conclusions were drawn to enable the answering of the research questions posed in chapter one of this thesis. This chapter also indicated the extent to which the aims and objectives of the study were met.

Chapter 7 – Conclusion and Recommendations

This contains a synopsis of the main conclusions that refer back to the aims, objectives and research questions of the study. Relevant recommendations are then made and areas of further work indicated.

1.10 Summary

This Chapter has presented an introduction to the environmental communication research presented in this thesis. Starting with the background to the research, the choice of research focus, the research problem, the aim and objectives of the study are discussed. A summary of the research design and methodology appiled for the study are given with the importance of both a user-centred and environment centred research method being highlighted.

CHAPTER 2

ENVIRONMENTAL COMMUNICATION

It must be hard for humans, forever floundering through inconvenient geography. Humans are always slightly lost. It's a basic characteristic. It explains a lot about them.

— Terry Pratchett (1992)

2.0 Introduction

This chapter reviewed wayfinding literature from the persective of environmental communication. By tracing the root and rationale of the term 'environmental communication', the study of wayfinding is appropriately positioned within related disciplines that study human-environment interraction. From broad fields of enquiry the chapter narrowes to focus the lens of inquiry on wayfinding in the hospital environment. Literature on spatial orientation and conceptulization of space was reviewed as well as the interraction between people and the environment during the process of navigation and wayfinding within the built environment. Various theories attempting to explain how people find their ways in the physical world, what people need to find their ways, how they communicate directions and how verbal and visual abilities influence wayfinding were highlighted. The chapter finally concludes with a discussion on the anticipated outcomes and benefits of wayfinding research in Kenya with an emphasis on the hospital environment.

2.1 Environmental communication

The term enviornmental communication was introduced by Romedi Passini and Paul Arthur in 1992 in their collaborative book *Wayfinding: People, Signs, and Architecture* that codified architectural and cognitive research on wayfinding (Hunter, 2010). They argued that the built environment and it's parts should communicate with it's users to facilitate ease of wayfinding. In other words this may be regarded as information embedded in the built environment. Passini (1980), further pointed out that a key rule of environmental communication is that the information presented is not seen because it is there but because it is needed. According to Hunter (2010) the work of Arthur and Passini was the first to distinguish architectural and information components of wayfinding, compile relevant evidence, and translate it into design guidance. This study

is grounded upon Passini and Arthur's research by investigating the environmental communication of the built environment of the hospital with the users. Passini and Arthur (1992) assert that 'part of the environmental and perception and cognition is a source of information to make and execute decisions'. Wayfinding is, therefore, about effective environmental communication, and relies on a succession of communication clues delivered through our sensory system of visual, audible, tactile and olfactory elements (Apelt et al., 2007). It involves the gathering of information in the environment and using it to make decisions for orientation and movement through space (Hunter, 2010). Environmental information encompasses all sensory-based information systems, and, more recently, GIS based systems. There are four primary wayfinding elements: architectural, graphic, audible and tactile communication. In addition, clues such as culinary aromas from coffee shops, restaurants, and aromatic plants and flowers are useful as navigational aids for people who are blind or vision impaired. Brandon (2008) asserts that the work done by Passini (1997; 1984) and by Arthur and Passini (1992) has provided a good structure for describing and expounding on varied issues which graphic designers grappled with for many years as they provided solutions for wayfinding. It has ratified the intuition of designers about good wayfinding design and in others it has corrected faulty notions (Rooke, 2012). At its best it has seen the development of a common language by which designers and clients can discuss wayfinding needs and solutions. In the Department of Health (DOH) document (DOH, 1999, 2005) offering guidance for improving wayfinding in NHS healthcare settings, Miller and Lewis (1998), fully acknowledge the work of Arthur and Passini (1992) where they refer to information processing, decision making and decision execution as the 'three key processes in the wayfinding process' (Arthur and Passini, 1992). The visual quality of an environment contributes to the legibility of the setting.

2.2 Space and orientation

Any discussion on environmental communication and wayfinding - which may also be defined as the mental processes of orientation in space - must, of necessity begin with some notions about the physical experience of space (Jesus, 1994). Space and orientation form the basis of all meaningful relationships that people establish with their environment. The word "orientation" is derived from the Latin word "oriens", meaning East, or the direction of sunrise. It stems from the mediaeval practice of drawing maps with East at the top (ibid) (see Figure 2.1).

CHAPTER 2

ENVIRONMENTAL COMMUNICATION

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This chapter reviewed wayfinding literature from the persective of environmental communication. By tracing the root and rationale of the term 'environmental communication', the study of wayfinding is appropriately positioned within related disciplines that study human-environment interraction. From broad fields of enquiry the chapter narrowes to focus the lens of inquiry on wayfinding in the hospital environment. Literature on spatial orientation and conceptulization of space was reviewed as well as the interraction between people and the environment during the process of navigation and wayfinding within the built environment. Various theories attempting to explain how people find their ways in the physical world, what people need to find their ways, how they communicate directions and how verbal and visual abilities influence wayfinding were highlighted. The chapter finally concludes with a discussion on the anticipated outcomes and benefits of wayfinding research in Kenya with an emphasis on the hospital environment.

2.1 Environmental communication

The term enviornmental communication was introduced by Romedi Passini and Paul Arthur in 1992 in their collaborative book *Wayfinding: People, Signs, and Architecture* that codified architectural and cognitive research on wayfinding (Hunter, 2010). They argued that the built environment and it's parts should communicate with it's users to facilitate ease of wayfinding. In other words this may be regarded as information embedded in the built environment. Passini (1980), further pointed out that a key rule of environmental communication is that the information presented is not seen because it is there but because it is needed. According to Hunter (2010) the work of Arthur and Passini was the first to distinguish architectural and information components of wayfinding, compile relevant evidence, and translate it into design guidance. This study

is grounded upon Passini and Arthur's research by investigating the environmental communication of the built environment of the hospital with the users. Passini and Arthur (1992) assert that 'part of the environmental and perception and cognition is a source of information to make and execute decisions'. Wayfinding is, therefore, about effective environmental communication, and relies on a succession of communication clues delivered through our sensory system of visual, audible, tactile and olfactory elements (Apelt et al., 2007). It involves the gathering of information in the environment and using it to make decisions for orientation and movement through space (Hunter, 2010). Environmental information encompasses all sensory-based information systems, and, more recently, GIS based systems. There are four primary wayfinding elements: architectural, graphic, audible and tactile communication. In addition, clues such as culinary aromas from coffee shops, restaurants, and aromatic plants and flowers are useful as navigational aids for people who are blind or vision impaired. Brandon (2008) asserts that the work done by Passini (1997; 1984) and by Arthur and Passini (1992) has provided a good structure for describing and expounding on varied issues which graphic designers grappled with for many years as they provided solutions for wayfinding. It has ratified the intuition of designers about good wayfinding design and in others it has corrected faulty notions (Rooke, 2012). At its best it has seen the development of a common language by which designers and clients can discuss wayfinding needs and solutions. In the Department of Health (DOH) document (DOH, 1999, 2005) offering guidance for improving wayfinding in NHS healthcare settings, Miller and Lewis (1998), fully acknowledge the work of Arthur and Passini (1992) where they refer to information processing, decision making and decision execution as the 'three key processes in the wayfinding process' (Arthur and Passini, 1992). The visual quality of an environment contributes to the legibility of the setting.

2.2 Space and orientation

Any discussion on environmental communication and wayfinding - which may also be defined as the mental processes of orientation in space - must, of necessity begin with some notions about the physical experience of space (Jesus, 1994). Space and orientation form the basis of all meaningful relationships that people establish with their environment. The word "orientation" is derived from the Latin word "oriens", meaning East, or the direction of sunrise. It stems from the mediaeval practice of drawing maps with East at the top (ibid) (see Figure 2.1).

Figure 2.1 A mediaeval map with East at the top.
Source: www. wikipedia.com

Therefore orienting oneself means locating east and relating one self to it. To find ones' orientation in space, one needs to:

find their position (the You-are-Here spot) and

find their heading (the direction they are facing)

If one does not achieve the first point, they feel lost. If they achieve the first point and know their position, but not their heading, they are unable to proceed in any wayfinding task. The cardinal points (N,S,E,W,) have reflected the directions of our natural space since the earliest cultures and have also significantly affected the physical structure of the built environment. For example, the Roman cities were organized around the "cardo" (axis mundi) running north-south and the "decumanus" running east-west (Norberg-Schulz,1971).

Establishing one's relative position within a system of spatial relationships has long been a human preoccupation. This capacity to deal with the world structurally and hierarchically, estabishing systems for orientation, is evident in our spatial, cognitive and linguistic realms. Orientation becomes a determining factor in our ability to concretely relate to the environment, and even to communicate (Jesus, 1994). Orientation and wayfinding constitute a fundamental activities in people's daily lives with wayfinding being the process used to orient and navigate an environment (Gluck, 1991). Every day people have to find their ways through cities and towns, through buildings, along

streets and highways. Most times they manage to find their way with little or no problem. However, when they fail to do so, the possibility of getting lost and being disoriented is very real.

Disorientation is the flip-side of wayfinding. Disorientation produces frustration, irritation, anxiety, and stress (Evans, 1980; Lang, 1987; Lawton, 1994; Carpman & Grant, 2002). It can threaten our sense of wellbeing (Lynch, 1960). Whereas varying degrees of disorientation may be widespread in many environments - interior and exterior, large and small - some environments appear more prone to it than others. It is, therefore, worth studying what factors lead to disorientation in order to understand them and attempt to mitigate against them. Such factors may partially lie in people's spatio-cognitive abilities as well as in the architectural environments they navigate. Research on wayfinding indicates that many people experience problems finding their way around public buildings such as airports, hospitals, offices or university buildings. In particular, research conducted by Carpman (1993); Grover (1971); DOH (2005) and Huelat (2007) identify the hospital environment as being particularly prone to disorientation. Huelat (2007), makes the observation that each visitor - whether a patient, a family member or a healthcare provider - enters the medical facility with a personal reality. Some visitors may not realize how different and confusing a health care facility is compared to a shopping mall or an airport. This is especially so for people who are there for the first time and have to find a destination without the help of a previously aquired "mental map". They have to depend on external information in the environment or what Norman (1988) termed "knowledge in the world".

2.3 Conceptualization of space

Mental conceptualization of space and of spatial phenomena have been the subject of intensive research. An essential contribution to the conceptualization of space is the work of the urbanist Kevin Lynch, studying the phenomenon of imageability of urban environments. In his experiment, Lynch studied the composition of sketches provided by the inhabitants of American cities (Lynch, 1960). The analysis of the sketches he collected revealed five basic structural elements of the city form: *paths, nodes, landmarks, districts* and *edges*. These elements present the basic concepts in the (static) spatial mental representations, i.e. the image of the city people retain after experiencing it.

Lynch's urbanistic analysis of elementary spatial concepts was based on a medium scale view on the city and did not consider a more detailed structure within the urban

fabric of the urban environment. However, human hierarchical reasoning is flexible in its ability to change the granularity levels of mental representation across multiple granularities. Humans identify patterns and structures within limited, smaller parts of the city, as well as in its larger region. A building may be analysed by adapting these spatial concepts. As a wayfinder navigates through the built environment, it is important to consider how navigation tasks are constructed. If it were possible to decompose navigation tasks in a general way, we might be able to determine where assistance is needed, or where training can occur. Several attempts have been made at such a model with the model proposed by Jul and Furnas (1997) standing out as being relatively complete, in that it incorporates the motion component into the process in a way not attempted before (Figure 2.2).

The model works as follows:

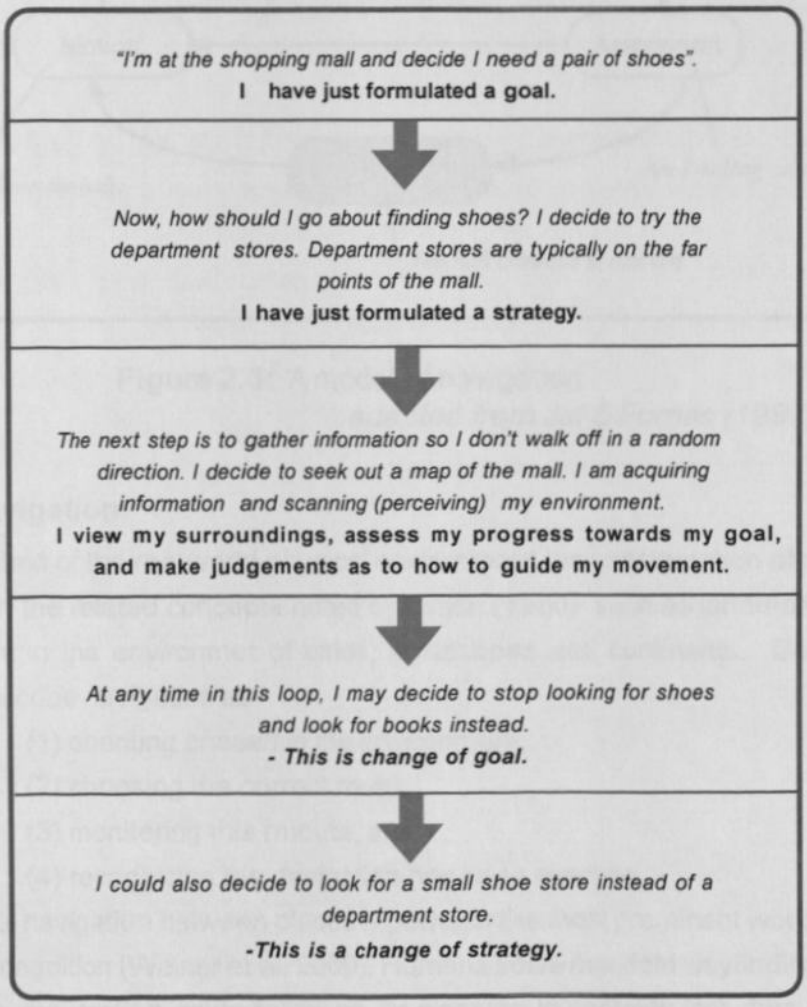


Figure 2.2: Model of a wayfinder navigating through the built environment.

Source: Adapted from Lynch (1960)

In any case, the task continues, shifting focus and process as necessary" (see Figure 2.3).

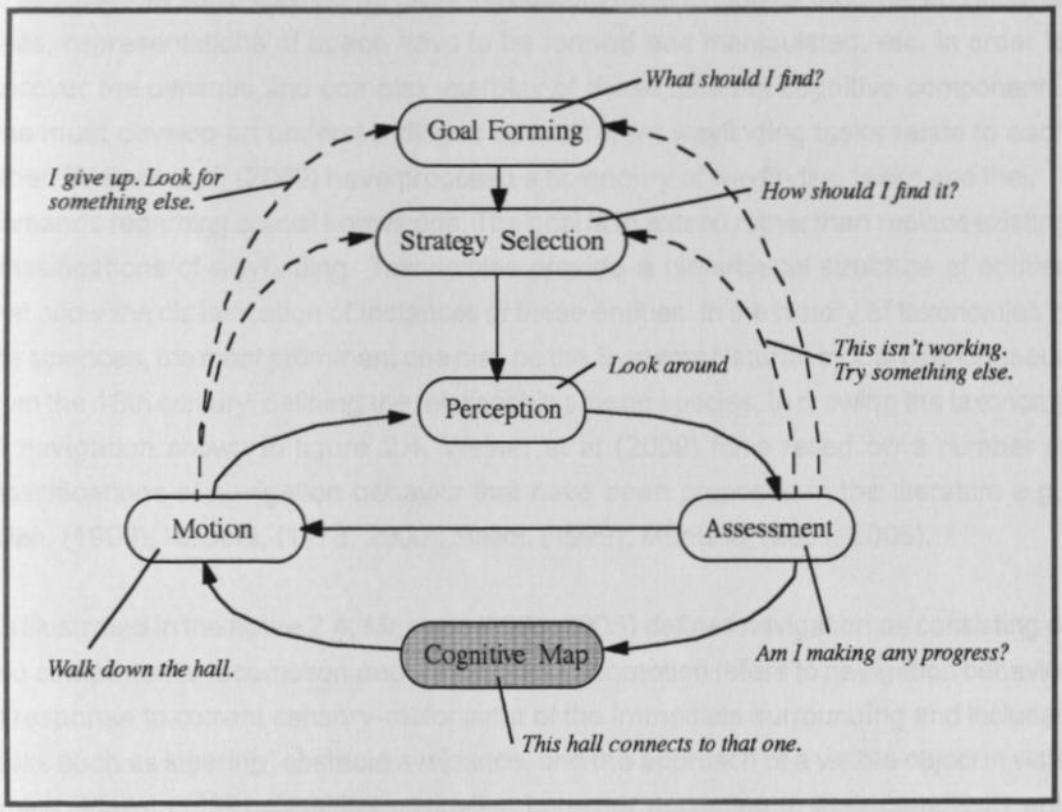


Figure 2.3: A model of navigation
adapted from Jul & Furnas (1997)

2.3.1 Navigation

In the context of the real world physical environment the consideration of navigation is tied in with the related concepts noted by Lynch (1960) such as landmarks, beacons and tracks in the environmet of cities, landscapes and continents. Downs & Stea (1973) describe navigation as:

(1) orienting oneself in the environment,
(2) choosing the correct route,
(3) monitering this rmoute, and
(4) recognizing the desination has been reached.

Purposeful navigation between places is perhaps the most prominent world application of spatial cognition (Weiner et al, 2009). Humans solve manifold wayfinding tasks such as search, exploration, route following, or planning in contexts including outdoor and urban environments, indoor spaces and virtual reality. The cognitive resources required for these tasks differ considerably, both with respect to the format and content of spatial knowledge involved and with respect to strategies of problem solving, choice of

perceptual cues from the environment and ultimately choice of movement sequences and navigation. Wayfinding belongs to the most complex cognitive operations. In order to successfully solve wayfinding tasks, navigators have to monitor external and internal cues, representations of space have to be formed and manipulated, etc. In order to uncover the dynamic and complex interplay of these different cognitive components, one must develop an understanding of how different wayfinding tasks relate to each other. Weiner et al, (2009) have proposed a taxonomy of wayfinding tasks and their demands regarding spatial knowledge. The goal is to extend rather than replace existing classifications of wayfinding. Taxonomies provide a hierarchical structure of entities that allow the classification of instances of these entities. In the history of taxonomies in the sciences, the most prominent one may be the Systema Naturae by Carolus Linnaeus from the 18th century, defining the relationship among species. In drawing the taxonomy of navigation shown in figure 2.4, Weiner et al (2009) have relied on a number of classifications of navigation behavior that have been proposed in the literature e.g., Allen, (1999), Kuipers, (1978, 2000); Mallot, (1999); Montello, (2001; 2005).

As illustrated in the figure 2.4, Montello (2001, 2005) defines navigation as consisting of two components, locomotion and wayfinding. Locomotion refers to navigation behavior in response to current sensory-motor input of the immediate surrounding and includes tasks such as steering, obstacle avoidance, and the approach of a visible object in vista space. Mallot (1999) classifies navigation behavior according to their complexity and according to the kind of memory required to perform the behavior. This class of navigation behavior is very similar if not identical to what has been referred to as locomotion by Montello (2005). Integration of spatial information over time allows forming a working memory.

The most elaborate taxonomy of wayfinding comes from Allen (1999). He defines three wayfinding tasks: exploratory navigation, travel to familiar destination, and travel to novel destinations and provides prototypical examples. Relocating to a new city and exploring the surroundings is a typical example of exploratory navigation; commuting between home and work place is a typical example of travel to familiar destinations, and wayfinding guided by maps is a typical example of travel to novel destinations (Allen, 1999). Allen furthermore describes six wayfinding means by which the tasks can be solved (oriented search, following a marked trail, piloting between landmarks, path integration, habitual locomotion, referring to cognitive map). Mallot (1999) distinguishes between different memory systems and learning processes involved, but again does not explicitly differentiate between different tasks. Allen (1999) distinguishes between both, wayfinding tasks and wayfinding means. In Allen's taxonomy, four out of the six wayfinding means can be applied in all three wayfinding tasks.

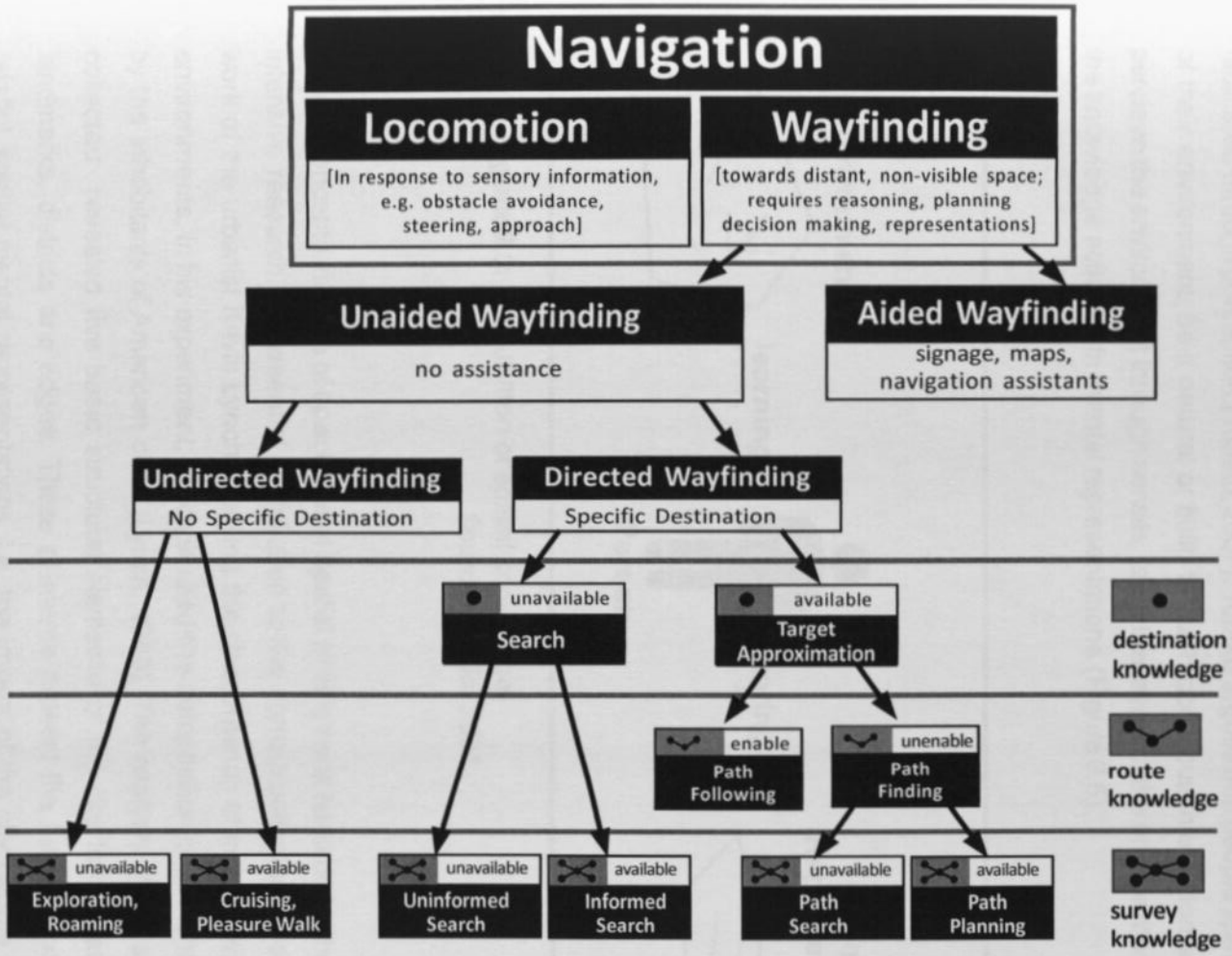


Figure 2.4 : Taxonomy of wayfinding tasks, classified by the existence of an external aid, a specific destination and the availability of different levels of knowledge.

Source: Weiner et al (2009)

2.3.2 Spatial knowledge

People store their spatial knowledge in mental representations of space. This envronmental knowledge is acquired through interaction with the environment and it is facilitated through perception (Tomko, 2007). Tomko argues that people learn the layout of their environment, be it natural or built, through continous interaction with it. They percieve the environment through senses, learn the layout of the environment and store the knowledge acquired in mental representations (Figure 2.5).

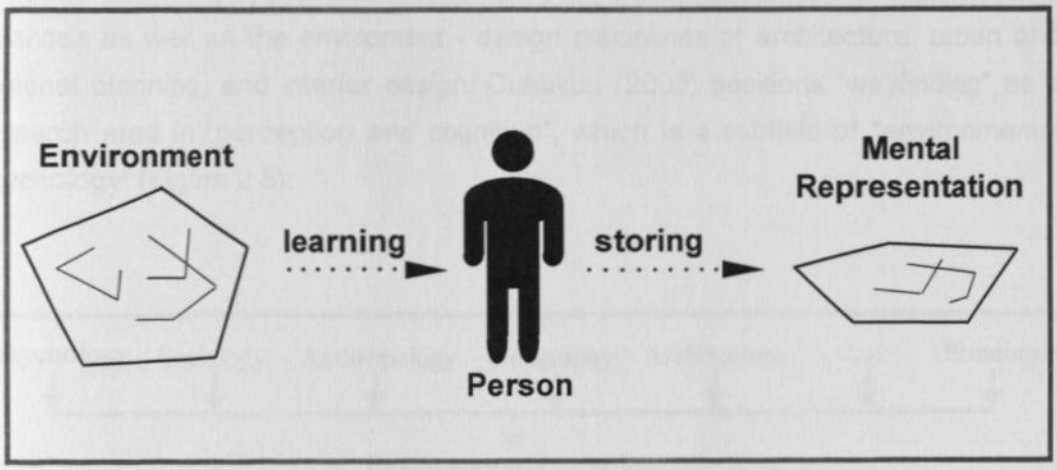


Figure 2.5: Acquisition of spatial knowledge.
Source: Tomko,2007

Mental conceptualization of space and of spatial phenomena have been the subject of intensive research. An essential contribution to the conceptualization of space is the work of the urbanist Kevin Lynch, studying the phenomenon of imageability of urban environments. In his experiment, Lynch studied the composition of sketches provided by the inhabitants of American cities (Lynch, 1960). The analysis of the sketches he collected revealed five basic structural elements of the city form: paths, nodes, landmarks, districts and edges. These elements present the basic concepts in the (static) spatial mental representations, i.e. the image of the city people retain after experiencing it.

2.4 Wayfinding

What in many respects is a new and exciting field of study, it has developed rapidly with it's multidisciplinary character leading to stimulation and cross-fertilization on the one hand, and to confusion and difficulty in communication on the other. This is due to the fact that those involved have diverse intellectual style and goals. Some are concerned with basic and theoretical issues while some, with applied real-world problems of environmental design. Altam and Stokols in the series forward to the book "Inquiry by Design" by Zeisel (1984), state that in recent decades the relationship between human behavior and the physical environment has attracted researchers from the social sciences as well as the enviroment - design disciplines of architecture, urban and regional planning, and interior design. Cubukcu (2003) positions "wayfinding" as a research area in "perception and cognition", which is a subfield of "environmental psychology" (Figure 2.5).

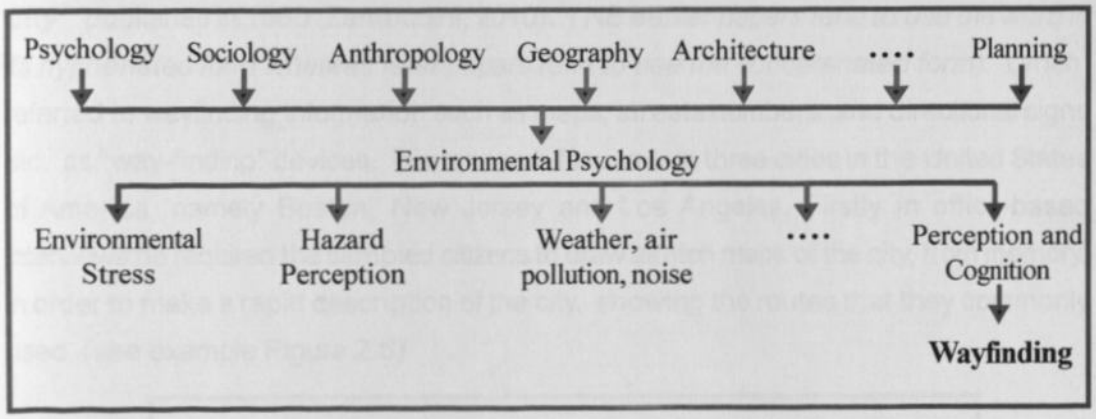


Figure 2.6 The hierarchical structure of the study area - wayfinding

Source: Cubukcu, 2003.

According to Rooke (2013) the developments in wayfinding appear to fall into three overlapping eras: the Pre-Passini Era (PrePE) from 1960 to the 1970s, the Passini Era (PE) from the late 1970s to 1990s and the Post-Passini Era (PoPE) from the mid 1990s to date. The first era sees the inception and conceptualisation of wayfinding. It is dominated by thinkers keen to study cognitive structures responsible for information processing and wayfinding is understood and explained in terms of spatial orientation and cognitive maps (e.g. Lynch, 1960; Downs & Stea, 1973, 1977; Siegel and White, 1975; Kaplan, 1976). In the second era, wayfinding is conceptualised further

by extending the concept of spatial orientation. The era is dominated by thinkers keen to study the dynamism of humans in space (e.g. Passini, 1977, 1984, 1996; Wiseman, 1981; Arthur and Passini, 1992).

Wayfinding is understood and explained in terms of spatial problem solving. The third era sees an extensive operationalisation of existing concepts, nothing new is offered in terms of conceptualization. The era is polarised into two camps: pro-Passinis (e.g. Carpman and Grant, 2001; Huelat, 2004; Brandon, 2008; Rooke et al., 2010b) and procognitivists (e.g. Golledge, 1999; Raubal, 2001; Haq and Zimring, 2003; Holscher et 2005). Implicit in the categorization are practices underpinned by environmental and cognitive psychology respectively.

2.4.1 Wayfinding background

The term "way-finding" was first used by the American urban planner Kevin Andrew Lynch in his seminal book on the perceptual reading of the city ***"The Image of the City"*** published in 1960 (Zamburlini, 2010). *(NB earlier papers tend to use the word in its hyphenated form whereas later papers tend to use the concatenated form).* Lynch referred to wayfinding information such as maps, streets numbers, and directional signs etc. as "way-finding" devices. His research focused on three cities in the United States of America, namely Boston, New Jersey and Los Angeles. Firstly in office-based interviews he required the sampled citizens to draw sketch maps of the city, from memory, in order to make a rapid description of the city, showing the routes that they commonly used. (see example Figure 2.6)

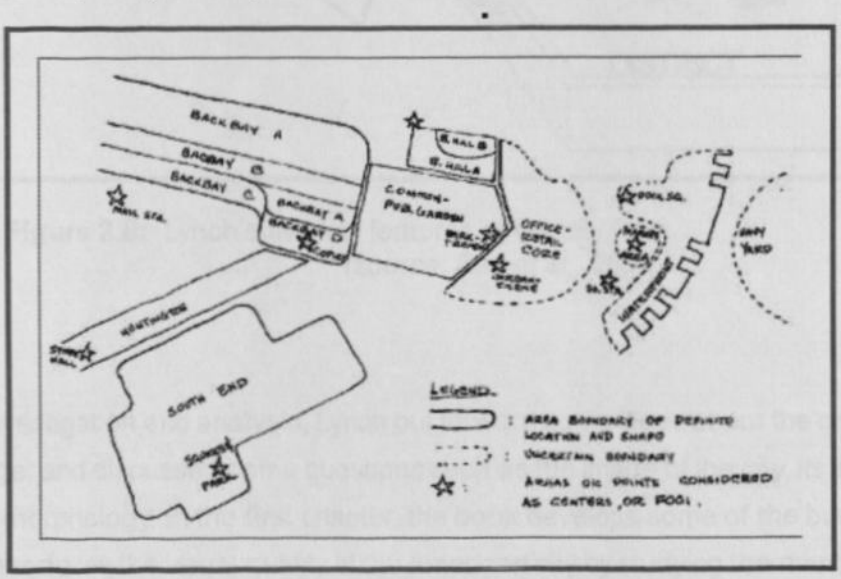


Figure 2.7: Sketch map of the city of Boston.
Source: Lynch (1960)

He then had trained observers in the field systematically examine these sketch maps and compare them to the actual layout of each city (Zamburlini, 2010). On the basis of this in-depth analysis, this classic study found that respondents organized their city images using a set of common images and features. He termed these as paths, landmarks, regions, edges and nodes. This work which is seen as many as being pivotal in how people understand environments, was based on the concept of spatial orientation and its prerequisite the cognitive map (Arthur & Passini, 1992). Figure 2.7 illustrates a representation of Lynch's definition of the five key features of the city form.

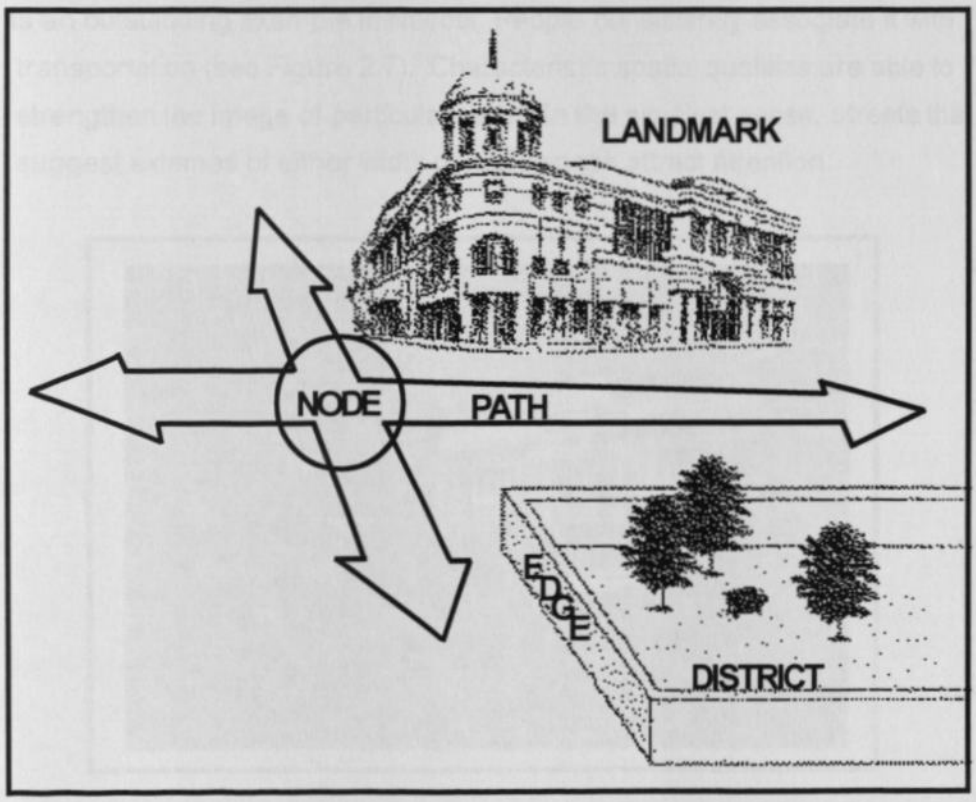


Figure 2.8: Lynch's five key features of the city form.
(source: Bell et al., 2005)

After the investigation and analysis, Lynch put forward some ideas about the concept of public image, and discussed some questions such as the image of the city, its elements and urban morphology. In the first chapter, the book develops some of the basic ideas and then introduces the visual quality of the American city by studying the mental image of a city as held by its citizens.

- **Path:** For most people interviewed by Lynch (1960), paths were the predominant city elements, although their importance varied according to the degree of familiarity with the city. Paths constitute the basis for what is widely discussed as route knowledge. They are the one-dimensional physical entities of the environment along which observers move. The city is experienced through movement along paths which are the most predominant elements used to organize the city. From a functional point of view, any network facilitating transport, such as streets, walkways, transit lines, canals, and railroads can represent a network of paths. Concentration of special use or activity along a street may give prominence in the minds of observers. The Accra road matatu stage in Nairobi is an outstanding example in Nairobi. People consistently associate it with transportation (see Figure 2.7). Characteristic spatial qualities are able to strengthen the image of particular paths. In the simplest sense, streets that suggest extemes of either width or narrowness attract attention.

Figure 2.9: Accra road matatu stage in Nairobi. An example of paths

Source: Fieldwork (2013)

- **Node:** nodes are the strategic foci into which the observer can enter, typically either junctions of paths, or concentrations of some characteristic. Although conceptually they are small points in the city image, they may in reality be large squares, or somewhat extended linear shapes, or even entire central districts when the city is being considered at a large enough level. The junction, or place of a break in transportation, has compelling importance for the city observer. Because decisions must be made at junctions, people heighten their attention at

such places and perceive nearby elements with more than normal clarity. As noted by Lynch (1960), some nodes are the focus and epitome of a district, of which they stand as a symbol. (see Figure 2.8)

Figure 2.10: Nairobi Railway matatu stage. An example of a node in the city of Nairobi.
Source: Fieldwork (2013)

- **Landmark:** Landmarks are point-like spatial features, serving as spatial references. The observer cannot enter within a landmark, it can only be experienced-observed-from the exterior. According to Lynch's definition, landmarks are simple physical elements which may vary widely in scale. The key physical characteristic of this class is singularity, some aspect that is unique or memorable in the context. Landmarks present convenient clues in the spatial structure of the imagined environment and become more easily identifiable, more likely to be chosen as significant, if they have a clear form; if the contrast with the background; and if there is some prominence of spatial location. Figure-background contrast seems to be the principal factor. Lynch (1960) distinguishes between distant landmarks, representing inaccessible locations, and local landmarks, visible only in a restricted space and from a certain viewpoint. The background against which an element stands out need not be limited to immediate surroundings. The KICC buliding and Times tower in Nairobi are landmarks that are unique against the background of the entire city (Figure 2.9).

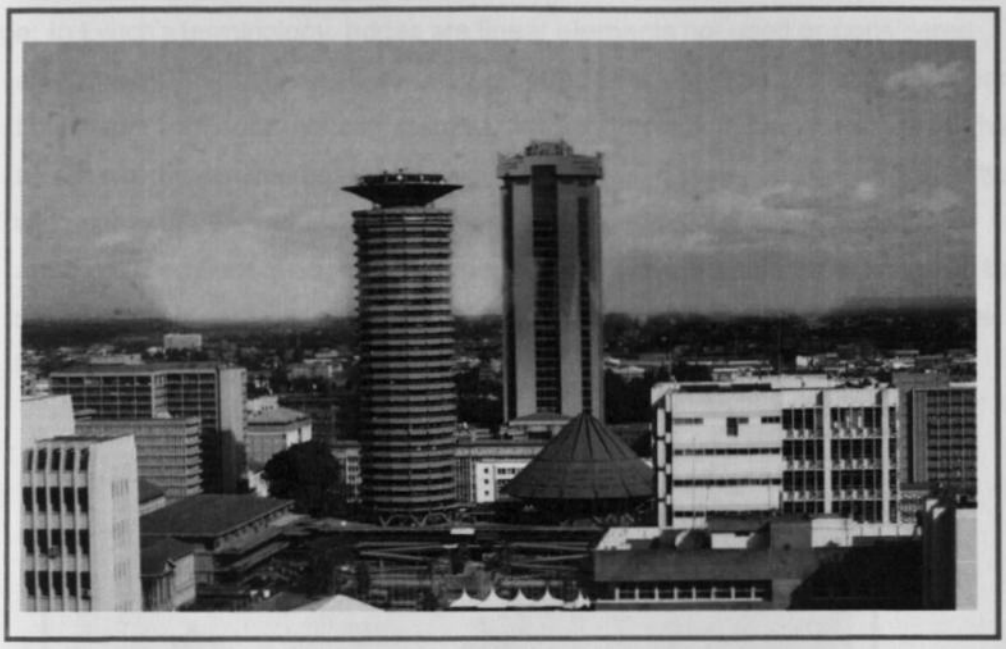


Figure 2.11 Landmarks in the skyline of the city of Nairobi.
Source: Fieldwork (2013)

- **District:** defined by Lynch (1960) as medium-to-large sections of the city, conceived of as having two dimensional extent, which the observer mentally enters "inside of" and which are recognizable as having some common, identifying character. Always identifiable from the inside, they are also used for exterior reference if visible from the outside. Districts and paths are singled out as the most dominant and distinctive elements of the city form.

Figure 2.12: Times Towers, Headquaters of The Kenya Revenue Authority (KRA). An example of a district
Source: Fieldwork (2013)

- **Edge:** In Lynch's terminology, edges are linear elements not used or considered as paths by the observer. They are the boundaries between two phases, linear breakes in continuity: shores, railroad cuts, edges of developments, walls. They are lateral references rather than coordinate axes. Lynch (1960) states that they are usually impenetrable to cross-movement and close one region off from another. The effect of edges on the perception of the hierarchical structure in the urban environment is closely related to the boundaries between districts. The term edge can be used interchangeably with barrier.

Figure 2.13: An example of an edge in the city of Nairobi.
Source: Fieldwork ,2013

Lynch,s concept of spatial orientation came into widespread when in the late 1970s when the phrase 'spatial orientation' was essentially replaced by the term wayfinding in the work by Romedi Passini (1977), an architect and environmental psychologist, who argued that the concept of spatial orientation did not take into account the dynamic aspects of the movement of humans. He argued that wayfinding involves more than just a generation of a static mental map of a spatial situation as suggested by Lynch (1960). He introduced the idea of wayfinding as a spatial problem-solving exercise in which people must solve a wide variety of problems as they move through architectural and urban spaces. He found that humans depend on information and cues within environmental spaces to aid decision making, decision execution and information processing (Passini 1977, 1984). In 1992, Passini collaborated with Paul

Arthur, the late Toronto designer, on a seminal work (*Wayfinding: People, Signs, and Architecture)* that codified architectural and cognitive research on wayfinding (Hunter, 2010). Their work, which clearly extended Passini's (1984) earlier work, introduced the term ***environmental communication***, arguing that the built environment and its parts should communicate with its users. According to Hunter (2010) the work of Arthur and Passini was the first to distinguish architectural and information components of wayfinding, compile relevant evidence, and translate it into design guidance (Rooke, 2002). Rooke (ibid) further states that Arthur and Passini were the first to articulate wayfinding as a spatial problem-solving exercise in which wayfinding is described as a process during which people must solve a wide variety of problems in architectural and urban spaces that involve both decision making and decision executing. According to Brandon (2008) Passini's work was recognized as being seminal in explaining many of the issues which graphic designers had been dealing with for many years and it gave designers the structure for describing what the design of wayfinding systems entailed. In some cases, he further asserts, it ratified the intuition of designers about good wayfinding design and in others it corrected faulty notions, and at its best, it has seen the development of a common language by which designers and clients can discuss wayfinding needs and solutions.

2.4.2 Definitions of wayfinding

Wayfinding has a large selection of definitions that have evolved during the research in the field of various disciplines. Through this survey of definitions we begin with an examination of the origins of the word then gradually distil a working definition that shall be used throughout this thesis.

'Wayfinding' is a term that has not quite made it into the English language. Encyclopedia Brittanica (on line) does not list it, nor does the Oxford English dictionary (Haq 1999). Nevertheless, it has become an important area of focus within environment-behavior research. Etymologically the word may be assumed to be a derivation of the words ***wayfarer*** and ***wayfaring***. Both of these words are derived from Old English; wayfaring (archaic) was first recorded as being used in 1536 AD, whereas an older version of the word, wayfering (obsolete) can be traced back to 890 AD (The Oxford Dictionary of English Etymology & An Etymological Dictionary of the English Language, 1924). The definitions of these words mean journeying or travelling, particularly on foot.

Solvej (2012) mentions a number of definitions for wayfinding observing that it is a concept with many definitions, i.e.: -"Wayfinding is a cognitive process that involves recognition of a stable, comprehensive set of spatial relationships." (Joowon Ahn 2006).

"Wayfinding defined in terms of spatial problem solving comprises three distinct processes: decision making, and elaboration of a plan of action, decision executing transforming the plan into overt behaviour and information processing which underlies both decision related processes" (Passini, 1985). "Wayfinding encompasses all the ways in which people and animals orient themselves in a physical space and navigate from place to place" (Golledge, 1999). "Wayfinding is the cognitive process of defining a path through an environment using and acquiring spatial knowledge helped by cues" (Carpman & Grant, 1996).

An informal but nevertheless accurate definition of wayfinding is provided by Bates (1989): *"Wayfinding means knowing where you are, knowing your destination, following the best route, recognizing your destination, and finding your way back out."* (figure 2.14)

Figure 2.14: Basic components of way-finding consisting of three parts: Origin (starting point), Destination(end point), and a route segments (connection) in between.
Source: Bates (1989)

In this definition "destination" may be seen as the original information need. "Knowing where you are" resembles the process of dealing with queries and respective responses. "Recognizing your destination" can be compared to recognizing the information need is resolved. A caveat seems to be that an information seeker's original information need may change significantly during search whereas the idea of a destination appears to be relatively static. Quite often, however, "destination" does not refer to a specific location but to loosely specified areas.

This thesis takes the everyday activity of wayfinding as a problem domain for studying how indviduals interact with an environmental setting to get from one place to the next. That is getting from an origin to a destination. It is a purposive, directed and motivated activity (Golledge, 1999).

2.5 Wayfinding theories

This section discusses the main theoretical approaches to human wayfinding and navigation that influenced this study. Wayfinding refers to the ability to navigate effectively through an environment and wayfinding research investigates the processes that take place when people orient themselves and navigate through space. Wayfinding and environmental cognition research has been embraced by a wide range of disciplines such as environmental psychology, architecture, geography, city planning, computer science, cognitive science, and others. Theories try to explain how people find their ways in the physical world, what people need to find their ways, how they communicate directions, and how people's verbal and visual abilities influence wayfinding. According to Mark (1997), knowledge about human spatial cognition is important for explaining and predicting people's behavior in geographic space. Spatial cognition refers to both the perceptual and conceptual processes involved in understanding the physical environment. Therefore, wayfinding theories need to integrate a link between perception and cognition if they are to serve as plausible accounts of people's everyday experience (Allen 1999).

Allen (1999) provides insights into the nature of spatial abilities and the role they play in cognitive mapping and wayfinding procedures. He gives considerable emphasis to the concept of individual differences in spatial cognition and in behavior. He argues that the scientific literature in psychology and geography contains a vast number of studies concerned with spatial abilities and a growing body of research on wayfinding, although little has been done to establish the relevance of the former for the latter. Thus the question of why some individuals are better than others at wayfinding has been difficult to address. Allen (ibid) suggests that a potentially informative way to think of wayfinding is to differentiate between wayfinding tasks and wayfinding means. Tasks include traveling to a previously known destination, exploration with the purpose of returning home, and traveling to a novel destination. Means include oriented search, following a continously marked trail, piloting (between landmarks), habitual locomotion, path integration,and reference to a cognitive map. He describes wayfinding behaviour as the "purposeful, directed and motivated relocation from an origin to a specific distant destination, which cannot be directly percieved by the traveller. This involves the interaction of a person with an environment, the purpose being to reach a destination. In general, the wayfinding ability of individuals is greatly influenced by a number of factors, . The most important of these being:

1. Individual Characteristics (e.g., age, sex, cognitive development, perceptual capability, mental and physical condition).

2. Characteristics of the environment (e.g., size, luminosity, signage, utilization, structure, familiarization with it).
3. Learning Processes (e.g., learning strategies, learning conditions, learning abilities).

Golledge (1999) reviews critical definitions relating to cognitive maps and wayfinding. He provides an overview of the role of cognitive mapping in human wayfinding and describes the processes of aquiring and storing spatial information about large-scale complex environments. Further he discusses how humans record and represent environmental knowledge. The role played by landmarks and routes in anchoring knowledge and in wayfinding is examined, and the differences between path following and route based environmental learning are explored. Errors commonly related to encoding, decoding, and internally manuplating cognized spatial data are highlighted. Wayfinding by humans in contexts other than with landmark usage is also examined, and an elaboration of errors commonly found in human wayfinding follow. Furthermore, the wayfinding ability of individuals is mainly affected by the following four factors: spatial ability, fundamental information processing capabilities, prior knowledge of the environment and motor capabilities. Spatial ability can be defined as the ability of every individual to perceive the surrounding environment with its sensing and cognitive mechanisms. This ability includes all cognitive procedures that are used whenever we are learning our environment and comprehend correlations among its elements. This leads to spatial consciousness, which describes the degree to which an individual understands/reacts with the environment using her spatial ability. Thus, wayfinding is a dynamic and demanding cognitive procedure, which involves many spatial and navigational abilities. Moreover, similarly to every other human activities, not every individual has the same navigational skills (Timpf et al,1992).

Downs and Stea (1973) suggested that wayfinding involves the following four steps:

1. Orientation: Finding out where someone is with respect to nearby landmarks and the navigation destination.
2. Route Selection: Selecting a route, under certain criteria, that will eventually lead the individual to the desired destination.
3. Routing Control: Constant control and confirmation that the individual follows the selected route.
4. Recognition of destination: The ability of an individual to realize that they have reached the destination or is located in a nearby area.

Basically speaking, if one is familiar with the environment, successful wayfinding is dependent on the accurate recall or recognition of known routes. Individuals use their knowledge and previous experience with geographic spaces in order to navigate from one location to another. If one is unfamiliar with the environment, movement relies on external aids, such as following signs, asking for directions, or using maps.

Weisman (1981) identified four classes of environmental variables that influence wayfinding performance in built environments:

1. visual access;
2. architectural differentiation;
3. signs and room numbers to provide identification or directional information;
4. plan configuration.

Seidel's (1982) study at the Dallas/Fort "Worth Airport showed that the spatial structure of the physical environment has a strong influence on people's wayfinding behavior. People's familiarity with the environment also has a big impact on wayfinding performance. Research on people's wayfinding performance helped to establish practical guidelines on how to design public buildings to facilitate wayfinding.

Arthur and Passini (1992) introduced the term environmental communication, arguing that the built environment and its parts should function as a communication device. They mention two major aspects regarding the understanding of buildings: a spatial aspect that refers to the total dimensions of the building and a sequential aspect that considers a building in terms of its destination routes. Destination routes should eventually lead to destination zones. These are groupings of similar destinations within buildings into clearly identifiable zones. In order to facilitate wayfinding to such destination zones the circulation system should be of a form people can easily understand.

This study is developed on Arther and Passini's aurgument that the built environment of the hospital should function as a communication device that facilitates effective user wayfinding.

2.6 The Importance of good wayfinding

The costs of poor wayfinding have been highlighted in relation to the impact it has on the wayfinder (Arthur and Passini (1992), Carpman and Grant (2001) and Huelat 2004). This impact includes stress related problems such as: raised blood pressure,

headaches, increased physical exertion, and fatigue are linked to wayfinding in complex environments (Rooke, 2012). Communicating effectively with patients and families is a cornerstone of providing quality health care. Patient surveys have demonstrated that when communication is lacking, it is palpably felt and can lead to patients feeling increased anxiety, vulnerability and powerlessness (Planetree, 2008).

The costs to the organization such as a hospital include:

1. lost staff time;
2. reduced staff concentration caused by the need to provide directions or other interventions;
3. lost business and dissatisfaction due to frustration and ill-will of users;
4. costly missed appointments or delayed meetings;
5. additional security staff and traffic management costs;
6. compensatory environmental communications systems;
7. potential law suits surrounding lack of safety and accessibility;
8. danger to users wandering into limited access areas of buildings; and
9. injury and death during emergency (ibid).

Zimring's (1990) study, for example, found that the hidden costs of direction-giving by people other than information staff equalled the cost of employing two full time professional (US$220,000 per year). Needless to point out that the lost hours could be better spent delivering a better healthcare service to the patients in the case of hospitals. Zimring argues that whilst direction-giving by staff and other occupants of the building are an essential part of wayfinding they are to be relied upon less when developing an effective and comprehensive wayfinding strategy. For the strategy to be effective, good wayfinding design principles/guidelines should be followed. Rooke (2012) while discussing wayfinding design principles observes that Carpman and Grant (2002) contend that evidence-based principles of wayfinding must be translated into built and graphic form through spatial planning and environmental communication. However, Peponis and Weiseman (2002) warn that designers should not assume that wayfinding principles are the same at all scales. They assert that these should reflect the: differences in interior and exterior wayfinding, wayfinding differences between first time and regular users, and differences in strategies used by significant population groups. Huelat (2007), proposes her principles in graphical form showing building blocks (Facility Amenities, Graphics, Signage, Architecture, Interior Architecture, Interior Design, Landscape and Master Plan) which she asserts rely on each other to form a solid wayfinding system (see Figure 2.15).

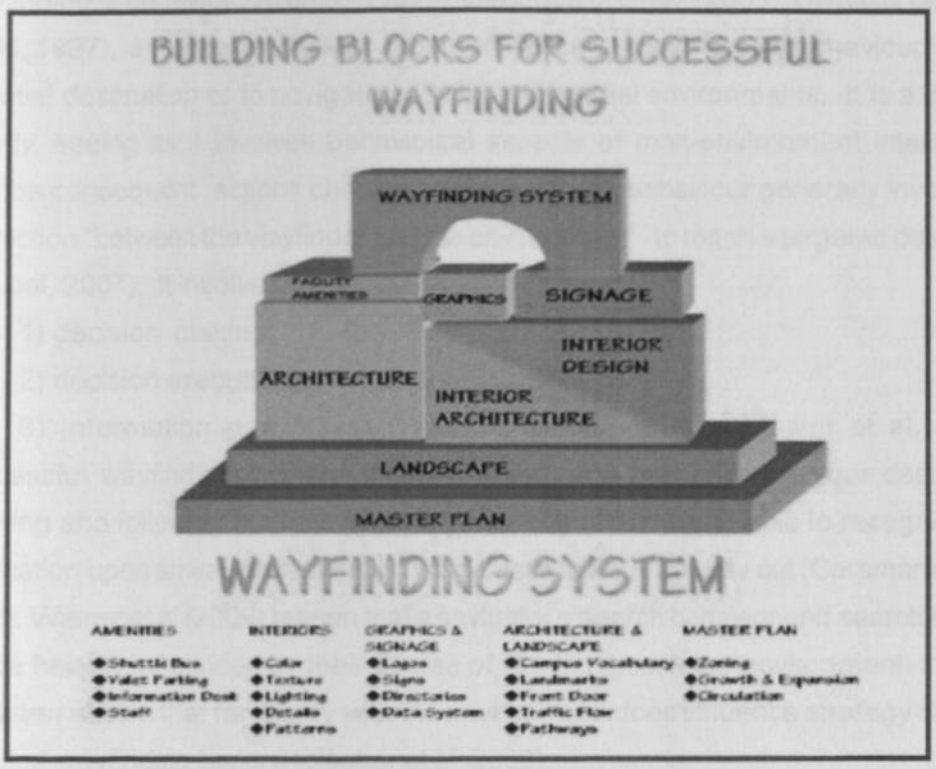


Figure 2.15: Building blocks model for successful wayfinding.
Source: Huelat, (2007).

According to this model a Master Plan includes the following; Zoning, Growth and Expansion and Circulation. Huelat argues that the Master Plan can provide a solid foundation for a good wayfinding system (Rooke, 2012).

2.7 Wayfinding Behavior

Behavior refers to things people do, including thinking, feeling, and seeing, as well talking with others and moving around (Zeisel, 1981). People behave in reaction to the environment they interract with. People throughout history have gravitated to town centres, market squares, and vibrant public spaces filled with global wares (Gibson, 2009). In these spaces people may "find their way" in the existential sense or they may become overwhelmed or disoriented if they physically lose their way. As Allen (1999) pointed out, much everyday wayfinding behavior in man-made/urban environments is aided by some form of externalized representations, such as maps, signage, route instructions, or by modern hand-held computers and route planners.

Wayfinding is behavior. Allen, G. (1999), Carpman & Grant (2003), Devlin & Bernstein (1995, 1997), and Passini (1984a, 1984b) all define wayfinding as a behaviour to reach a spatial destination or to navigate and orient in spatial environments. It is a *dynamic activity,* seeing as it involves behavioural aspects of man-environment interactions, and the consequent actions chosen. This wayfinding behaviour generally involves an interaction "between the wayfinder and the environment" to reach a targeted destination (Raubal, 2007). It involves

1) decision making,

2) decision execution, and

3) information processing (Passini, 1984a, 1984b; Passini et al., 2000). Successful wayfinding involves knowing where you are, knowing your destination, knowing and following the best route to your destination, being able to recognize your destination upon arrival, and reversing the process to find your way out (Carpman &Grant, 1993). Wiener et al (2009) reason that a navigator's search behavior and search strategy will be heavily influenced by their degree of familiarity with the environment. In fact, it has been shown that familiarity with the environment does influence strategy choice in directed wayfinding tasks (Hölscher et al, 2006).

2.7.1 Factors that affect wayfinding behavior

It is possible to identify a person's information-processing capabilities as they relate to architectural elements and space. Difficulties, that may manifest themselves in a person's behavior, may arise when a person taking in information from the environment is not able to comprehend or decipher it and then process it to facilitate wayfinding. Environmental communication provides information that is embedded in the built environment. This is information that may be deciphered by the wayfinder to enable them navigate the environment. The ease with which they are able to process and use this information may be noted in their wayfinding behavior. A well designed environmental communication system otherwise known as a wayfinding system/strategy provides the wayfinder with cues that are easy to see, understand and use to lead them from point to point along their journey to their desired destination. In such a situation the experience of wayfinding and navigation is seen as stress free.

The degree of familiarity that an individual has with a given setting is one obvious and potentially powerful influence on wayfinding behavior (Baskaya et al, 2004). As familiarity with an environment increases, performance in wayfinding and spatial orientation tasks improves both in accuracy and latency (Bryant, 1982; O'Neill, 1992), and the degree of complexity of the layout of the environment becomes less important. A navigator's search

behavior and search strategy will be heavily influenced by their degree of familiarity with the environment. In fact, it has been shown that familiarity with the environment does influence strategy choice in directed wayfinding tasks (Hölscher, Meilinger, Vrachliotis, Brösamle, & Knauff, 2006). The impact of the navigator's knowledge on cognitive task characteristics becomes even more apparent, when both extensive familiarity with the environment and information about the specific location of the target are available. Here the wayfinding agent can engage in a mental planning process to determine the shortest route to the target. Spatial knowledge is a key factor along which wayfinding tasks may be classified.

This spatial knowledge has to be applied and is strongly influenced by the physical properties of the built environment as well as wayfinding information available. Figure 2.16 illustrates the interraction of this tri-partite arrangement.

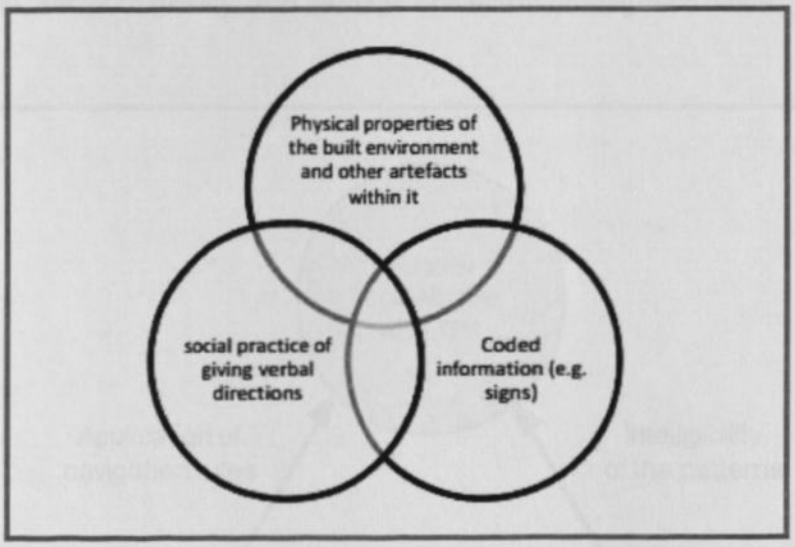


Figure 2.16: The tripartite conception of knowledge flows
Source: adapted from Rooke et al (2010)

2.8 Wayfinding Performance

The literature on wayfinding performance discusses empirical results of how people find their ways. Investigations are based on collecting people's perceptions of distances, angles or locations. Kevin Lynch's (1960) *The Image of the City* is regarded as the foundation for human wayfinding research. His goal was to develop a method for the evaluation of ciy form based on the concept of *imageability* (i.e., "that quality in a physical object which gives it a high probability of evoking a strong image in any given observer") and to offer principles for city design. The ability of the user of an environment

to "read" and utilize this imagability reflects the *legibility* of the environment. For an environment to be truly legible it must be easily and readily *deciphered* by everyone who engages and interracts with it.

From a theoretical point of view, wayfinding performance is the result of a two-way process between a person's cognitive ability and their environment (Moore & Golledge, 1976; Gearling, Boeoek & Lindberg, 1986; Gaerling & Evans, 1991; Golledge, 1999). The environment suggests distinctions and relations, and the wayfinder makes path choices based on perceived environmental information, with the cognitive abilty mediating between the two (see Figure 2.17). He selects and organizes what he sees making use of many kinds of cues may for orientation. Lynch (1960) believed that people use different elements of the environment, such as "the visual sensation of color, shape, motion, or polarization of light, as well as other sense such as smell, sound, touch, kinesthesia, sense of gravity, and perhaps of electric or magnetic fields."

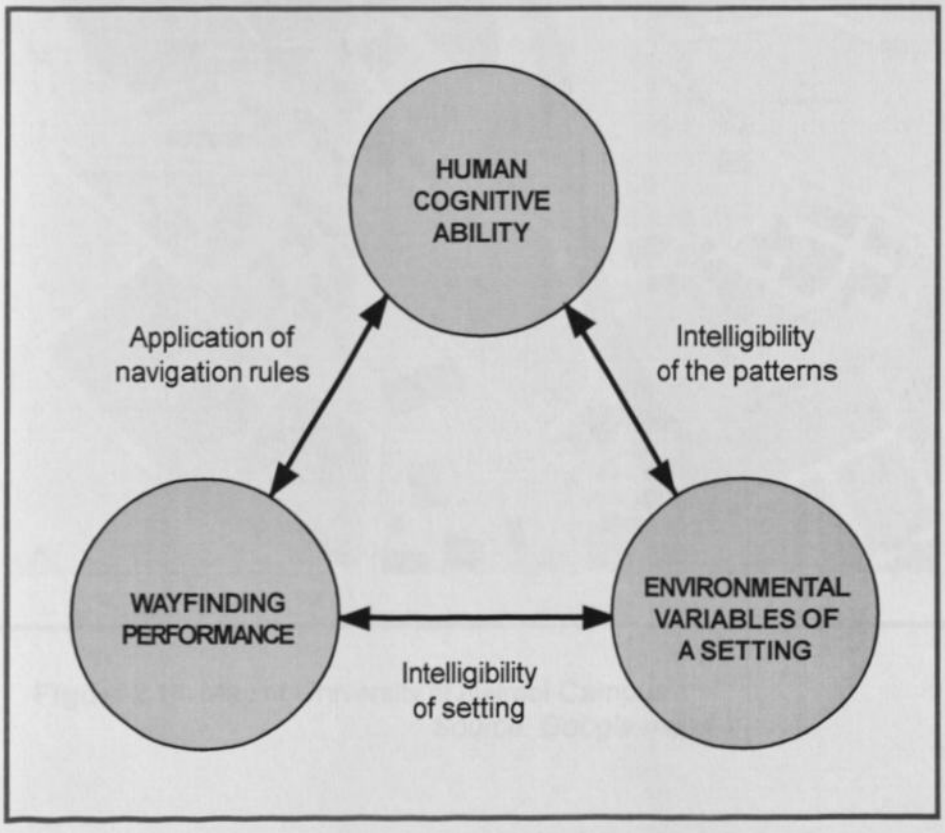


Figure 2.17: The traditional wayfinding model composed of three parameters.
(Source: Lu & Bozovic-Stamenovic, 2009)

2.9 Wayfinding with Maps

Cartographic maps are the quintessential example of information displays for wayfinding. There are a host of design issues for optimizing map effectiveness, such as legend and symbol design. The degree of schematic abstraction in map design is relevant. Maps used to wayfind need not communicate extremely detailed and precise metric information about distances and directions. Particularly when the map is used to navigate on a constrained path network, such as on a campus. Most travelers may only want to know the connections among halls—the quantitative distance between them may be irrelevant (i.e. see Figure 2.18). for instance.

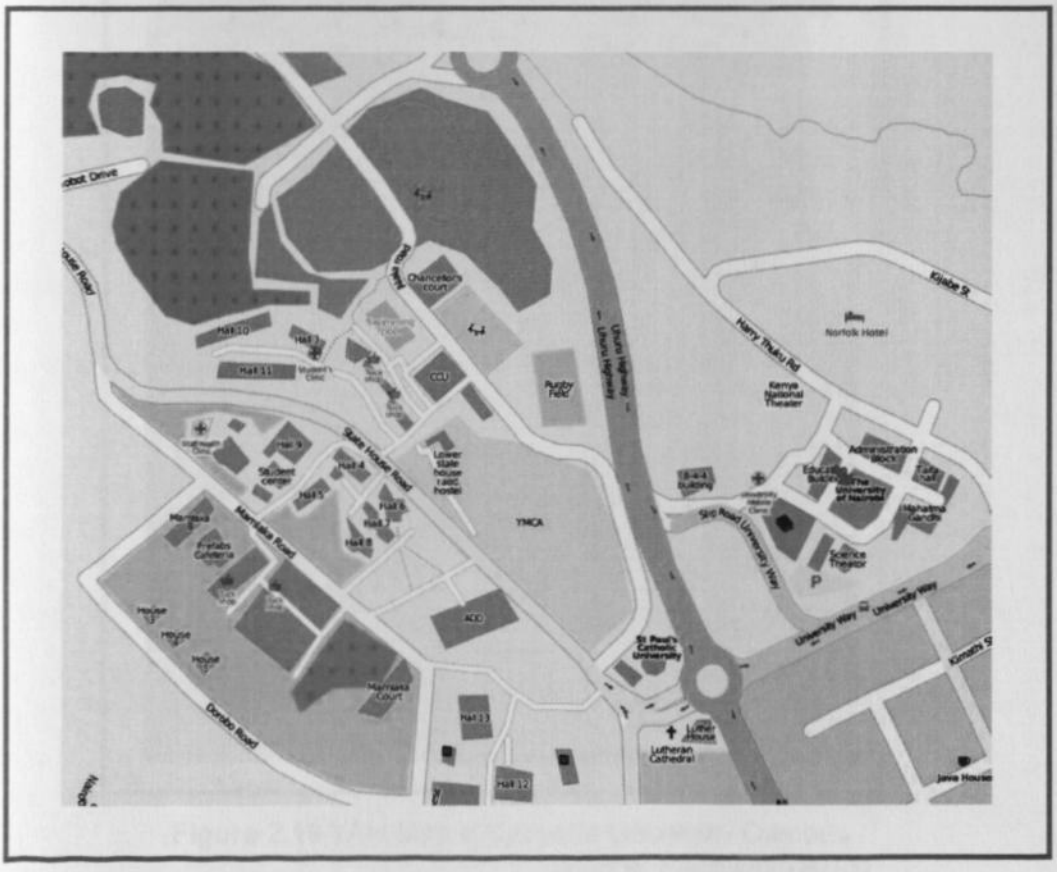


Figure 2.18 Map of University of Nairobi Campus
Source: Google maps.

However, even though a campus map may not depict metric information accurately, it is a graphical display that necessarily depicts metric information, and some users of the map may interpret its metric relations inappropriately. An important issue for maps used to wayfind is their orientation, in particular which direction on the map is placed

at the top (Levine et al., 1984). When maps are used outside the context of a particular surrounding environment, their orientation is primarily a mater of convention—orientations that differ from common convention (e.g. north at the top) do cause difficulties in such cases. But when a map is being used to actively guide navigational decisions in the surrounding environment, most people perform faster and more accurately when the top of the map is aligned with the forward direction of movement.

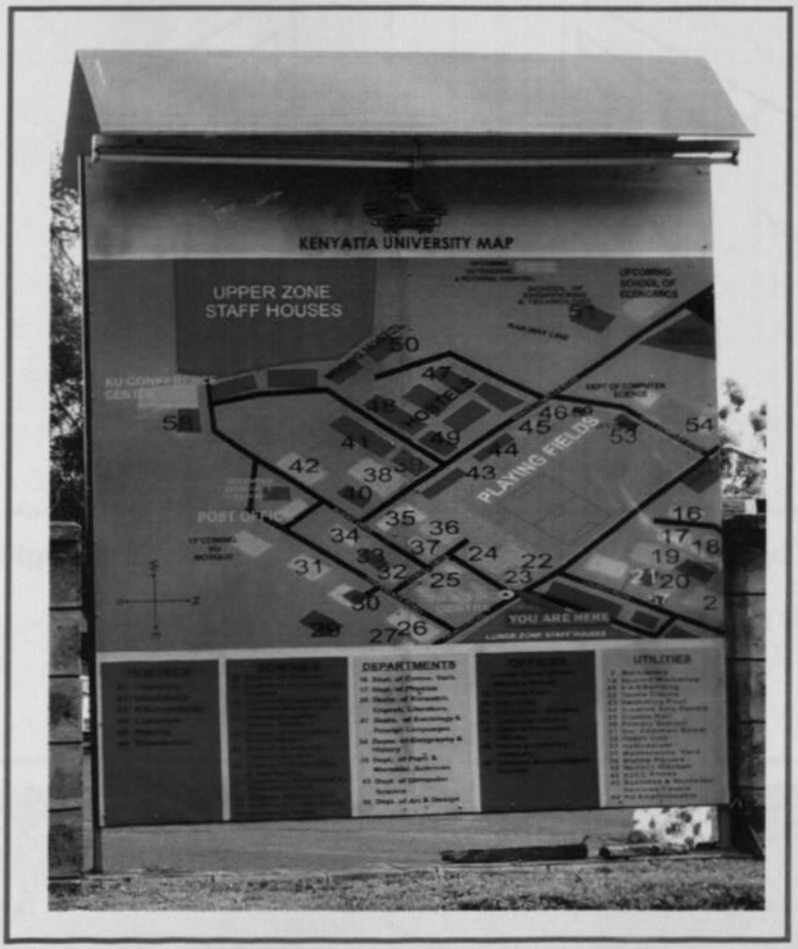


Figure 2.19 YAH Map at Kenyatta University Campus
Source: Fieldwork (2013)

In this case, the bottom is aligned with the backward direction, and left and right on the map are left and right in the surrounds. This is known as "forward-up" or "track-up" alignment. For most people, maps not so aligned must be physically or imaginally reoriented, that is if their misalignment is recognized (a minority of people are able to apply feature-matching strategies that obviate the need for realignment). These processes are cognitive costly and in fact lead to disorientation. The error and extra

time caused by using misaligned maps is called an alignment effect. Figure 2.20 shows an example of misaligned you-are-here (YAH) maps.

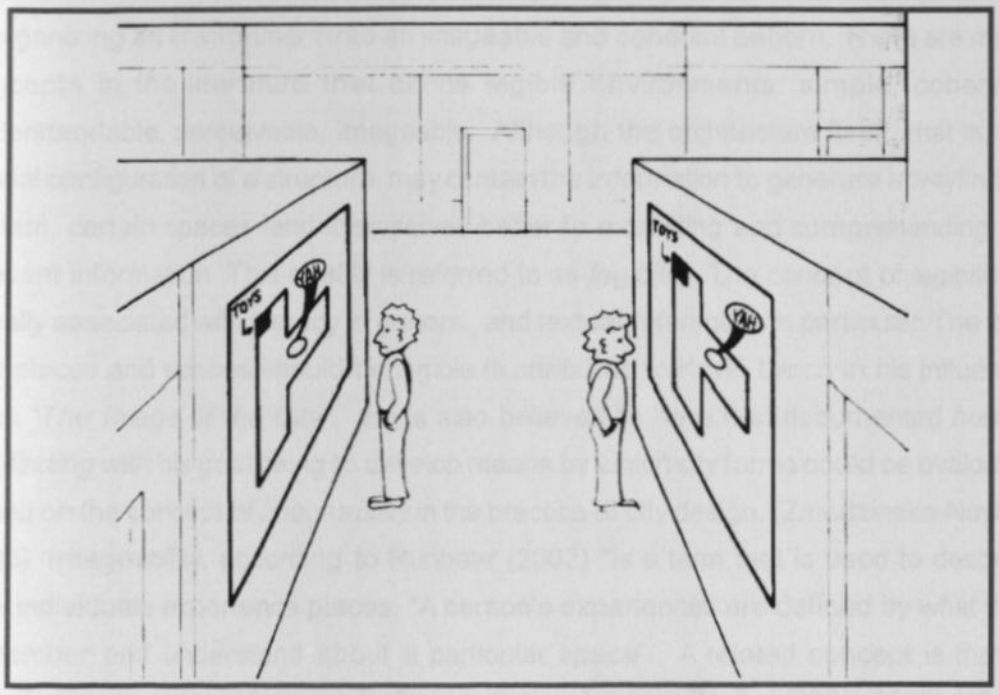


Figure 2.20 The orientation in which YAH maps are mounted leads to misaligned maps
Source: Levine et al. (1984).

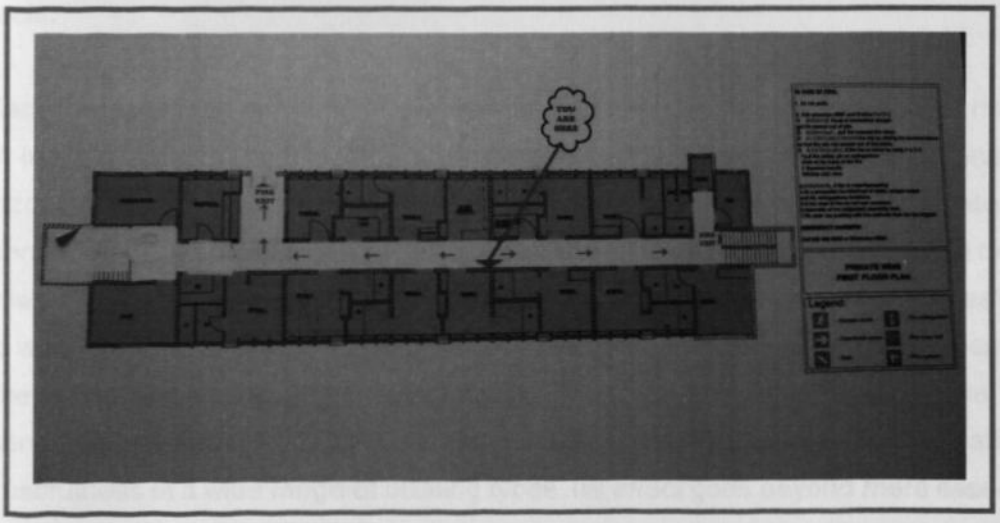


Figure 2.21 An example of a real situation noted at a hospital in Nairobi
Source: Fieldwork (2013)

2.10 Legibility

One potentially significant yet little investigated criterion for post occupancy evaluation is the "legibility" of a setting—the degree to which a building facilitates the ability of users to find their way within it (Weisman, 1981). Legibility is described as the possibility of organizing an environment into an imageable and coherent pattern. There are many concepts in the literature that define legible environments: simple, coherent, understandable, perceivable, imageable. Although the architecture itself, that is, the spatial configuration of a structure, may contain the information to generate a wayfinding system, certain spaces lend themselves better to extracting and comprehending the relevant information. This quality is referred to as *legibility*. The concept of legibility is usually associated with literacy in general, and textual references in particular. The idea that places and spaces should be legible is attributed to Kevin Lynch in his influential book *"The Image of the City"*. He is also believed to have first documented *human wayfinding* with his goal being to develop means by which city forms could be evaluated based on the concept of *imageability* in the practice of city design. (Zmudzinska-Nowak, 2003). Imageability, according to Runhaar (2002) "is a term that is used to describe how individuals experience places. "A person's experiences are defined by what they remember and understand about a particular space". A related concept is that of *affordances* (a concept from ecological psychology), which Raubal (2001; 2007) defines as, "what an object, or an assemblage of objects, or an environment enables people to do". On the other hand Norman (1998) coined the phrase *knowledge in the world* to describe external information that people depend upon for wayfinding as guidance, and further elaborates the applicability of the concept of affordance to mundane everyday objects.

A place that facilitates obtaining and understanding of environmental information has a high legibility factor. The legibility of key architectural elements, such as entrances, horizontal and vertical circulation, and major landmarks, is a prerequisite to understanding the spatial organization of a building. If the space does not have a clear spatial organization, it is not understood, hence it has a low legibility factorand does not help with wayfinding. The principle of its spatial organization has to be communicated to the wayfinding users (Arthur & Passini, 1992). Dogu and Erkip (2000) make the observation that the legibility of an architectural environment has been found to affect the usefulness of a wide range of building types. Its effect goes beyond mere ease-of-use of a building and includes other variables such as personal comfort. Wener and Kaminoff (1983) found that legibility in a correctional center significantly reduced user confusion, anger, perceived crowding, and overall emotional discomfort. The

addition or deletion of certain architectural elements, for example, signage, can manipulate legibility of a place. However, even the graphics of signage systems—the choice of lettering; the contrast created by black, white, and colored elements; the size; the position; and illumination of a sign—all contribute to its comprehension, hence to the legibility of a space (Passini, 1984).

"The *legibility* of a route is the ease with which it can become known, or (in the environmental sense) the ease with which relevant cues or features needed to guide movement decisions can be organized into a coherent pattern. Legibility influences the rate at which an environment can be learned (Freundschuh, 1991).

Table 2.1: Architectural wayfinding components

Objective	Components	Elements
Clear articulation and coherent grouping of exterior and interior spaces	Shaping site and setting	Landscapping, berming Roadways, entrances/exits Pedestrian routes, sidewalks, pathways
	Building form and architectural features	Building form Building volumes Physical seperation or clustering of components Roof design Placement of openings Cladding (skin) = textures, materials, colors Decoration, ornamentation
	Articulating interior spaces	Programmatic organization Defining spatial units Defining destinition zones Interior design
Creating legible circulation systems design	Exterior and interior circulation systems	Design concepts (paths, markers, nodes/ intersections, edges/links) Approach from street Roadways Parking External paths and walkways Entrances and exits Connection to mass transportation
	Level change devices	Elevators Staircases Escalators
	Internal transportation	Mobile aids People movers Fixed rail systems
Integrating communication systems	Information wayfinding design	Environmental graphics Sygn systems Orientation devices You are here maps Realtime information devices

Source: Hunter, 2010.

Architectural wayfinding focuses on wayfinding in built forms and urban settings because wayfinding strategies in natural outdoor settings are different (Golledge, 1999). In outdoor built environments, properties of spatial layout are more important than program in determining patterns of movement, while inside buildings, movement "can be understood primarily in terms of specific purposefulness rather than spatial regularity" (Peponis and Wineman, 2002).

2.10.1 Sense of the place

In order for a place to be considered legible the element of the person interacting with it should be taken into account. Szymanski (2010) defines sense of the place as a feeling of being in differentiated space and a feeling of spatial orientation and understanding. From the earliest prehistoric times, man identified the things that he saw around him by making drawings or carvings on cave walls. This was his form of communication. He viewed his world in relation to the elements of nature such as the earth, the sky, the sun, the stars, mountains and other physical elements. As language developed, names and meanings were added. Over time, the unknown became known and was communicated to others. The world became managable. Most likely, drawings of maps evolved as a way to represent or symbolize this expression of the environment and communicate a sense of place, a sense of here in relation to there (Wilford, 1981). With this realization, the world became a structured space, a system of places (Norberg-Schultz, 1980). Through images, names and meanings we are able to grasp the concept of a sense of place. A sense of place is that comfortable feeling of being at home in, and belonging to, some particular part of the world. It provides a feeling of security which blends together past and future. A sense of place is essential to any ordering of our lives (Downs & Stea,1977). During architect Kevin Lynch's study of how people living in Boston, Jersy City, and Los Angeles orient themselves (Lynch, 1960), He found certain places to be more legible than others. They were easier to understand and organize into a coherent pattern. He reffered to "wayfinding devices" such as maps, street numbers, and route signs; but determined that it is physical form and arrangement that enables the creation of a mental image of the environment for the wayfinder. When a person has a clear mental image of a place, they are comfortable in a space and can travel about it without conscious consideration of their actions. On the other hand, when a person is disoriented; unclear of where they are and where to go, the result is a feeling of discomfort, which will result in negative place experiences (Lynch 1960).

It is the task for the Designer, the Architect, and the Planner to facilitate a stong sense of place and allow it to develop user friendly envronments. By understanding what sense of place is and the factors that contribute to it, it is possible to suggest ways in which

designers can facilitate a stronger sense of place in the design of newly established urban settings.

"A sense of place is something that we ourselves create in the course of time. It is the result of habit or custom" (Jackson 1994).

2.11 Wayfinding design

Passini (1980) studied the communication aspect of wayfinding design. In terms of wayfinding communication, designers have to respond to three major questions: what information should be presented, where and in what form. Passini further pointed out that a key rule of environmental perception is that information is not seen because it is there but because it is needed. During wayfinding, people will select that information which is relevant to their task. An analysis of decisions made by subjects who tried to find a destination, showed that they tended to perceive information when it was directly relevant to the behaviors associated with an immediate task and did not perceive information irrelevant to the immediate task even if it might be useful later on. Therefore, spatial abilities are sensitive to perceptual information, and in particular the time and place to receive it. The design draws upon the requirements based on interviews with nurses and job coaches at rehabilitation hospitals and institutes. Previous work by Passini (1977) with dementia patients has shown that the patients exhibited marked cognitive wayfinding deficiencies. They tend to have significantly reduced cognitive mapping abilities. They are not able to make wayfinding decisions requiring memory or inferences while they may still be able to make decisions based on explicit architectural information and directional signs. They can no longer develop decision plans, and can only operate from one decision point to the next so that they can be mobile and as autonomous as possible. This motivated us to use a prompting device to provide directional guidance at decision points.

2.12 Signage

As we discuss signage, it is important to take cognisance of the 'current misunderstanding that wayfinding is essentially the same as signage' (Muhlhausen 2006). Lynch's referral to maps, street numbers, directional signs etc. as "way-finding" devices may have contributed to the emergence of this narrow view. Whilst acknowledging the important role played by signage in wayfinding, Muhlhausen (2006) asserts that wayfinding used to navigate unfamiliar environments, doesn't rely exclusively on signs.

However, as shown in figure 2.22 signage plays a major role in facilitating environmental communication.

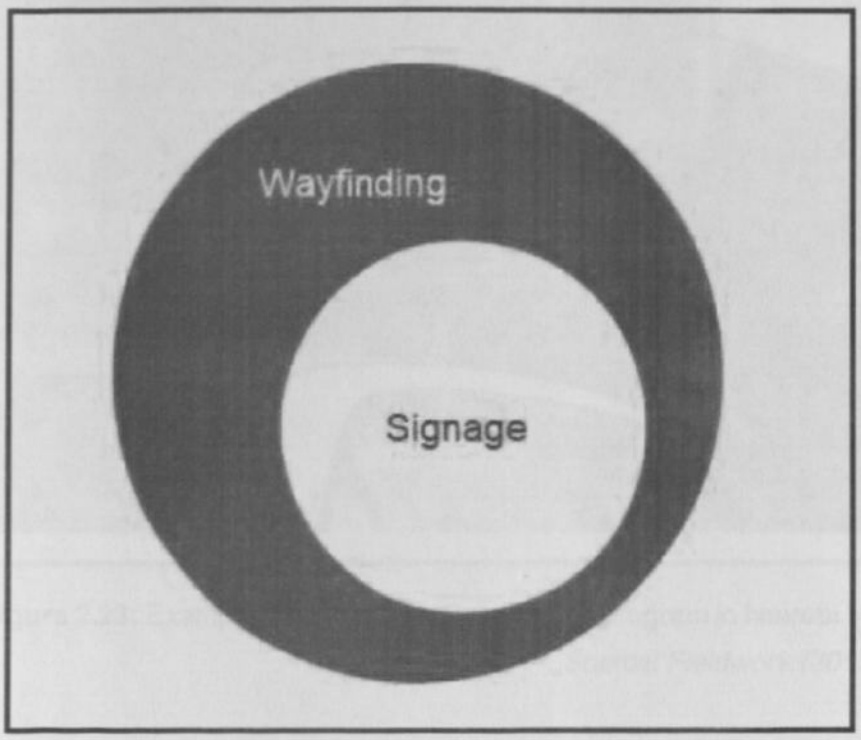


Figure 2.22: Signage plays an important role within the broader realm of wafinding cues.

Source: Calori (2007)

Although the terms signage and wayfinding are often used interchangeably, it is very important to keep in mind this distinction. Typically, the primary objective of a signage program is to help people find their way through an environment, whereas effective wayfinding solutions often require more than signage alone. Clear, well-defined pathways and other visual cues such as prominent landmarks, all aid wayfinding, as do printed maps, human guides, and, more recently, portable GPS systems (Calori, 2007).
Signage and wayfinding are most commonly expressed in unified sign programs that informationally and visually knit together a site (Calori, 2007). Figure 2.23 illustrates an example of signage and wayfinding program.

Figure 2.23: Example of signage and wayfinding program in Nairobi.

Source: Fieldwork (2013)

A key objective in wayfinding is to enable each person to form a mental map of a site or environment, so that clearer the physical layout of a site, the clearer the mental map will be. Even the most carefully concieved sign program will not solve all the problems of navigating a site that contains confusing, circuitous pathways. However, in spite of good signage and other visual wayfinding cues, many people are better at understanding information given to them verbally and so would rather ask someone how to get from point A to point B than follow signs or read a map. Signage and other visual wayfinding cues can assist even these people navigate their environment when there is no one around to ask.

2.12.1 Signs

Signs are tools that aid in wayfinding. They are an environmental source of wayfinding information. The main purpose of most signs is to communicate and direct the traveller along a particular way. Whether we are identifying a building, directing to a destination, presenting a cautionary message, or providing information, communication is key. Basically there are four important type of signs (Figure 2.24): (a) ***Information signs***, for instance a signpole with locate a destination and / or to orientate yourself in the build environment.

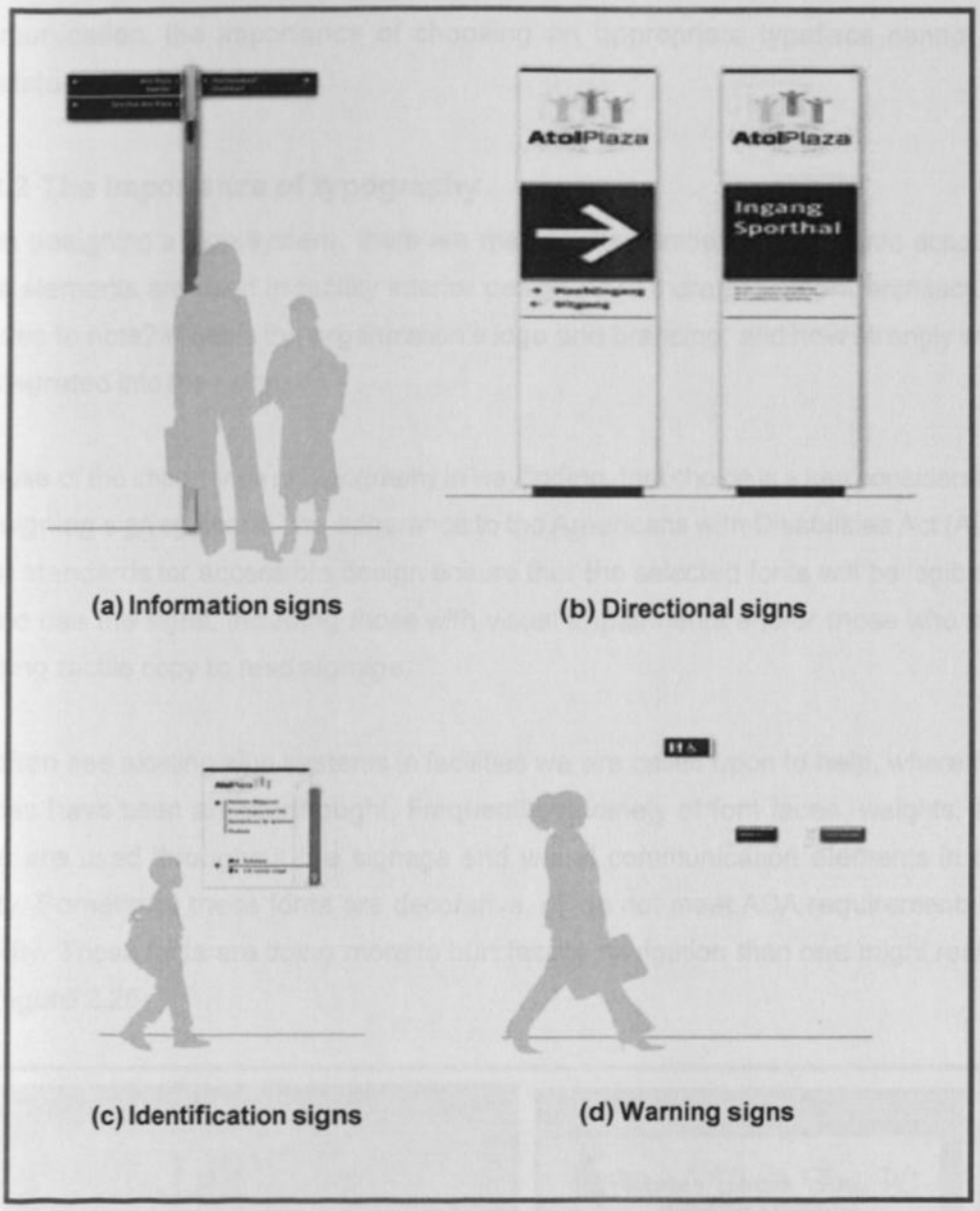


Figure 2.24: Four important type of signs.
Source: designworkplan (2013)

(b) ***Directional signs***, where information is displayed to find destinations, located on several strategic points in the build environment; (c) ***Identification signs***, where information about individual locations is displayed such as buildings, locations and public facilities; (d) ***Warning signs***, to indicate safety procedures such as a fire escape routes, no smoking areas and other regulations that is, or is not allowed in a specific area.

Communication relies on many elements. Often sign placement, color, and use of symbols play a role in what the sign is telling you. But in any sign that uses text-based

communication, the importance of choosing an appropriate typeface cannot be overstated.

2.12.2 The Importance of typography

When designing a sign system, there are many considerations to take into account. What elements are used in facility interior design? Are there prominent architectural features to note? What is the organization's logo and branding, and how strongly will it be integrated into their signs?

Because of the importance of typography in wayfinding, font choice is a key consideration in designing sign systems. The adherance to the Americans with Disabilities Act (ADA, 1990) standards for accessible design ensure that the selected fonts will be legible to all who use the signs, including those with visual impairments and/or those who may be using tactile copy to read signage.

We often see existing sign systems in facilities we are called upon to help, where font choices have been an afterthought. Frequently, a variety of font faces, weights, and styles are used throughout the signage and visual communication elements in one facility. Sometimes these fonts are decorative, or do not meet ADA requirements for legibility. These fonts are doing more to hurt facility navigation than one might realize (see figure 2.25).

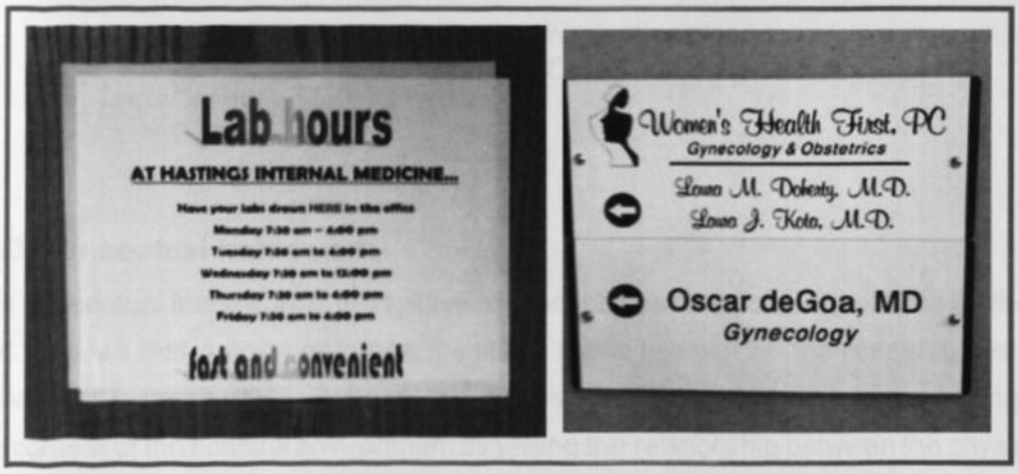


Figure 2.25: Examples of illegible fonts used on signboards.
Source: Architectural sign associates (Accessed April 2014)

Because of the importance of typography in wayfinding, font choice is a key consideration in sign systems. Reliance on ADA standards ensures that chosen fonts will be legible to

all who use them, including those with visual impairments and/or those who may be using tactile copy to read signage. Where people are not able to read a language, symbolsare used. The ability of symbols to convey messages to those who don't speak the language is believed to be so strong that attached to the bodies of the American Pioneer and Voyager Space ships, sent on their missions to explore beyond the solar system, are plaques using graphic symbols to explain where they originated in the event they are intercepted by extra-terrestrials (Cowgill & Bolek, 2003). see Figure 2.26.

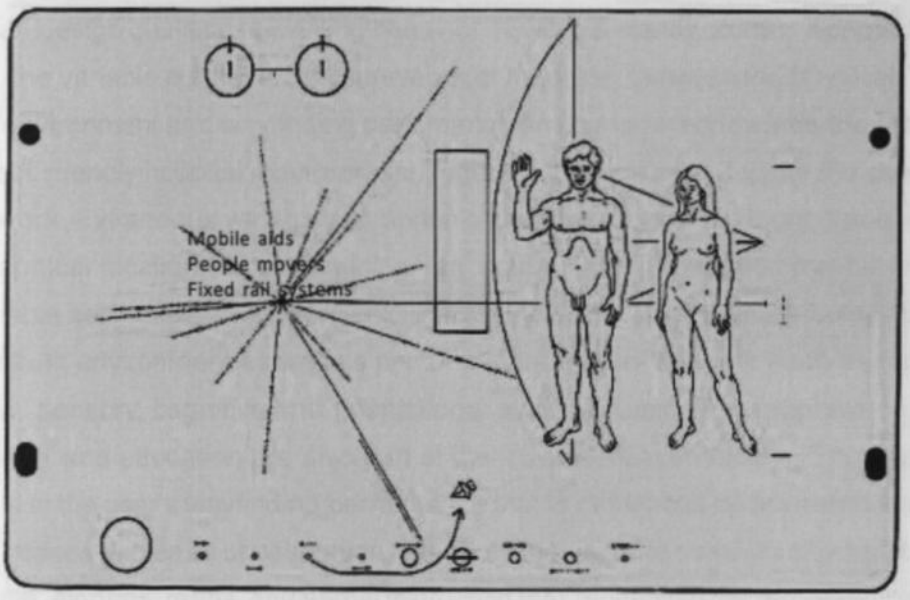


Figure 2.26: Inter galactic communication plaque
Source: Cowgill & Bolek, 2003)

2.13 Conceptual framework

The conceptual framework is the system of concepts, assumptions, exceptions, beliefs, and theories that support or inform the study. It is a key part of the research design (Miles & Huberman, 1994; Robson, 2011). This study examined ease of wayfinding in the context of the hospital environment by testing the relationship between the physical environment and user behavior during the process of wayfinding. As noted earlier in this thesis, various studies have explored wayfinding from diverse disciplines ranging from the social sciences to environment - design. Subsequently, the focus of study has drawn from the orientation of the disciplines. Some researchers, such as Golledge, (1999); Raubal, (2001); Haq & Zimring, (2003) have underpinned their studies with

theoretical issues of cognition while others such as Carpman & Grant (2001); Huelat (2004); Rooke et al (2010) have underpinned theirs with applied real world environmental issues. From the perspective of cognition, wayfinding is explained in terms of spatial orientation This study emanating from the discipline of Design was conceptulized as an applied real world research dealing with wayfinding as an environment and behavior issue.

The conceptual framework underlying this study, therefore, was adapted from Ewing & Handy's conceptual framework on people's walking behavior which linked perceptual or urban design qualities to walking behavior (Ewing & Handy, 2009). Adapted for this study, the variable elements that intervene (or mediate) between the physical features of the environment and wayfinding perfomance are considered towards the realization of a user friendly hospital. environment. Figure 1.1 graphically depicts the conceptual framework. Extraneous variables comprise of the physical environment made up of the geographical location, urban planning, landscape, and the spatio-physical structure that enable accessability. Independent variables include architectural attributes that make up the built environment as well as personal attributes of the user such as familiarity, mobility, sensory, cognitive and orientational abilities. User demographics of gender, race, age, and education are also part of the independent variables. The dependent variable is the user's wayfinding performance that is influenced by environmental cues, visual access and ease of navigation. A modulating variable consists of graphic design elements, signage, maps, and verbal instruction that modulates the dependent variable. The outcome is the creation of a user friendly hospital environment that facilitates ease of wayfinding and user satisfaction.

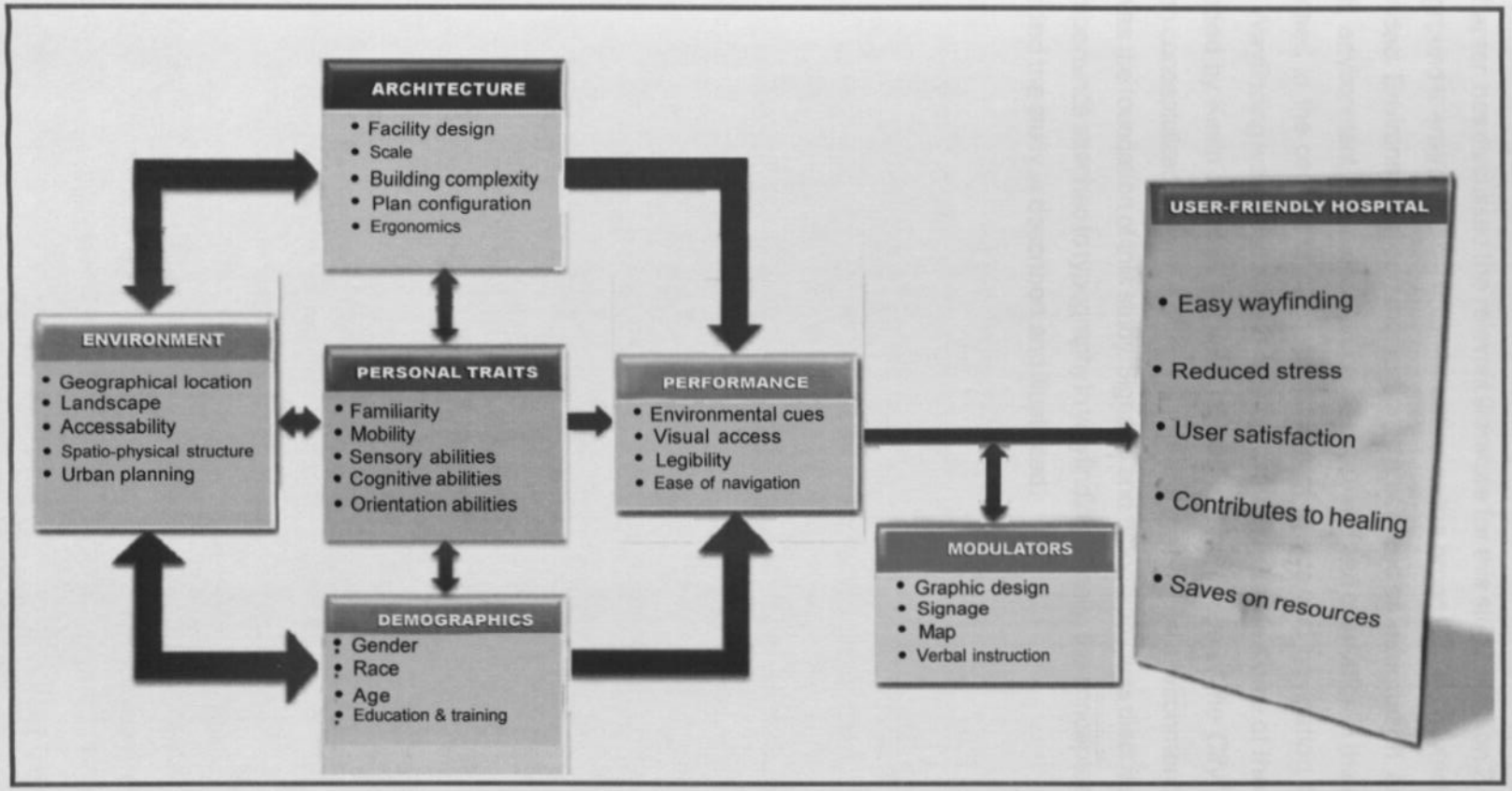


Figure 2.27: Conceptual framework linking Environment, wayfinding performance to user friendly hospital

Source: Researcher construct, 2013.

2.14 Summary

This Chapter has discussed the relevant literature for this study. Section 2.1 presented a background to environmental communication as the broad field from which wayfinding is grounded. Environmental communication is presented as information embedded in the built environment. The mental processes of space and orientation in the environment is dicussed in the context of conceptulization of space and navigation through that space. Wayfinding was disscused in relation to the five key features of the city form as expounded by Kevin Lynch in his seminal book, *"The Image of the City"*, wayfinding was then conceptulized within the city of Nairobi and the hospital environment in particular, which was the foundation of this study. Signage and typography was discussed because of the importance attached to typography in wayfinding. Finally, the conceptual framework that guided the study is described and illustrated.

CHAPTER 3

THE HOSPITAL ENVIRONMENT

Order is no guarantee of understanding. Sometimes just the opposite is true... Cities don't come in chapters with restaurants in one section and museums in another; their order is organic, sometimes confusing, never alphabetic. To really experience a city fully, you have to acknowledge confusion.

- Richard Saul Wurman, (1996)

3.0 Introduction

This chapter discusses the built environment of the hospital that has evolved over time. By tracing the history of hospitals from the early hospital to the modern hospital as we know it today, one is able to have a clearer view of the recent introduction of wayfinding research in hospitals. Just as Wurman (1996) observes of the city in the quotation above, the hospital environment also has unique challenges due to the very nature of it being the hospital. To experience a hospital one has to acknowledge confusion realizing that this is a place where people who are unwell go for healing. As many studies have shown, patients and visiting family members often have a hard time navigating in the large building complexes. Literature pertaining to architectural design of the hospital environment, that has to take into consideration general hospital function relatioships, traffic circulation as well as curetive and healing elements, is reviewed. Finally, the history of the hospital in Kenya is reviewed, leading to the focus of the setting for the case study undertaken in this research.

3.1 History of hospitals

The evolution of hospitals in the Western world from charitable guesthouses to centers of scientific excellence has been influenced by a number of social and cultural developments. These influences have included the changing meanings of disease, economics, geographic location, religion and ethnicity, the socioeconomic status of clients, scientific and technological growth, and the perceived needs of populations (Risse, 1999). According to Wall (2008) during the early years of Christianity a nursing tradition developed when the benevolent outreach of the church included not only caring for the sick but also feeding the hungry, caring for widows and children, clothing the poor, and offering hospitality to strangers.

From the Encyclopædia Britannica online (Accessed on 20th June, 2014), it can be said, however, that the modern concept of a hospital dates from AD 331 when Constantine, having been converted to Christianity, abolished all pagan hospitals and thus created the opportunity for a new start. Until that time disease had isolated the sufferer from the community. The Christian tradition emphasized the close relationship of the sufferer to his fellow man, upon whom rested the obligation for care. Illness thus became a matter for the Christian church. Religion continued to be the dominant influence in the establishment of hospitals during the Middle Ages . The growth of hospitals accelerated during the Crusades , which began at the end of the 11th century. Military hospitals came into being along the traveled routes; the Knights Hospitalers of the Order of St. John in 1099 established in the Holy Land a hospital that could care for some 2,000 patients. It is said to have been especially concerned with eye disease, and may have been the first of the specialized hospitals. This order has survived through the centuries as the St. John's Ambulance Corps.

Throughout the Middle Ages, but notably in the 12th century, the number of hospitals grew rapidly in Europe. The Arabs established hospitals in Baghdad and Damascus and in Córdoba in Spain. Arab hospitals were notable for the fact that they admitted patients regardless of religious belief, race, or social order.
Late antiquity witnessed one revolution in the medical scene: the birth of the hospital. Literary sources occasionally mention hospitals, but only documents from Egypt reveal how widespread they were. These testimonia from Egypt record a multitude of hospitals founded by private individuals and independent of ecclesiastical institutions.

The origin of the hospital as an independent institution for the care and treatment of the sick can be dated to the third quarter of the fourth century AD. The hospital resolved major tensions in the medical, ecclesiastical and religious scenes of late antiquity.

3.2 The early hospital

In ancient cultures, religion and medicine were linked. The earliest documented institutions aiming to provide cures were ancient Egyptian temples (Wikipedia accessed on 20th June 2014). In ancient Greece, temples dedicated to the healer-god Asclepius, known as Asclepieia, functioned as centres of medical advice, prognosis, and healing (Risse,1990). At these shrines, patients would enter a dream-like state of induced sleep known as *enkoimesis,* not unlike anesthesia, in which they either received guidance from the deity in a dream or were cured by surgery (Diz et al., 2001). Asclepeia provided

carefully controlled spaces conducive to healing and fulfilled several of the requirements of institutions created for healing (Risse,1990). In more recent times, however, the primary place for treating, curing, or caring for those who were ill was the home (Nagasawa, 2000). However, in some cases this was neither possible nor acceptable. It was not possible for those who did not have homes in which to be kept or family members who could care for them. The cases of acceptability was coupled to prevailing superstitions, psychological fears, and, or religious dogma. Where sickness was thought to be retribution for acts resulting in a "fall from grace" or that disease was the "due reward" for those who were somehow "unclean", the conditions under which the sick were to be maintained were limited. At that time it was rare for new buildings to be designed as hospitals (Thompson & Goldin,1975) The first building type which was designed as a hospital is what we now call the Nightingale Hospital (Figure 3.1).

Figure 3.1: An interior view of a typical "Nightingale" ward
Source: Nagasawa (2000)

Curiously Florence Nightingale (1820-1910), the first person to define the function of hospital buildings was neither a physician nor an architect, but was a nurse. Nagasawa (2000) narrates her experience at Scutari, a hospital converted from Turkish barracks, where she proved that the mortality rate of patients could be reduced through the provision of a better physical environment than was common then. In the end she proposed a pavilion type hospital consisting of 2-story high "Nightingale Wards" with specified high ceiling heights, spacious around each bed, and the layout of wards with

greater spacing on an ample site. This decentralized configuration of wards/buildings was disseminated throughout the world as a typical hospital at the end of the 19th century. The beginning of the 20th century saw remarkable discoveries from the scientific field (e.g. anestesia/sterilization techniques, bacteria, X-rays, and antibiotics.) that were crucial to changing the understanding of the causes of sickness and disease and/or their treatment. This further fueled the development of increasingly sophisticated western medical technologies. The exponential development of technology continues in the twentieth century and is increasingly affecting our lives. One area in which advanced technology is seen as being fully utilized is modern hospital buildings. In order to improve the economical efficiency of expensive medical equipment and to make full use of scarce professional human resources such as physicians, nurses, radiologists and clinical laboratory technicians, new functional units such as radiology departments, pathology labs, operating theaters, CSSD, dispensing and pharmaceutical departments, central catering and medical records departments started to appear in hospitals in the early part of the 20th century. This resulted in a move towards centralization of hospital departments and functions. Centralization of functions created various complicated movements of people and materials. Hospital staff move among various departments during their working hours. In-patients may have to walk long distances from their wards each day. Out-patients may have to visit various diagnostic or theraputic departments and wait at each area for hours.

3.3 Hospital design

According to Nagasawa (2000) designers of hospital buildings begun to search for more compact building shapes in order to reduce costs by reducing external wall-to-floor ratios. The aim was to shorten walking distances between relevant departments and to find more economical solutions to material handling (Freisen, 1957). The result is that modern hospitals do not look like homes, but rather like factories. The compact building shapes are, however, well suited in situations where ample site areas are not available such as in growing cities. However, Horsburgh (1995) augues that for a hospital to be successful, it must be designed to promote healing as well as efficiency. He notes that pleasant surroundings that attract patients can be an important asset in today's competitive health care environment. He further identifies four architectural qualities needed to achieve this balance as:

1. Spatial orientation.
2. Connection.
3. Scale.
4. Symbolic meaning.

3.3.1 Spatial orientation

Spatial orientation is important for patients and family members who, under the stress of illness, are susceptible to information overload,frustration and confusion. Structures, signs, and landmarks should all serve as clear and simple indicators of a patient's or visitor's location within the hospital. Figure 3.2 shows an example of a landmark that may be used as a reference point in describing and remembering a location.

Figure 3.2: An example of a landmark at Kenyatta National Hospital

Source: Fieldwork 2013

3.3.2 Connection

Connection among people as well as between people and the environment can be established by such means as well designed walkways that facilitate face-to-face meetings and private spaces along the walkways that enhance communication. Windows and skylights should be abundant, and windowsills in patient rooms should be low so the exterior landscape can be seen from the beds. Fountains, waterfalls, and aquariums can provide a soothing ambiance. The belief that gardens are beneficial for people with illness dates back centuries and has appeared in widely different cultures (Ulrich,1989). In the early decades of the twentieth century the emphasis was on the creation of environments that would succeed as functionally efficient delivery platforms for important new medical technology and science. In more recent years the importance of including theraputic features such as gardens has been realized. Figure 3.3 shows a meeting place situated in a garden space.

Figure 3.3: Photo of meeting spaces
Source: www.stockfreeimages.com

3.3.3 Scale

Scale is an important psychological factor. Hugh, opulent atriums can make patients and family members feel small and insignificant, while cramped spaces with low ceilings can feel stressful. Figure 3.4 shows a space with a high, opulent atrium.

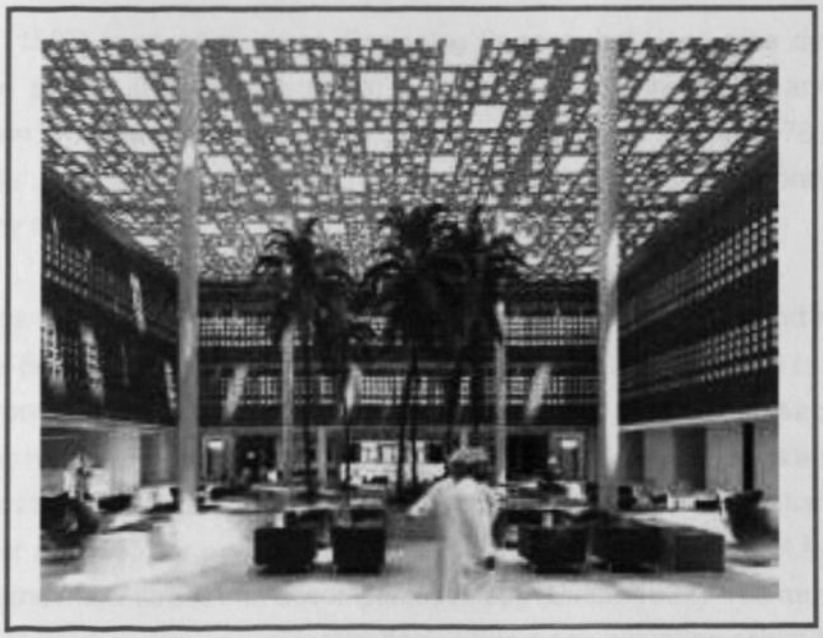


Figure 3.4: Photo of opulent atrium
Source: www.stockfreeimages.com

3.3.4 Symbolic meaning

This can be conveyed by a hospital's structure and physical style. The building should give the impression of a welcoming environment geared to the care of the individual patient as well as security, cleanliness, and comfort. Hospitals that resemble large office buildings, emphasizing the organization and not the person, fail to create a place where patients can relax and focus on healing.

Figure 3.5: A relaxing environment
Source: www.stockfreeimages.com

Winslow (1997) in an article titled 'Designing Spaces that Heal' cites data from the Planetree project that suggests that a pleasing environment enhances patient satisfaction. The Planetree Consulting Organization was founded in 1978 by a patient who felt dehumanized by her hospital experience. It promotes a strong patient-centred philosophy of health care.

Thousands of years ago hospitals were temples or spas with gardens and water views. It may be time to combine the wisdom of the past with the advanced technology of today so patients can benefit from the best of both worlds. In recent years a growing awareness has developed internationally among healthcare administrators and designers of the need to create functionally efficient environments that also have patient-centrered (Gerteis et al., 1993) or psychologically supportive characteristics that help patients cope with the major stress that accompanies illness (Ulrich, 1992). The most important factor motivating awareness of facility design has been mounting scientific evidence that environmental features or characteristics play a role in improving patient health outcomes (ibid)

3.3.5 The healing environment

Figure 3.6: An example of healing environment
Source: www.stockfreeimages.com

A recent report by John Hopkins medical researchers, quoted by Ulrich (1992), identified upward of seventy published scientific-experimental studies concerned with the effects of healthcare facility design on medical outcomes (Rubin et al., 1997). The interaction between humans and the different environments in which they are placed has long been known. More than 2000 years ago, the ancient Roman physician Galen recognized the healing aspect that an environment could provide. He understood the consequences of unclean conditions; thanks to his health philosophy, he had the highest survival rate among all physicians who treated the gladiators (Pearcy, 1985).

Florence Nightingale was also famed for her focus on sanitation and other aspects of the environment that contribute to the health and healing of the patients. She was not only a leader in improving sanitation and ventilation, but was also instrumental in bringing forth the body-and-mind connection. She understood that the environment played a central role in a patient's healing of body and mind. Nightingale went on to influence the health care environment by varying the patient's visual perspective, utilizing color and natural light more effectively, and eliminating excessive noise.

3.4 The modern hospital

Modern hospitals are the most complex of building types comprising of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging and emergency rooms, and surgery. Hospitality functions, such as food services and housekeeping; and the fundamental inpatient or bed-related function (Carr, 2007).

Figure 3.7 Karen hospital, an example of a modern hospital in Nairobi, .
Source: Fieldwork, (2013).

In addition to a wide range of services that must be accomodated, hospitals must serve and support many different users and stakeholders. The basic form of a hospital is, ideally, based on its functions which may be listed as:

- bed-related inpatient functions
- outpatient-related functions
- diagnostic and treatment functions
- administrative functions
- service functions (food, supply)
- research and teaching functions

The configuration of a hospital is largely influenced by the physical relationships between these functions. Certain relationships between the various functions are required. Figure 3.8 illustrates these relationships.

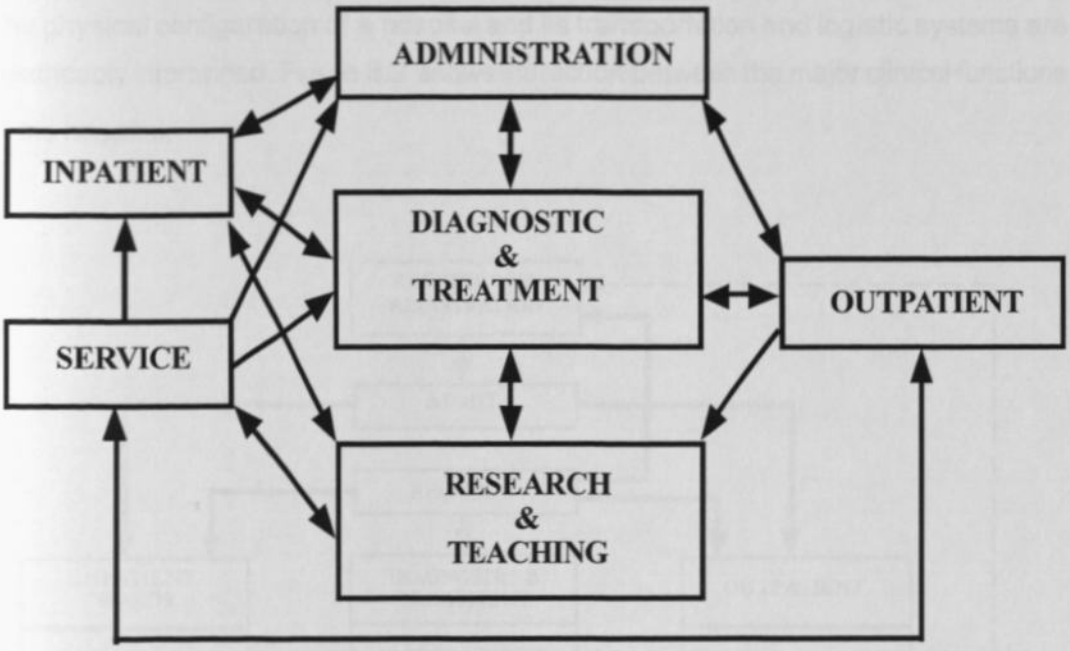


Figure 3.8: General Hospital Relationships
Source: Carr, 2007

Hospitals are the most complex of building types (Carr, 2007). Each hospital is comprised of a wide range of services and functional units. These include diagnostic and treatment functions, such as clinical laboratories, imaging, emergency rooms, and surgery; hospitality functions, such as food service and housekeeping; and the fundamental inpatient care or bed-related function. The basic form of a hospital is, ideally, based on its functions:

- bed-related inpatient functions
- outpatient-related functions
- diagnostic and treatment functions
- administrative functions
- service functions (food, supply)
- research and teaching functions

Physical relationships between these functions determine the configuration of the hospital. Certain relationships between the various functions are required—as in the flow diagram shown in Figure 3.8.

The functional units within the hospital can have competing needs and priorities. Idealized scenarios and strongly-held individual preferences must be balanced against mandatory requirements, actual functional needs (internal traffic and relationship to other departments), and the financial status of the organization.

The physical configuration of a hospital and its transportation and logistic systems are inextricably intertwined. Figure 3.9 shows intrraction between the major clinical functions of the hospital.

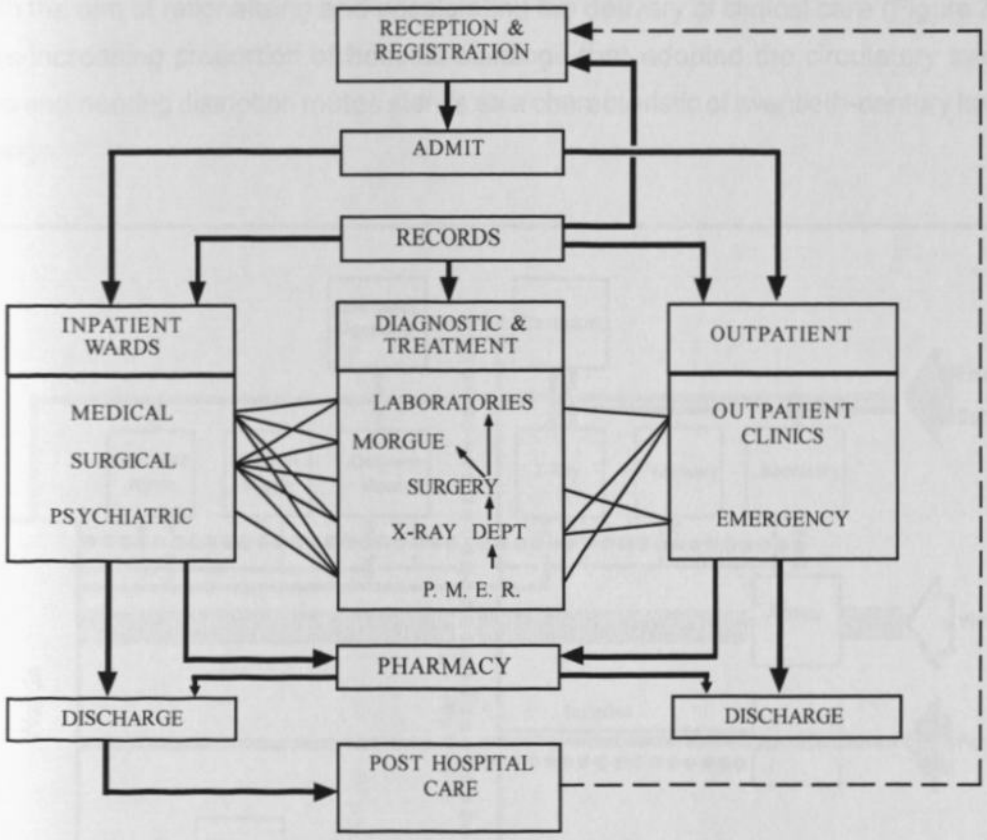


Figure 3.9: Major Clinical Relationships
Source: Carr, 2007

The transportation systems are influenced by the building configuration, and the configuration is heavily dependent on the transportation systems. Apart from the owners and key hospital staff who are involved early in the design process, the other stakeholders, i.e. patients, visitors, support staff, volunteers, and suppliers do not generally have direct input in the design of the hospital. Their interests are advocated for by the designer. Good hospital design integrates functional requirements with the human needs of the varied users. Movement within the hospital is facilitated by the interaction of an environmental graphic communication system and the users.

Jonathan Hughes (1997) makes reference to the zoning of functions and circulatory logic of the Greenwich District Hospital building (1962-74). He makes mention of Gordon Friesen, 'the influential American pundit of post-War hospital planning'. Like modernist town planning, Friesen's hospital planning privileged the building's circulatory systems with the aim of rationalizing and accelerating the delivery of clinical care (Figure 3.10). The increasing proportion of hospital buildings that adopted the circulatory systems and engineering distribtion routes stands as a characteristic of twentieth-century hospital design.

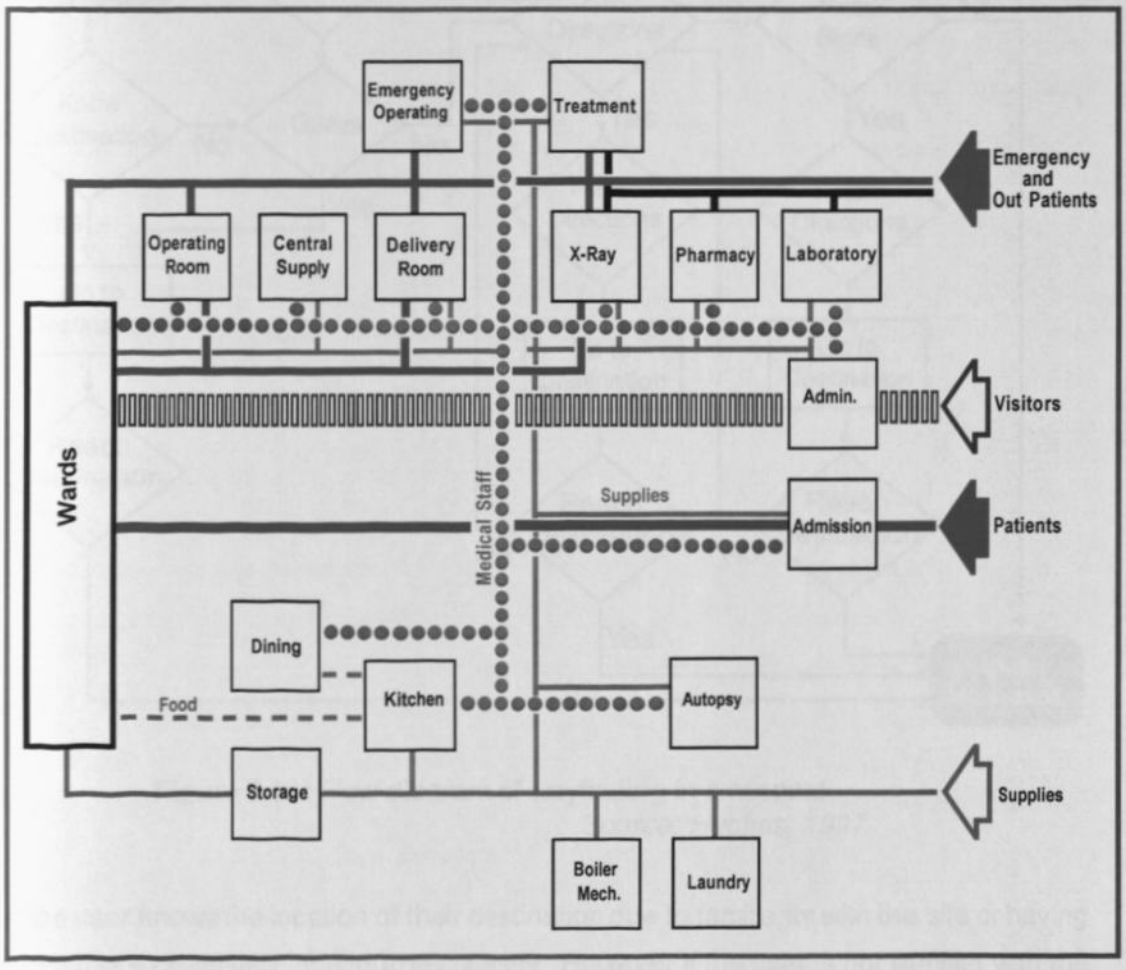


Figure 3.10: Gordon Friesen's circulatory logic for a modern hospital
Source: Hughes, 1997

Figure 3.11 depicts the locomative flow of a user through a hospital environment. Upon entering, one either knows the location of their destination or does not know. Their movement is influenced by this initial state which determines their next course of actions until they exit the environment.

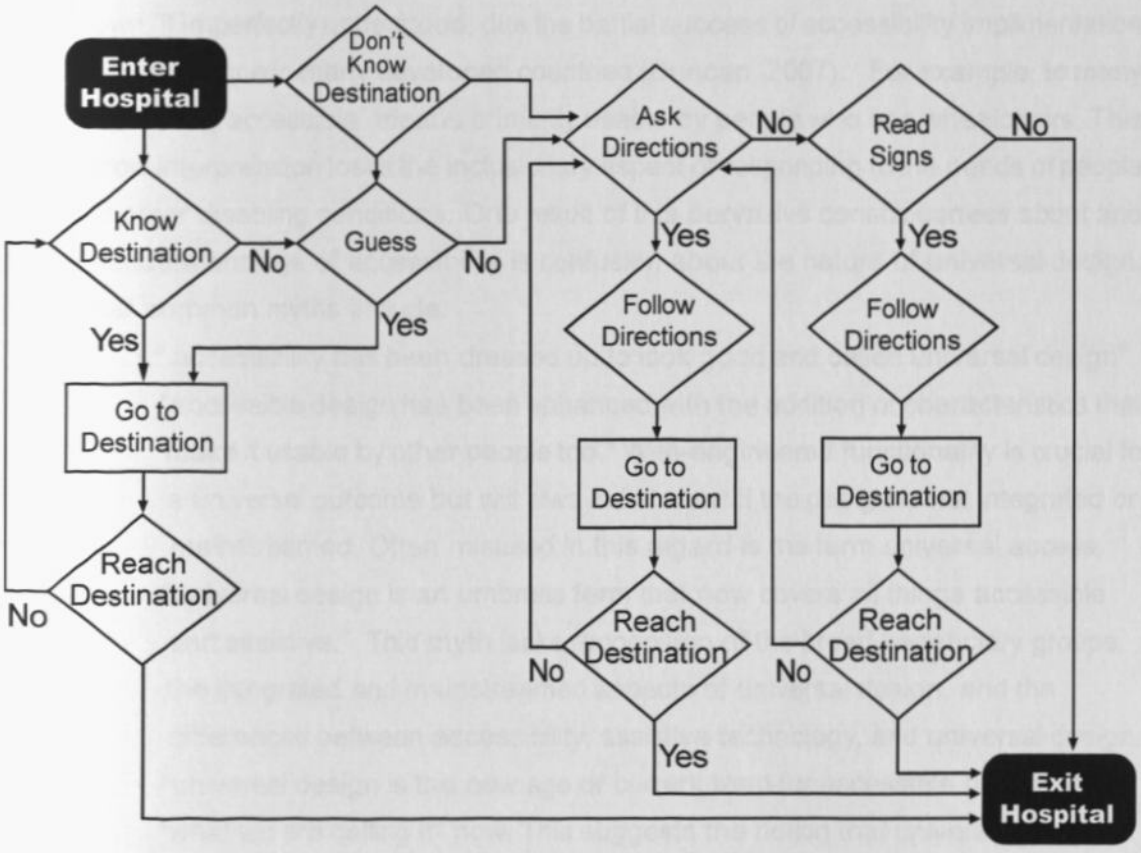


Figure 3.11: Flow diagram of wayfinding in a hospital
Source: Hughes, 1997

If the user knows the location of their destination due to familiarity with the site or having been there previously, the journey is easy. However if the user is not familiar with the site and does not know the location of their destination, they ask for directions, read environmental cues and signs (or both) or leave the site.

3.5 Universal access

As cited by M'Rithaa (2009) *universal access* refers to the ability of all people to have equal opportunity and access to a service or product from which they can benefit, regardless of their social class, ethnicity, background or physical disabilities (Obrenovic et al, 2007). It is a vision, and in some cases a legal term, that spans many fields, including education, disability, telecommunications, and healthcare. The term "accessibility" and the ideas about an "accessible" built environment are commonly known, if imperfectly understood, due the partial success of accessibility implimentation and compliance in many developed countries (Duncan, 2007). For example, to many people "fully accessible" means primarily usable by people who use wheelchairs. This narrow interpretation loses the inclusionary aspect of responding to the needs of people with other disabling conditions. One result of this pervasive consciousness about and misunderstandings of accessibility is confusion about the nature of universal design. Other common myths include:

- " accessibility has been dressed up to look good and called universal design"
- "accessible design has been enhanced with the addition of characteristics that make it usable by other people too." Well-engineered functionality is crucial to a universal outcome but will always fall short if the design is not integrated or mainstreamed. Often misused in this regard is the term universal access.
- "universal design is an umbrella term that now covers all things accessible and assistive." This myth lacks recognition of the broad beneficiary groups, the integrated and mainstreamed aspects of universal design, and the differences between accessibility, assistive technology, and universal design.
- "universal design is the new age or current term for accessible design. It is "what we are calling it" now. This suggests the notion that universal design is merely the politically correct term that one must be careful to use in polite company. With this thinking, universal design is grouped together with code compliance and other efforts.

In spite of the progress that has been made in the field of universal design, it must be remembered that this field is still young: Accessibility itself has only been practiced for 50 years, seriously for only for 25 years. Universal design is just a bit over 20 years since its conceptualization and the principles and guidelines are only marking the10 year anniversary in 2007 (ibid). There is legitimate confusion between universal design and more similar concepts or concepts from other places such as visitability (an US-based approach, limited to housing, that promotes limited usability features), Design for All (a similar idea to universal design, principally in use in Europe), Life Span Design

(used in the US, principally reflecting age sensitive design), Transgenerational Design (an idea formed in the US that good design now must accommodate people of all ages), Flex Housing (developed by Canadian Housing and Mortgage that includes features of accessibility as well as other innovative design ideas), and Lifetime Homes (developed in the UK, broadly applied standards with specific usability features) , among many others. The variety of concepts and common misunderstandings regarding universal design highlights the need for continued educational activities and suggests the need for international communication and collaboration (Duncan, 2007).

This study considers universal access to be a desirable aspect that may be facilitated by a good wayfinding system that enable all users of the hospital environment,regardless of gender, age, educational background, physical capability. Equal opportunity and access to the services being offered in the facility should be availed to even those who face challenges be they physical, mental or sensory (see figure 3.12). Where physical access is not always possible, alternate means should be employed to provide comparable meaningful experiences.

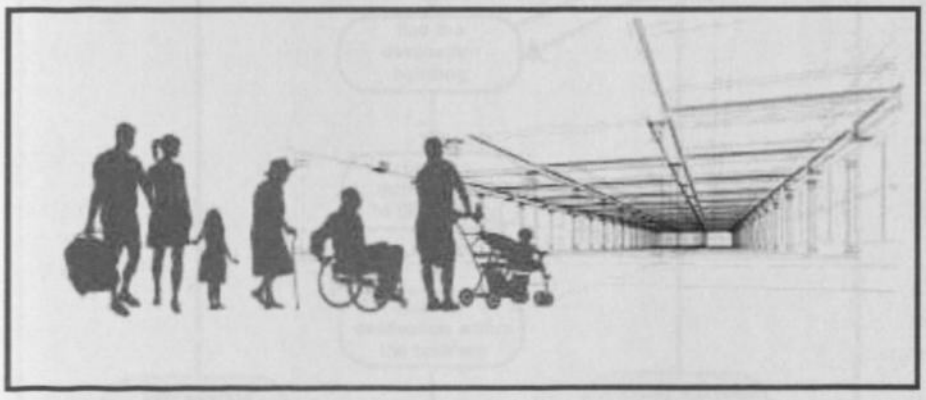


Figure 3.12 Universal access to buildings for all citizens particularly those who face challenges be they physical, mental or sensory.
Source: O'Sullivan (http://www.fosarchitects.com)

The principle of universal access applies thoughout the environment encountered. In the hospital environment this goes beyond just the entrance and toilet facilities. It should also be considered throughout the wayfinding system taking into account all the points at which the user is required to make locomotion decisions along their journey to their destination.

Figure 3.13 depicts a typical series of tasks that reguire decisions to be made when wayfinding in a hospital.

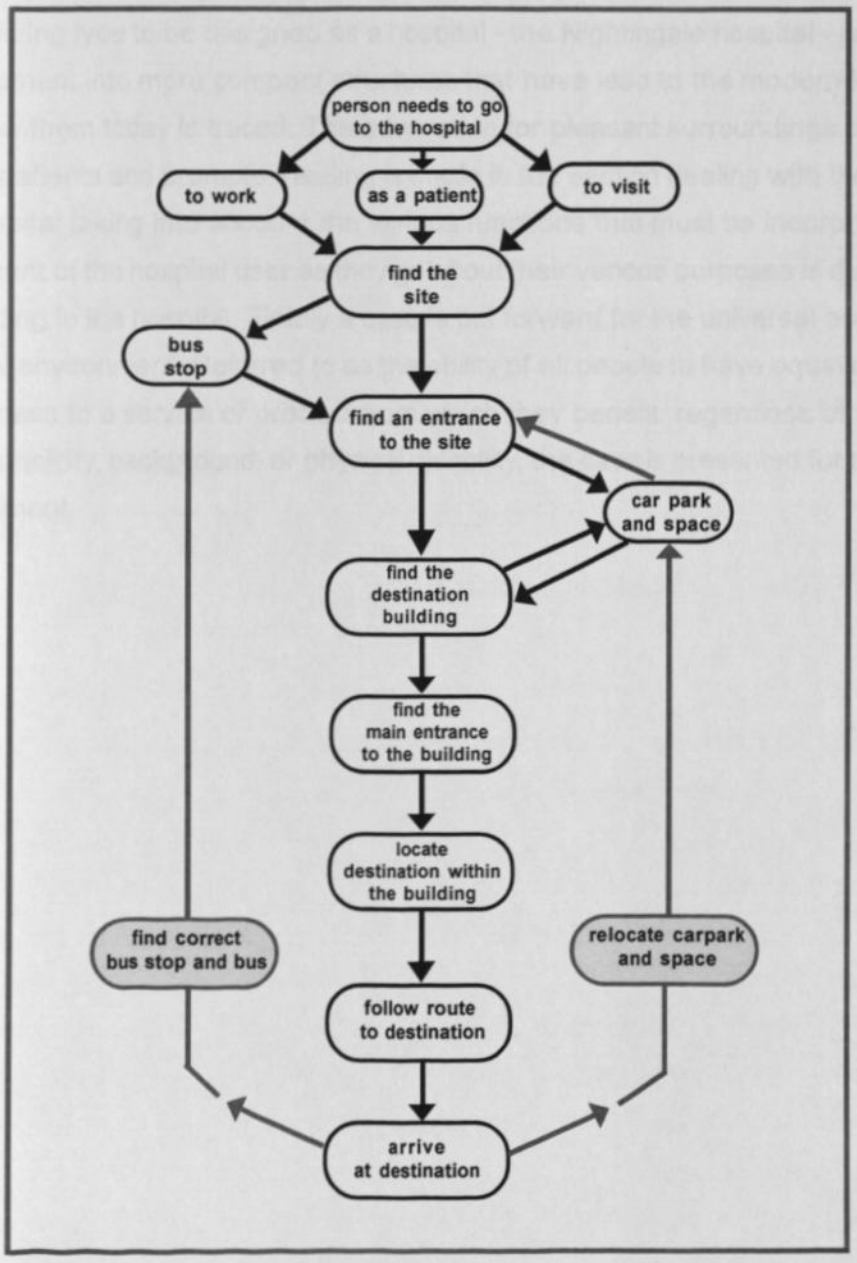


Figure 3.13 A typical series of tasks that reguire decisions to be made when wayfinding in a hospital.
Source: NHS (2005)

3.6 Summary

This chapter on the hospital environment set the basis upon which the study was founded. By attempting to understand the dynamics of this unique environment that exists to heal broken bodies one soon realizes that it is a special place all in all. The chapter begins by going back into the history of the hospital. Looking at the foundation of the early hospital it shows how religion and medicine were linked in ancient cultures. The first building type to be designed as a hospital - the Nightingale hospital - is cited. The development into more compact structures that have lead to the modern lospitals as we know them today is traced. The advocation for pleasant surroundings designed to attract patients and promote healing is made in the section dealing with the design of the hospital taking into account the various functions that must be incorporated. The movement of the hospital user as they go about their various purposes is discussed as wayfinding in the hospital. Finally a case is put forward for the universal access to the hospital environment. Referred to as the ability of all people to have equal opportunity and access to a service or product from which they benefit, regardless of their social class, ethnicity, background, or physical disability, the case is presented for the hospital environment.

CHAPTER 4

THE KENYATTA NATIONAL HOSPITAL

Despite all of the challenges of the broken system, there are hospitals that are figuring out a way to create patient-centered culture - they're doing it... And it's the little things that they put into place that actually impact the patient's experience. But when you take them all together they begin to change the culture. And even though they may not have a huge impact on the macro system, in that hospital and for those patients, they are making a difference."

- Susan Frampton , 2008

4.0 Introduction

This chapter introduces the Kenyatta National Hospital (KNH) as the selected case study site. By briefly tracing the history of hospitals in Kenya it puts into perspective the picture of this large hospital that has undergone numerous expansions and renovations over a period of over 124 years. Subsequently, the particular dilemmas of user wayfinding issues that may be traced to this expansion resulting in a complex hospital, is explored. Emphasis is placed on the physical properties of the environment, communication of wayfinding information to the users and quality service aspirations of the hospital.

4.1 Background to the study area

The Kenyatta National Hospital located in Nairobi, Kenya was selected as the area of study for wayfinding in hospitals in Kenya. Kenya is a former British colony that achieved self-rule in June 1963 and gained independence (*Uhuru*) on December 12, 1963. Exactly one year later, Kenya became a republic. Kenya is located in the Eastern Africa region bordered by Ethiopia and Sudan to the north, Somalia to the east, Uganda to the west and Tanzania to the south. Administratively, it is divided into 8 provinces namely Nairobi, Central, Coast, Eastern, North Eastern, Nyanza, Rift Valley and Western. The provinces are divided into districts, which total to 72 districts. Major cities and towns are: Nairobi - population: 2,143,254 Mombasa - population: 665,018, Kisumu - population: 322,734, Nakuru - population: 231,262 (1999 census). Nairobi was selected because it has the largest Kenyan population and all the demographic parameters are present in the Nairobi population.

Nairobi is the capital and largest city in Kenya. It is the most populous city in eastern Africa, with a current estimated population of about 3 million. The hospital selected is

located in the Nairobi central business district (NCBD).

The largest hospital in Kenya is Kenyatta National hospital. According to the Kenya Service Provision Assessment Survey, 2004, Kenya has a total of 303 hospitals in all the eight provinces with different managing authorities. These include government, non-governmental organisations (NGOs), private for-profit, and faith-based organisations (FBOs). This total is inclusive of two national referral hospitals and eight provincial general hospitals. Kenyatta is a referral hospital admitting patients referred from all government hospitals in Kenya.

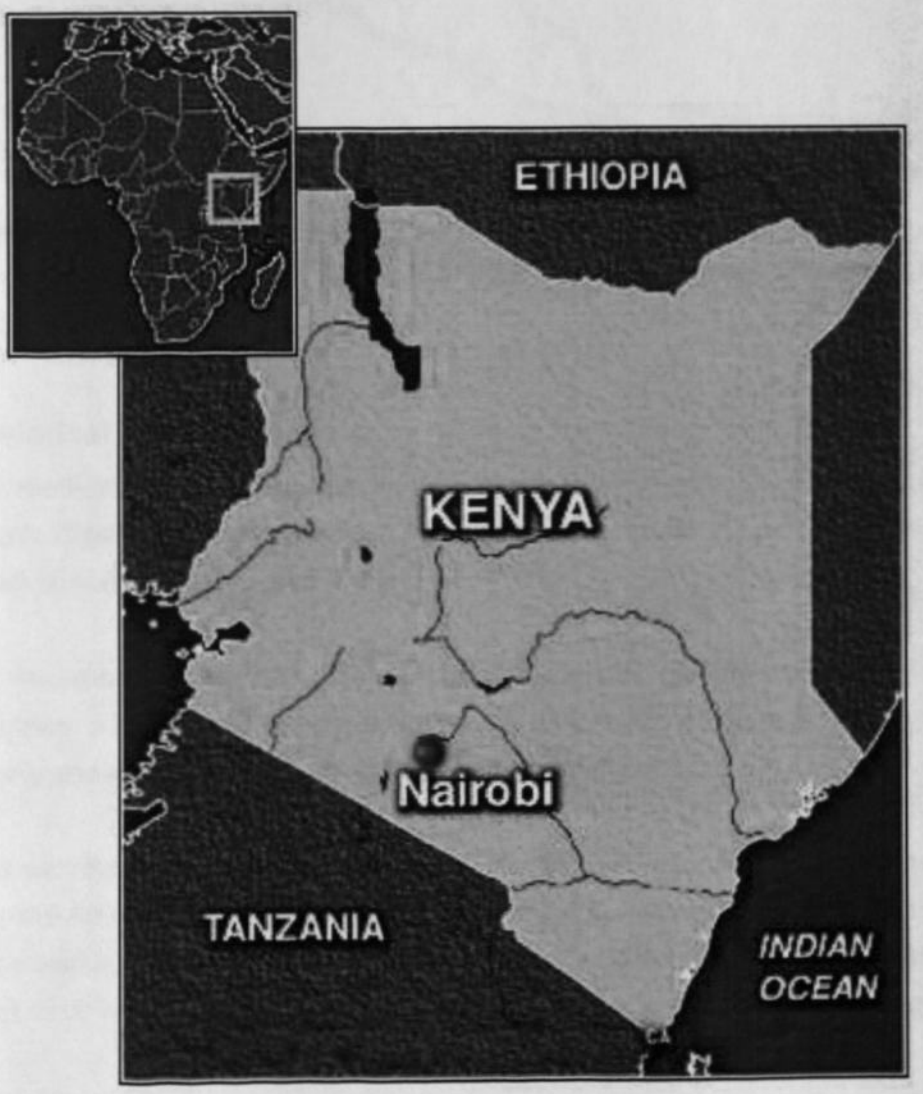


Figure 4.1: Map of Kenya in Africa showing Nairobi
Source:http://www.bedouin-camp.com/map

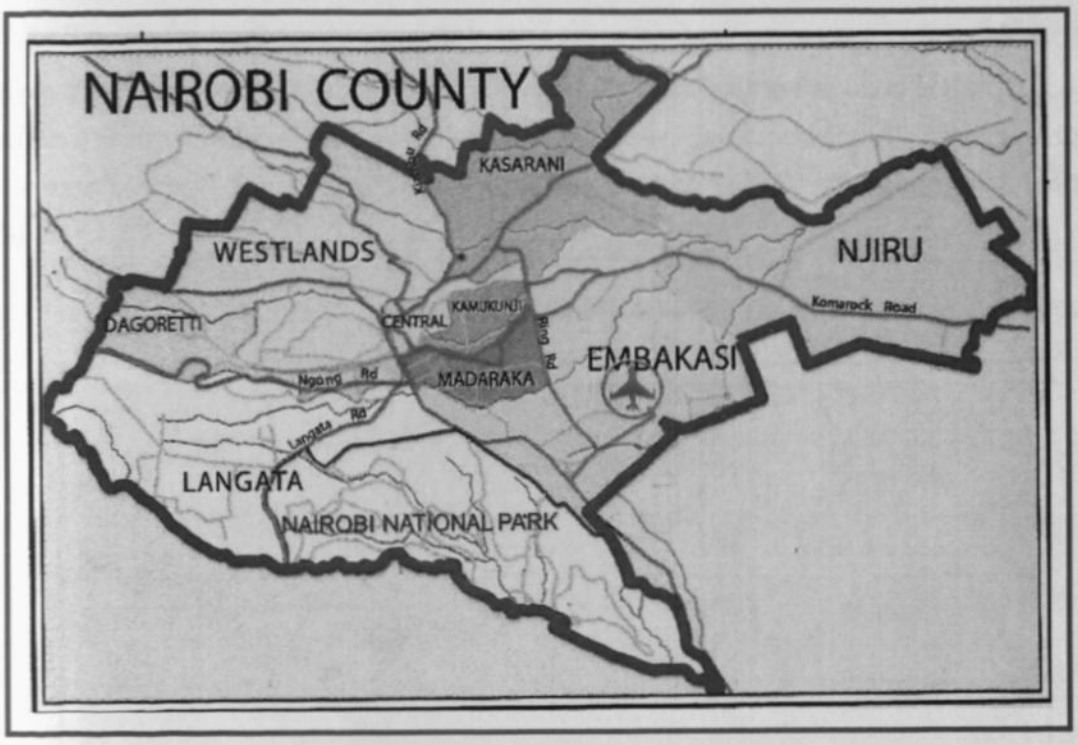


Figure 4.2: Map of Nairobi county showing Kenyatta National Hospital
Source: http://commons.wikimedia.org/

4.2 Historical background

Western medicine trickled slowly into Kenya with the first little colonial hospitals erected in the bush, most of them near missions. During the 1914 -18 world war, larger hospitals appeared on Nairobi Hill to serve military needs.

By the mid-nineteen thirties, Nairobi had numerous peripheral Government Dispensaries, a European Hospital serving the Civil Service, a native hospital with an Asian wing and a few private Nursing homes for the settlers.

After the war, the Government built the King George the VI Hospital. It had some 600 beds for the African population and a larger Asian wing was added, the funds for this being donated by the Asian Community. The European Hospital was also enlarged, but could not cope with the great demands made by the post war flood of immigrants.

4.3 Kenyatta National Hospital

Kenyatta National Hospital is located in the capital city of the Republic of Kenya. It is within the administrative County of Nairobi. Physically it is located about 3 kilometers to the south-west of the Nairobi Central Business District (NCBD) off Ngong road. (see figure 4.3).

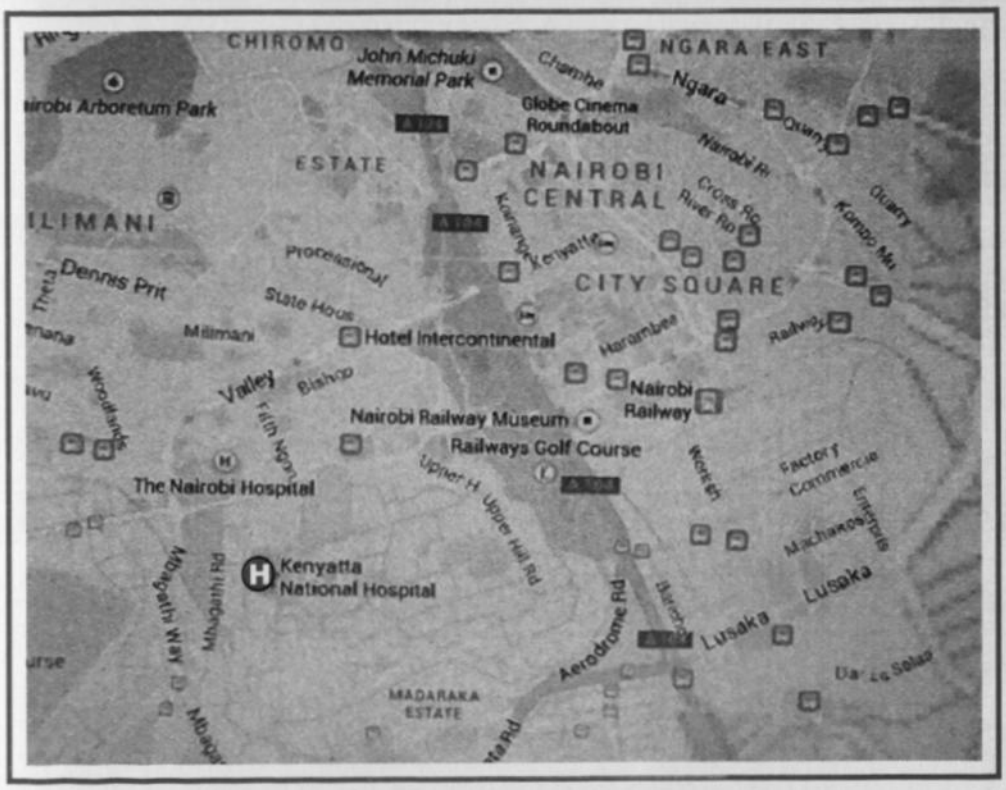


Figure 4.3: Location of the Kenyatta National Hospital from the Nairobi Central Business District.
Source: Google maps

Kenyatta National Hospital (KNH) is the oldest hospital in Kenya. Built in 1901 when it was called the Native Civil hospital and had a bed capacity of 45 beds. Extensions made in 1939, 1951, and 1953 increased bed capacity to 600 (Mohammed et al, 1985). In 1951 it was renamed the King George VI Hospital. In 1957 the Infectious Disease Hospital was constructed with 234 beds, and in 1965 the British Military Hospital at Kabete was taken over as the Orthopaedic Unit, and later a Dental Wing was added.

Following Kenya's independence from the British Colonial Government in 1963, the hospital was renamed Kenyatta National Hospital in 1964 -- after the first President, Jomo Kenyatta. It was then decided that it would be a national teaching hospital. An expansion program was carried out in three phases which included the main hospital, the clinical science blocks, the medical students hostels, and the hospital service blocks. A new ward tower block was completed and put into use in 1981putting into place the landmark feature that distinguishes Kenyatta National Hospital. (Fig 4.4).

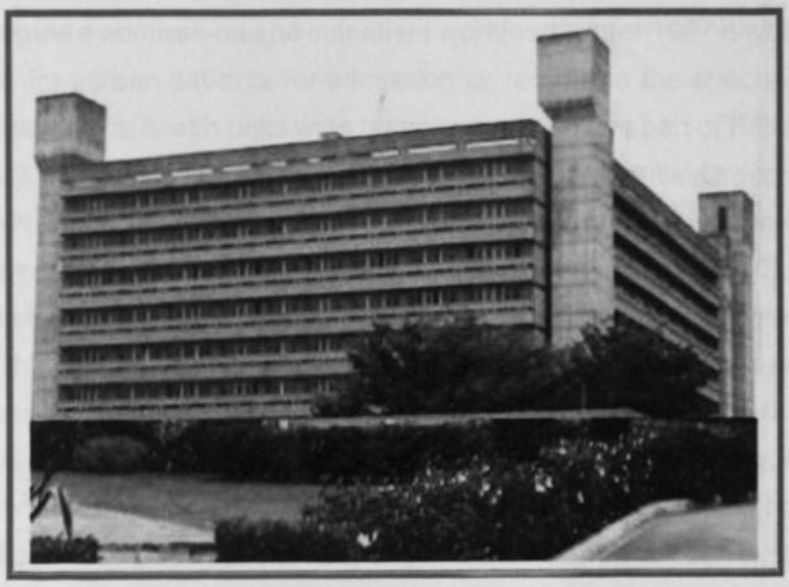


Figure 4.4: KNH ward tower block.
Source: Fieldwork (2013)

This extension program brought the bed capacity to 1,928 (REACH, 1989). According to the Performance Audit Report of the Auditor-General (2012), the responsibilities of the Hospital as spelt out in the Legal Notice No. 109 of 6 April 1987 were as follows;

i) to receive patients on referral from other hospitals or institutions within and outside Kenya and provide them with specialized health-care services ;
ii) to provide facilities for medical education for the College of Health Sciences of the University of Nairobi;
iii) to provide facilities for medical training in nursing and other health and allied professions; and;
iv) to participate as a national referral hospital in national health planning.

The core business of Kenyatta National Hospital is to receive and treat patients on referral from lower-tier institutions. The Hospital provides radiotherapy, heart surgery, neurosurgery, plastic and reconstructive surgery, critical-care, post-natal care, orthopedic surgery, kidney transplant surgery, renal therapy and burns management among other specialized services (Auditor-General, 2012).

Until 1967 KNH had a casualty department which handled all emergency cases. There was also an admissions procedure which was operated by senior staff and which handled only patients who had been referred for further specialized care. This made it possible to regulate admissions and outpatient workload. After 1967 it was decided to have filter clinics screen patients for admission or referral to the specialized clinics. A number of peripheral health units were taken over to become part of KNH to facilitate this process (Mohammed et al, 1985). In April 1987 a Presidential Order, through Legal Notice No. 109 of 6 April 1987, converted Kenyatta National Hospital (KNH) into a State Corporation, governed by a Board of Directors (REACH, 1988). With the change to a state corporation, overall ownership of the hospital was retained by the government through the Minister of Health, but a hospital board was given responsibility for the assets, liabilities, and development and management of the hospital. The government continued to provide annual development and recurrent funding, and retained control over board appointments, funding levels, fee structures, and staff remuneration levels. The Board was given the authority to generate revenue through cost sharing; to procure goods and services, including hiring and firing staff; and to use availableresources to accomplish the mission of the Hospital (Collins et al, 1996).

Currently, Kenyatta National Hospital is the largest government-run referral, teaching and research hospital in Kenya. It covers an area of 45.7 hectares and within the KNH complex are College of Health Sciences (University of Nairobi); the Kenya Medical Training College; Kenya Medical Research Institute and National Laboratory Service (Ministry of Health). It draws patients from all over the country with the majority of them coming from the greater Nairobi area, but may not be representitive of the general population. According to the hospital's website (accessed on 1st August, 2014) the hospital has 50 wards, 22 out-patient clinics, 24 theaters (16 specialized) and Accident & Emergency Department. Out of the total bed capacity of 1800, 209 beds are for the Private Wing. It has over 6000 staff members. In addition to the hospital's primary mandate to provide specialized health-care services to patients on referral from provincial and district level hospitals as such it has an average annual Outpatient attendance of 600,000 visits and an average annual Inpatient attendance of 89,000

patients. The annual budgetary allocation is KSh4.6 billion (GVPedia.com, accessed on 15th August, 2013).

KNH facilitates medical training and research and participates in national health-care planning. The specialized health-care services provided by the Hospital include radiotherapy, heart surgery, neurosurgery, renal dialysis and kidney transplant operations, plastic and reconstructive surgery, orthopedic surgery and burns management among others. (Auditor-General, 2012)

The Kenya Health Policy Framework (1994-2010) places Kenyatta National Hospital at Level Six; the apex of the national health-care delivery system. Therefore, the level of efficiency with which the hospital delivers services to the public is a matter of national importance. Furthermore, due to its exalted position, the hospital is expected to set high standards of health-care delivery that other public and private hospitals may emulate. It is for these reasons that the Auditor General considered it important to conduct a performance audit on the operations of the Hospital.

4.4 ISO 9001:2008 Certification

On 28th June, 2012 the Kenyatta National Hospital recieved ISO 9001:2008 certification from the Kenya National Bureau of Standards (KEBS) at a ceremony graced by the then minister for health, Prof. Anyang Nyong'o. The ISO 9001:2008 is the best known and most widely used model of a quality management system. It is an international Standard which sets minimum requirements for a quality management system (Bennett, 2013). Certification of the ISO 9001 quality management system demonstrates the hospital's commitment to quality and patient focus. It makes a committment to consistency, continual improvement and patient satisfaction. These are tangible benefits that play an important part in building a sustainable culture of high performance.

The ISO 9001 standard provides specific requirements for a quality management system that will enhance the ability to consistently deliver care that meets patient needs - as well as statutory and regulatory requirements (DNV GL accessed Jan. 2014). Independent assessment and certification of the quality management system by the Kenya Bureau of Standards (KEBS) gives a clear demonstration to stakeholders that the hospital is working to apply an effective quality management system in it's organisation.

Improving quality and enhancing patient safety through the implementation of a quality management system is the best way to provide patient centred care. ISO 9001 provides a model for a quality management system which focuses on the effectiveness of clinical, business and support processes to ensure high quality care is provided.

The attainment of this certification is, therefor a big achievement for KNH and this is proudly announced to the public and all stakeholders through communication devices such as notice boards (e.g. figure 4.5).

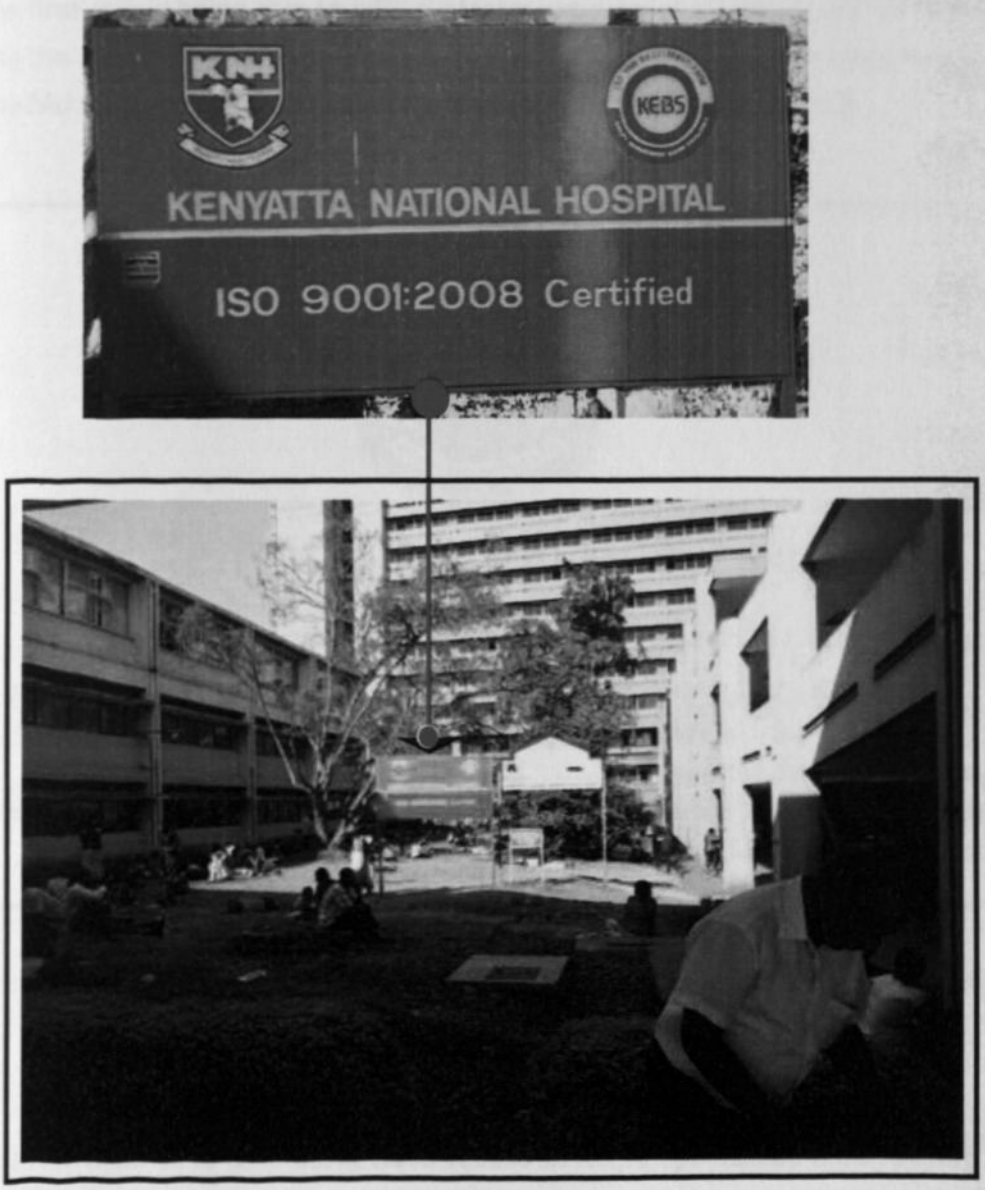


Figure 4.5: One of many signboards informing the public of KNH certification to ISO 9001:2008 Quality standard.
Source: Fieldwork (2013)

Certification and continuous improvement of the management system is a journey. The requirements in the ISO 9001 standard set clear targets for implementation and assessment of the management system. Internal Quality Audits are perform annually and re-certification Audits every third year.

The first of eight principles of the 9001:2008 Quality Management System is customer focus (Goult, 2009). Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations. Understanding what the customer wants is the first step in being able to fulfill customer expectations. With Quality Health Care being the aim for KNH as proclaimed in the hospital logo,the customer focus is captured in the Motto, Vision, and Mission of the institution as shown in figure 4.6.

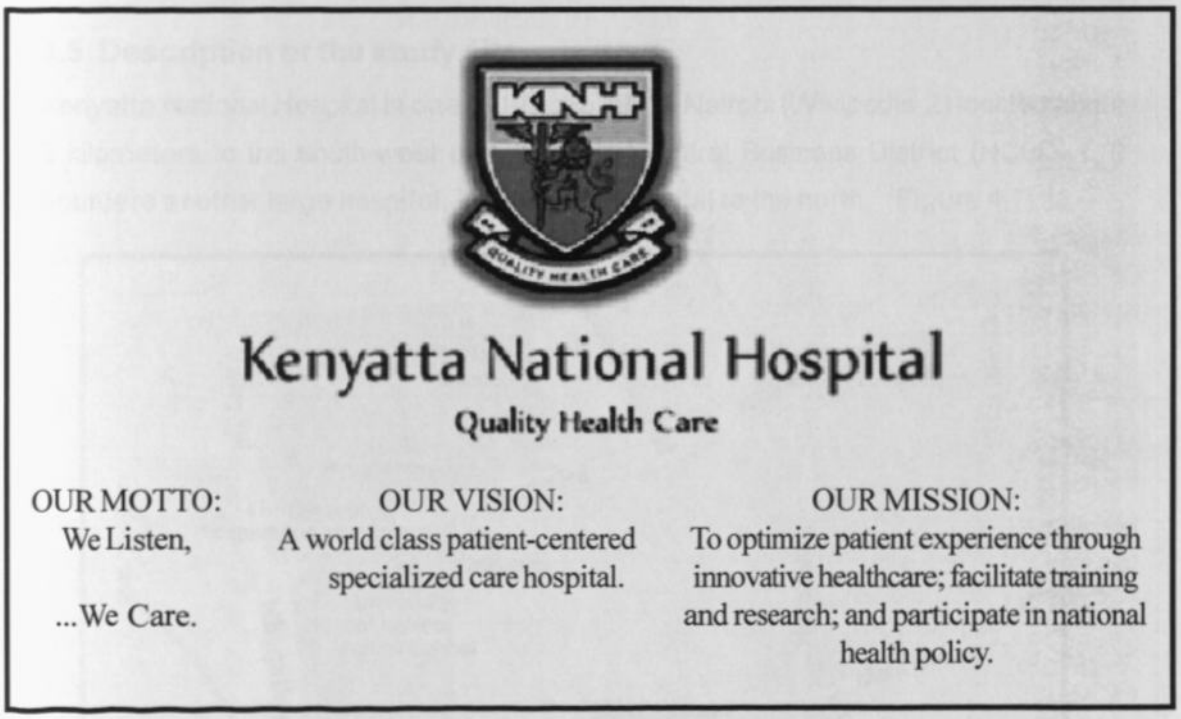


Figure 4.6: KNH Motto, Vision, and Mission statements of Quality delivery in line with ISO 9001:2008 Quality standard.

Source: Fieldwork (2013)

The KNH vision is to be a world class patient centered specialized care hospital. It is committed to optimizing patients experience through innovative healthcare; facilitate training and research; and participate in national health policy. The spirit of the ISO 9001:2008 is based on continual improvement (Bennett, 2013). This being the case it

is worth noting the fact that the provision of Quality health care is an awsome challenge for KNH. This is because too many patients come to KNH due to the fact that it is the only public health-care institution in Kenya that provides the full range of specialized health-care services to patients from all over Kenya, the Great Lakes Region, Southern and Central Africa (Auditor-General, 2012). It also provides training facilities for the University of Nairobi (College of Health Sciences) and the Kenya Medical Training College. According to the KNH Master Plan (1989), KNH has experienced numerous environmental, management and efficiency problems which have in turn hindered the fulfillment of it's stated objectives. The failure of primary and other lower-tier health-care institutions to function efficiently pushes the burden to KNH. In addition unlike other regions, Nairobi County lacks a provincial-level public hospital that would ease the burden.

4.5 Description of the study site

Kenyatta National Hospital is one of 19 hospitals in Nairobi (Wikipedia 2) located about 3 kilometers to the south-west of the Nairobi Central Business District (NCBD). It boarders another large hospital, The Nairobi Hospital to the north. (Figure 4.7)

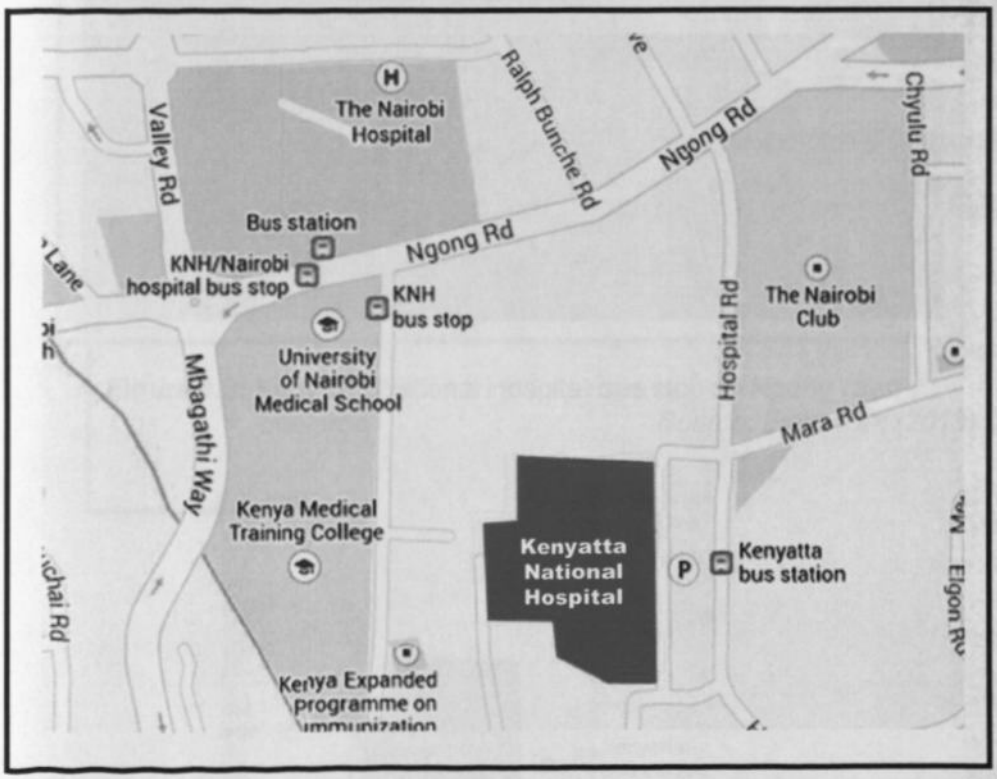
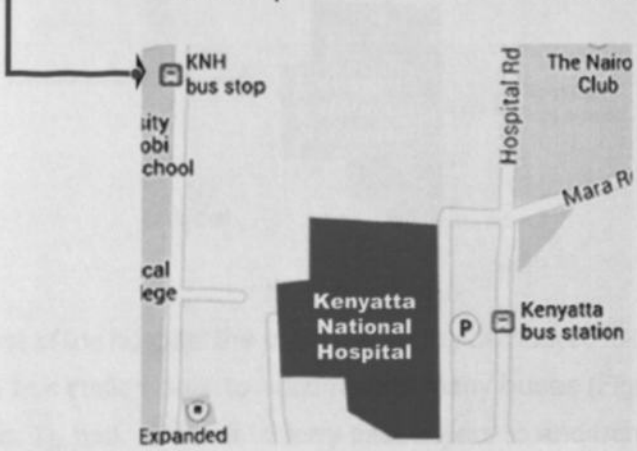


Figure 4.7: Kenyatta National Hospital locational map
Source: Google maps

4.5.1 Access to Kenyatta National Hospital

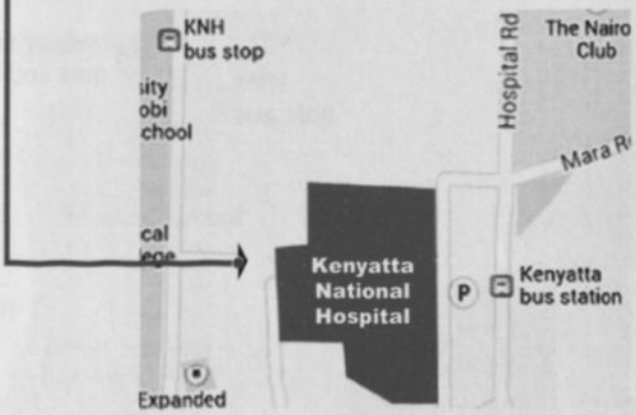
There are two main approaches to the KNH compound. Two roads provide access. Mbagathi road to the west of the hospital and Hospital road to the east of the hospital (see Figure 4.7). Both branch off Ngong road, which is a major road heading west from the Nairobi Central Business District (NCBD). Being a major National hospital, access is well facilitated for both public and private means. For those travelling by public means two bus stops serve the hospital as shown in Figure 4.7. The approach from the north of the hospital is on Ngong road . This is a major bus stop that also serves the Nairobi Hospital, the University of Nairobi Medical School and the Kenya Medical Training College (Figure 4.8).

Figure 4.8: Kenyatta National Hospital bus stop on Ngong road bus stop *Source: Fieldwork (2013)*



From this Ngong road bus stop the hospital is accessed through the University of Nairobi Medical School gate (Figure 4.9). To some extent this may be considered as a back entrance to the hospital since the face of the hospital and most of the hospital's services on offer are more visible from the main gate entrance on Hospital road to the east of the hospital. However, this west side entrance leads from the University of Nairobi College of Health Sciences teaching facility. Apart from hospital staff, university students and lecturers, patients and visitors also access the hospital from this entrance.

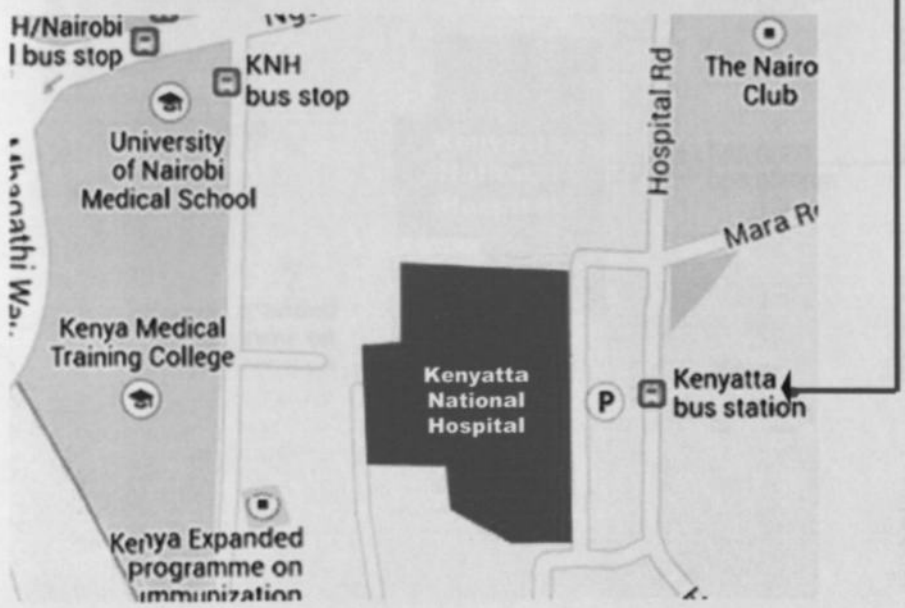
Figure 4.9: Kenyatta National Hospital access from Ngong road bus stop *Source: Fieldwork (2013)*



To the east of the hospital the main bus facility dedicated to the hosptal is located. This is a large bus station built to accomodate many buses (Figure 4.10). Here city buses (Route no. 7), park and wait to ferry passengers to and from the hospital to various

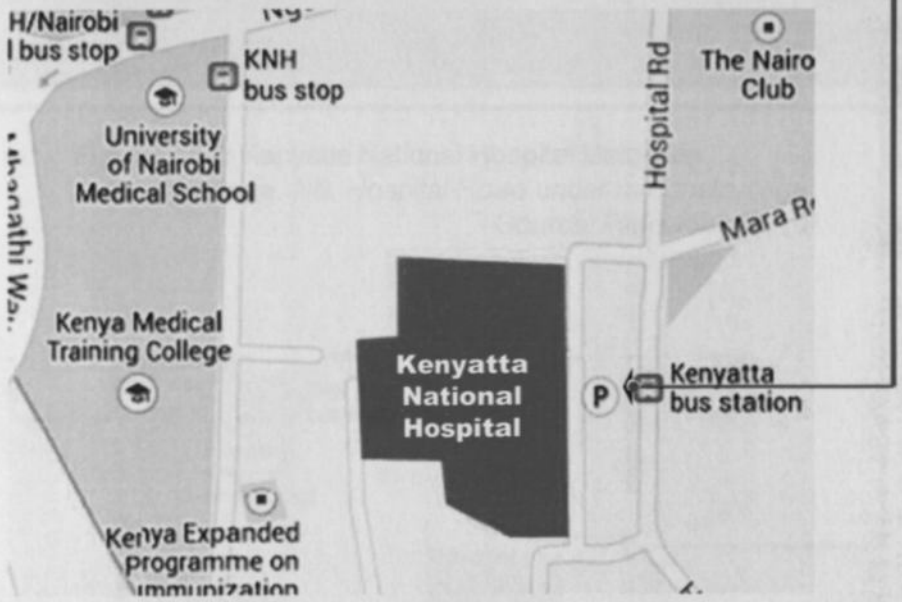
destinations within Nairobi City centre and beyond. Because, as noted in other sections of this thesis, Kenyatta National hospital serves a very wide patient base. People come from all over the country and beyond. For this reason this facility is provided to ease travel from the city centre to the hospital and back. Outpatients visiting the hospital, relatives and visitors use this avenue for access to the hospital with ease.

Figure 4.10: Kenyatta National Hospital Bus Station
Source: Fieldwork (2013)



From the main bus station, the front of the hospital is accessed. As shown in Figure 4.11, there is alot of human activity going to and from the bus station. It particularly vibrant close, during, and after the visiting hours. Also evident from this vantage is the direction signage (in corporate blue colour) to various sections of the hospital.

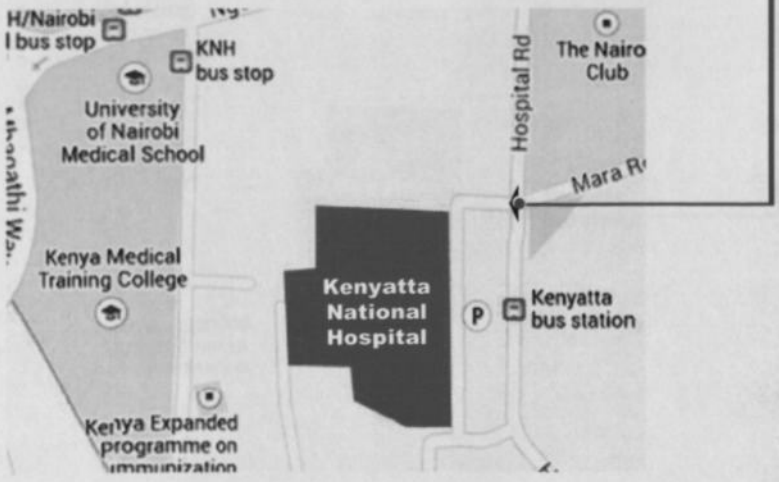
Figure 4.11 View of KNH from entrance gate from the "No. 7" Bus station
Source: Fieldwork (2013)



For those using private means to the hospital compound, the main entry is along Hospital road, off Ngong road (see Figure 4.7). Here the main gate to the hospital is located (Figure 4.12). This is the main gate to all the operational services of the hospital including the Administration block and other KNH associated units.

From a distance, along the approach road, a large information board is visible which gives lists the various units available on the compound.

Figure 4.12: Kenyatta National Hospital Main gate entrance. *NB. Hospital Road under re-construction.*
Source: Fieldwork (2013)



Agro chemical Supplies
Dental Unit
Gender Based Violence Recovery Centre
Mult. Disciplinary Clubfoot Clinic No 46
Kenya AIDS Vaccine Initiative
KNH Lab Demonstration Rooms
UON Lab Room 10
KNH Human Resource
Orthopedic Technology unit No 45
Labor Wards
Polyshyric Aghersis Research
General Wards
Radiotherapy Dept
E C G Dept
Orthopedic clinic
Dr Kimani
Assistant Chief Nurse 1 105
University Dental Hospital
Physiotherapy Dept
Hearing Aids
E C G Dept
Eye Clinic
Nairobi Hospice (NICC)
KNH Private Wing
Kenyatta National Hospital
Schistosomiosis Project Machakos
Dr Murage
Maternity Theater
Centre for Public Health Research
KNH Adminisration Block
Speech Therapy Clinic
National Nurses Association of Kenya
Kemri Welcome Trust Research Program
Kambuni Fred
Paediatric Emergency No 22
Bleeding center
Surgical Clinic No 24
Seminary
Western Union
Physicians & Medical Workers for Social Responsibility
Medicine & Poison Information Center
Obstetrics & Gynaecology Clinic 1B
ISOLATION ROOM
Minor Theatre
Kenya National Aids Control Programme
Barclays Bank KNH ATM
KNH Accident & Emergency
W
S
N
E

Figure 4.14: Facility floor layout plan at KNH plotted upon google map.

Source: Fieldwork (2013)

4.6 Summary

Chapter Four continues with the hospital environment, but focuses on the study area of the Kenyatta National Hospital. From its historical background that spans over one huindred years the introduction is given. The hospitals' physical location within the County of Nairobi is elaborated upon. The development over the years as well as the change of mandate from being fully government run to becoming a parastatal is explained. The certification to the ISO 9001:2008 standard is mentioned in line with expectations that this places upon the institution in terms of quality delivery of service. In a detailed description of the study area access to the hospital is described. This is done by highlighting access from the point of view of the user. The method used is by graphic and photographic utilization in an attempt to give as much of a visual and realistic explination as possible. Finally a detailed floor plan of the facility is presented showing the layout of the various speciality clinics and zones within the the hospital environment.

CHAPTER 5

RESEARCH DESIGN AND METHODOLOGY

"Inquiry is the creation of knowledge or understanding; it is the reaching out of a human being beyond himself to the perception of what may be or could be, or what the world could be or ought to be."

- Charles West Churchman, (1971).

5.0 Introduction

This chapter discusses the research methodology for this study in five sections;

- Section One discusses the basis for the chosen epistemological orientation for this study.
- Section Two considers the methodology framework for undertaking the study making a case for the selected research design.
- Section Three explains the methods selected for the collection of the appropriate data to address the research questions and the stated objectives of the study.
- Section Four describes the research instruments and the procedures used in the data collection process.
- Section Five explains how the data were captured, coded and analyzed.

Finally, a brief summary of the chapter is given.

5.1 Theoretical perspective

Despite the natural tendency for the researcher (especially the novice) to select a data gathering method and "get on with the job", the choice of methods they use will be influenced by the research methodology chosen. This methodology, in turn, will be influenced by the theoretical perspectives adopted by the researcher, and, in turn, this will be influenced by the researcher's epistemological stance (Gray, 2002).

The epistemological assumption refers to the ways to acquire knowledge (Bryman, 2001). This knowledge is acceptable in certain paradigms. The normative paradigm and the interpretive paradigm. Epistemology in the normative paradigm is how the social world can be investigated as natural science. Here hypotheses have to be test by empirical approaches and the results have to be objective through scientific method. In contrast, epistemology in interpretive is to acquire the knowledge by investigating the phenomena in many ways, because the social context is different from natural science. Therefore, investigation of the social phenomena can result in many interpretations. Furthermore, in critical theory, practical issues can construct the knowledge. Critical theory tends to change the conditions of certainty through criticizing the practical, politics, and social issues. As a result, the results can be subjective. Figure 5.1 illustrates the relationship between two assumptions of epistemology (what is knowledge) and ontology (what is real) .

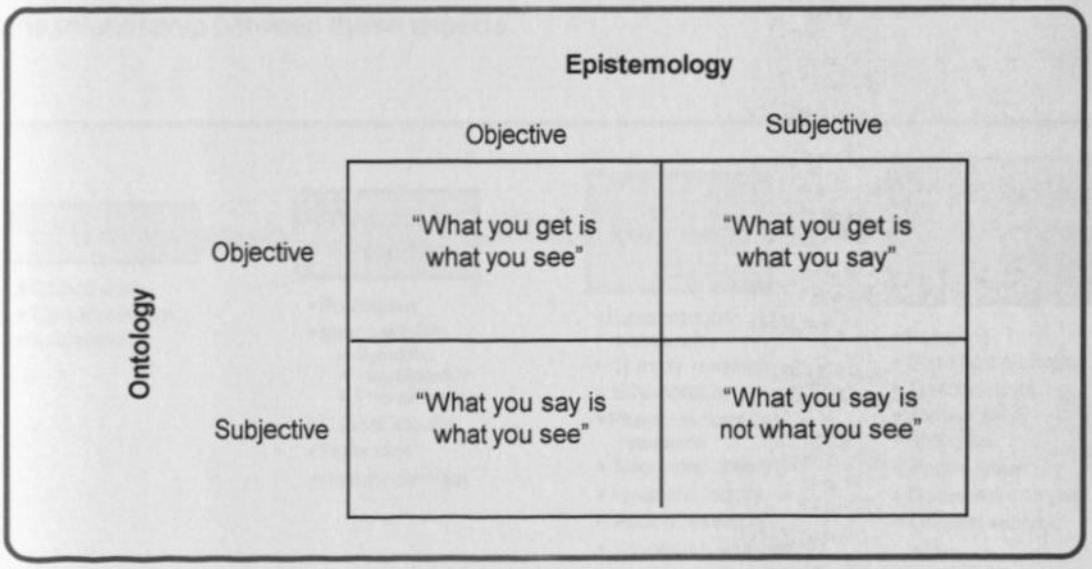


Figure 5.1: Relationship between two assumptions
Source: Brown (1994)

Ontology is the study of being, that is, the nature of existence and what constitutes reality. So, for example, for positivists the world is independent of our knowledge of it – it exists 'out there' while for relativists and others, there are multiple realities and ways of accessing them. While ontology embodies understanding *what is,* epistemology tries to understand *what it means to know* (Gray, 2009). Epistemology provides the philosophical background for deciding what kinds of knowledge are legitimate and

adequate. As Easterby-Smith et al. (2002) point out, having an epistemological perspective is important for several reasons. First, it can help to clarify issues of research design. This means more than just the design of research tools. It means the overarching structure of the research including the kind of evidence that is being gathered, from where, and how it is going to be interpreted. Secondly, a knowledge of research philosophy will help the researcher to recognize which designs will work (for a given set of objectives) and which will not. Crotty (1998) quoted by Gray (2009) suggests that an interrelationship exists between the theoretical stance adopted by the researcher, the methodology and methods used, and the researcher's view of the epistemology. As Dainty (2008) observes, it is common, if not expected, practice that a study must clearly define its philosophical grounding from the outset. The ideas presented in Crotty (2004), Creswell (2003) and Easterby-Smith et al (2004) bear testimony to this. According to some of these authors the researcher must make clear what their position is regarding: ontology (what is real), epistemology (what is knowledge), axiology (what is of value) and methodology (how do we go about studying it). Figure 5.2 illustrates the relationship between these aspects.

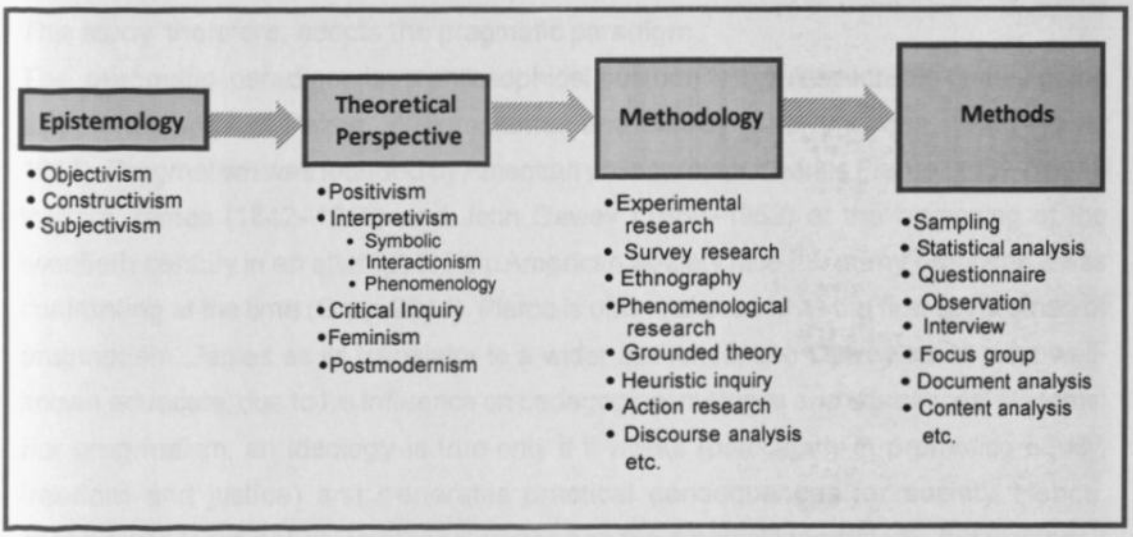


Figure 5.2: Relationship between epistemology, theoretical perspectives and research methods. (adapted from Crotty, (1998)
Source: Gray (2009)

From an epistemological standpoint, the researcher adopted an interpretive paradigm to acquire the knowledge by investigating the phenomena in many ways. This is as opposed to epistemology in the normative paradigm where the social world is investigated as natural science where the results have to be objective through scientific method.

Axiological assumption explains the role of values. Quantitative research is value-free and unbiased, while qualitative research is "value-laden and biased" (Creswell, 2003). Since the researcher opted to use a mixed-method research design the bias associated with a purely qualitative research does not have a significant impact on the findings from this study.

According to Allyn & Bacon (2003) there are four types of research design, namely quantitative, qualitative, analytical study and mixed-method (see figure 5.3). This study adopted a mixed-method evaluation design using exploratory, observational and descriptive study within a case study framework.

The mixed-method approach is where both quantitative and qualitative methods are adopted (e.g. Brewer and Hunter, 1989). It is defined as a research design that includes at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words) (Greene et al, 1989). Robson (2002) points out that this approach can help in that, rather than focusing on a single, specific research question, it may be used to address different, but complementary questions raised within a study. Chapter one of this thesis raises such questions that lend themselves to this approach. This study, therefore, adopts the pragmatic paradigm.

The pragmatic paradigm is a philosophical position with a respectable history going back to the work of Peirce, William James and Dewey (Cherryholmes, 1992; Howe, 1988). Pragmatism was founded by American philosophers Charles Pierce (1839–1914), William James (1842–1910) and John Dewey (1859–1952) at the beginning of the twentieth century in an attempt to help American society face the many problems it was confronting at the time (Gray, 2014). Pierce is often referred to as the first spokesman of pragmatism, James as its translator to a wider audience, and Dewey as its most well-known advocate, due to his influence on pedagogical methods and educational systems. For pragmatism, an ideology is true only if it works (particularly in promoting equity, freedom and justice) and generates practical consequences for society. Hence, pragmatists focus not on whether a proposition fits a particular ontology, but whether it suits a purpose and is capable of creating action (Rorty, 1998).

For these pragmatists, truth is 'what works' (Robson, 2002). Hence the test is whether or not it is feasible to carry out worthwhile studies using qualitative and quantitative approaches side by side. Of this Tashakkori and Teddlie (1998) provide an extensive set of examples. Reichardt and Rallis (1994) cited in Robson (2002) contend that this pragmatic approach is feasible because the fundamental values of current quantitative and qualitative researchers are actually highly compatible and include the following

beliefs:

- the value-ladenness of enquiry;
- the theory-ladenness of facts;
- that reality is multiple, complex, constructed and stratified; and
- the underdetermination of theory by fact (i.e. that any particular set of data explicable by more than a single theory).

5.2 Research design

"A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure" (Selltiz et al 1962). It is the conceptual structure within which research is conducted as it constitutes the blueprint for the collection, measurement and analysis of data. According to Zeisel (1984), the research design an investigator chooses to study a problem with depends on:

- the way the problem is defined,
- what the investigator wants to know,
- the nature of the object being studied,
- previous knowledge the study is based on, and
- the type of results desired.

The majority of experimental studies on human wayfinding behavior and related cognitive competencies are based on direct observation of navigator behavior (Hölscher et al., 2006).

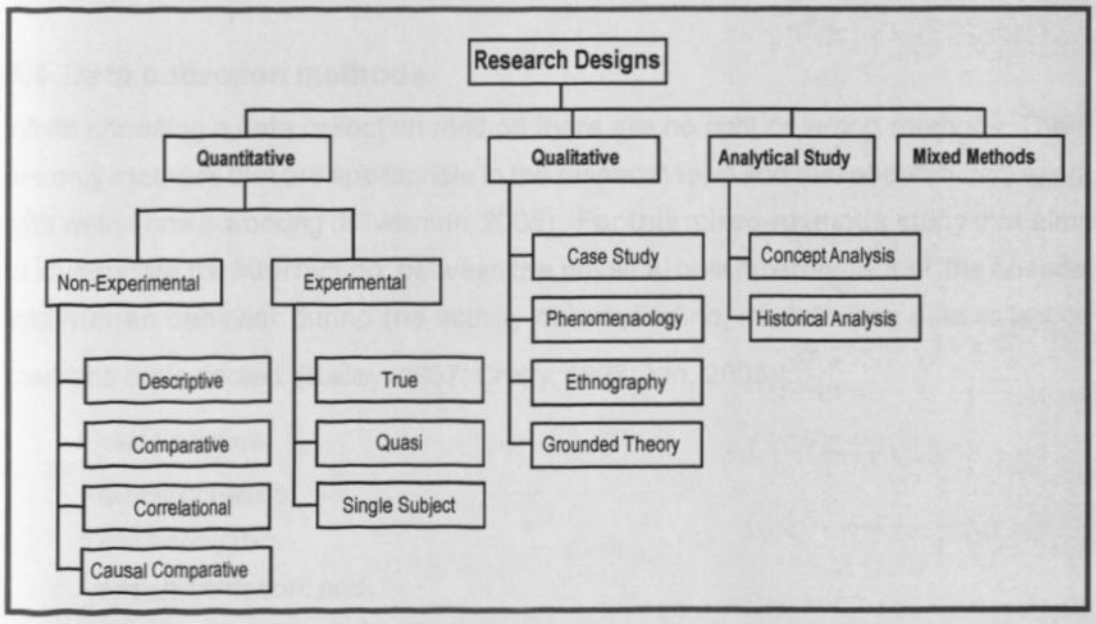


Figure 5.3: Types of Research Design
(Source: Allyn & Bacon ,2003)

5.3 Research methodology

The choice of research methodology is determined by a combination of several factors – for example, whether the researcher believes that there is some sort of external 'truth' out there that needs discovering, or whether the task of research is to explore and unpick people's multiple perspectives in natural, field settings. It is influenced, then, by whether the research is inclined towards a positivist, interpretivist, or other perspective. It will also be influenced, for example, by the researcher's attitude towards the ways in which she or he thinks theory should be used – whether research should begin with a theoretical model or perspective (deductive approach) or whether such models should emerge from the data itself (inductively) (Gray, 2014). Research methodology is a way to systematically solve the research problem. It is 'a general approach to studying research topics' (Silverman, 2005). In this sense the choice of method should reflect an 'overall research strategy' (Mason, 1996). As illustrated in Figure 5.2, the methodology is the lens through which the framework for the study is selected. It provides the opportunity of choosing an experimental research, survey research, ethnography, phenomenological research, grounded theory, action research, heuristic inquiry, discourse analysis, amongst others. The research framework thus selected, determines which data collection methods are used and how each is used. The data collection methods chosen should be appropriate to the research topic as well as the data sought. Most research methods can be used in research based on either quantitative or qualitative methodologies (Silverman, 2005). This also pertains for the mixed-method approach adopted for this study (Creswell, 2003).

5.4 Data collection methods

While choosing a data collection method there are no right or wrong methods. There are only methods that are appropriate to the research topic and the research framework with which one is working (Silverman, 2005). For this mixed-methods study that aims to investigate the interraction between the physical built environment of the hospital and human behavior during the activity of wayfinding, the following data collection methods are selected (Bailey, 1987; Crotty, 1998; Yin, 2003):

- case studies;
- questionnaires;
- observations;
- experimentation; and
- desk review of available literature.

5.4.1 Case study

The data collection method deemed appropriate to study the stated problem of wayfinding in the hospital environment is the case study research method. This is because as Yin (2003) argues, a case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations).

According to Bell (2004), a case study strategy is particularly appropriate because it gives an opportunity for one aspect of a problem to be studied in some depth within a limited time scale. Zeisel (1984) supports this view when he states that researchers use a case study strategy when they want to develop intensive knowledge about one complex object because case studies are designed to understand an object as a whole. One major feature of case study methodology is that different methods are combined with the purpose of illuminating a case from different angles: to triangulate by combining methodologies. Case study has been described as 'an umbrella term for a family of research methods having in common the decision to focus on inquiry around an instance' (Adelman et al., 1977). As in all research, evidence is collected systematically, the relationship between variables is studied, and the study is methodically planned. According to Bell (2004), case study is concerned principally with the interraction of factors and events and as Nisbet and Watt (1980) point out, 'sometimes it is only by taking a practical instance that we can obtain a full picture of this interraction'. In a recently published book, *Architectural Research Methods* by Linda Groat and David Wang (2002), the relation between different research strategies in the field of architecture is illustrated as in Figure 5.5.

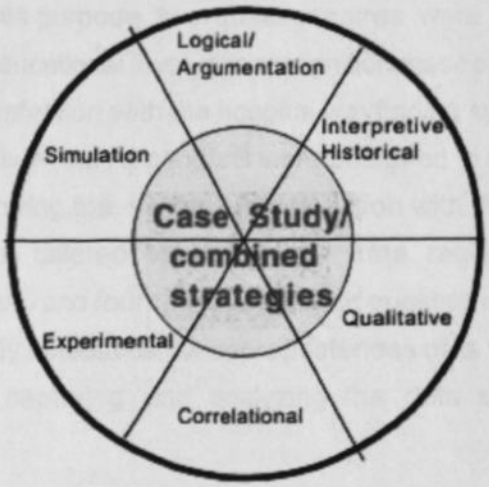


Figure 5.4: A conceptual framework for research methods.
After Groat & Wang (2002).
Source: Johansson (2003)

According to Johansson (2003), Groat & Wang explain the relations between methodologies, as shown in their diagram, by arguing that those close to each other have more similarities than those that are further apart. Qualitative and interpretive research have in common a holistic approach to the research subject, but with differing time perspectives. Correlational research, on the other hand, shares with qualitative research a focus on naturally occurring circumstances, but is dependent on quantitative data. Experimentation is also dependent on quantitative data, but with the requirement that the researcher must be able to manipulate isolated variables. Likewise, simulation requires control and manipulation. Logical argumentation — which includes, for instance, space syntax analysis — shares with simulation an emphasis on abstraction. And interpretive-historical research is dependent on a constructed logic of interpretation. This completes the circle.

Though observation and interviews are most frequently used in case study, no method is excluded. Methods of collecting data are selected which are appropriate for the task. The great strength of the case-study method is that it allows the researcher to concentrate on a specific instance or situation and to identify, or attempt to identify, the various interractive processes at work. Where information sought cannot be obtained solely by the case study, as in the instance of people's perception, a survey shall be undertaken or any other tool necessary to capture data to address the stated objective objectives.

5.4.2 Questionnaire design

A survey research method was used to collect data from the users of the hospital environment. For this purpose two questionnaires were developed to obtain data on demographics, educational level, sign recognition, ease of navigation using wayfinding information and satisfaction with the hospital wayfinding system. The questionnaires, depicted in Appendix A and Appendix B were designed to collected data based on the main issues surrounding the wayfinders interaction with the wayfinding system at the hospital. They were tailored to gather the data required to address the study's research questions two and four. In addition, each question was probed for its usefulness in achieving the study objectives; for appropriateness of its format; and in consideration of the method of capturing and analyzing the data sought (Fink, 1995b; Nardi, 2006).

Respondents were allowed to give any relevant additional information under the category of 'other' added to each question. This allowed the respondent to insert their own choices if those provided were inadequate. Structured questionnaires werechosen because they are an efficient method of collecting systematic primary data from respondents (Rea and Parker, 2005; Nardi, 2006).

The two questionnaires had a total of 30 questions divided into four sections. The first section solicited general information from the wayfinder i.e. gender, age and educational level attained. These questions were intended to collect biographical data that would provide a contextual background for the rest of the survey. Being direct and relatively easy to answer, these general questions were also intended to put the respondent at ease, hence their positioning at the beginning of the questionnaire (Salant and Dillman, 1994). The next section enquired about the wayfinders ability to use environmental communication to reach their intended destination within the hospital. This section dealt with the main issues under investigation in the study. Table 5.1 summarises the information solicited from the users under the various research questions.

Table 5.1: Data collected from users of the hospital environment

Research questions	User
Background data	o Gender, o Age, o Education level o Visual communication
Research question 1 What wayfinding information is present in the built environment of the hospital?	o Visual access to entrance o Information desk o Availability of signage o User direction by wayfinding information
Research question 2 How do wayfinders use wayfinding information present in the hospital to find their way to their destinations?	o Sign recognition, o Destination, o Familiarity o Confidence o Prior direction or information o Visual access to entrance o Information desk o Use of signage
Research question 3 How does legibility present in the hospital influence the wayfinding behavior of the user?	o Information desk o Visual access o Sign recognition, o Use of signage o Destination, o Familiarity o Confidence
Research question 4 What is the level of user satisfaction with the wayfinding information in the hospital?	o Directions from Information desk o Availability of signage, o Enough wayfinding information o Confidence o Clear paths o Visual access to lab

Source: Researcher construct (2013)

The second questionnaire Appendix B dealt with issues relating to user satisfaction with their wayfinding experience, for instance, appropriate signage, ease of wayfinding to stated destination, and the role of spoken directions.

5.4.3 Observation

Observing behavior means systematically watching people use their environments. What do they do? How do activities relate to one another spatially? And how do spatial relations affect participants? (Zeisel, 1984) Zeisel continues to point out that, at the same time, observers of environmental behavior look at how the physical environment supports or interferes with behaviors taking place within it, especially the side effects the setting has on relationships between individual or groups. Foster (1996) notes that observation offers advantages over interviews and questionnaires in that it allows for recording of human behaviour directly "without having to rely on the retrospective and anticipatory" responses of informants. Observing behavior in physical settings generates data about people's activities and the relationships needed to sustain them, about regularities of behavior, about expected uses, new uses, and misuses of a place, and about behavioral opportunities and constraints that environments provide (Zeisel, 1984) "You do not have to be an expert to observe behavior" according to Zeisel. He presents a table outlining the observation of environmental behavior (Table 5.2)

5.4.3.1 Observation of users

Wayfinding problems are already recognized in the hospital. Two-day observations of patients and visitors intended to find the nature of the problem and the related behaviour rather than demonstrating the frequency of the problem. The reports from these consequently consist in examples of behaviour and are reported later in this thesis.

Table 5.2: Observation of Environmental Behavior

Observing Environmental Behavior
Qualities of the Method • Emphatic • Direct • Dynamic • Variably intrusive *Observer's Vantage Points* • Secret outsider • Recognized outsider • Marginal participant • Full participant *Recording Devices* • Notation • Precoded checklist • Maps • Photographs • Videotapes and movies *What to observe* • Who: actor • Doing what: act • With whom: significant others • Relationships • Context • Setting

Source: Zeisel (1984)

This study used various types of observation methods. The first was an ethnographic method that entailed a direct unobstrusive observation of the behavior of wayfinders. Here the participant observer sat discreetly, made observations of how users interacted with environmental information before them. Observing behavior is emphatic and direct, deals with dynamic phenomena, and allows researchers to vary their intrusiveness in a research setting (Zeisel, 1984). The second observational protocol was in the form of a site survey form filled by users navigating their way to a selected destination within the hospital. This was filled by wayfinders who had no prior engagement with the environment.

5.4.4 Wayfinder test

For this test, participants, unfamiliar with a route within the hospital building were required to travel to a previously pre-determined destination. From a common start point they were to find their way to this destination. The detailed discussion of this experiment is outlined in section 5.7 of this chapter.

5.4.5 Desk review of available literature

This process involved consulting books, journals, newspapers, internet-based resources, and other published information available from the case study (such as drawings, plans, and strategic documents).

5.4.6 Photographic registration

The main corridors of the hospital were registered. For ethical reasons where images of patients or visitors appeared due to the natural inability to exclude them from the scene, any recognizable features were deliberately blurred using the Adobe Photoshop image manipulation.

5.5 Population and sample design

Generally, a population is composed of the entire set of objects, events or people that can be studied (Rea and Parker, 2005). Sampling is done because it would normally be impractical to study every single individual in the population. It is also done to save time, money and effort while conducting the research. For this study the aim was to establish how people visiting the built environment of the hospital navigate the site to reach their intended destinations. The population is therefore all those who visit the hospital for variuos activities. These include administrators, workers, suppliers, patients, and visitors.

5.5.1 Population

In research the interest is in the working or study population. The working population is that part of the general populations that possesses the characteristics that the research aims to study, that is, fulfils the requirement of the research (Ibid.). Since this study aims at understanding wayfinding in the hospital environment of Kenyatta National hospital, the target population is taken as all those who navigate this environment in the course of their duty, service, treatment, or visit.

5.5.2 Sampling design and sample size

Population sampling is the process of taking a subset of subjects that is representative of the entire population. The sample must have sufficient size to warrant statistical analysis. Still, every researcher must keep in mind that the ideal scenario is to test all the individuals to obtain reliable, valid and accurate results. If testing all the individuals is impossible, then the researcher must rely on sampling techniques.

For this study, in order to achieve the stated objectives within the budget and timeframe, it was important to keep the number of facilities studied to a manageable level. Non-probability sampling strategy, as described by Kothari (2004), was used. This sampling strategy enables researchers to choose respondents "as they wish" and without random sampling. Non-probability population sampling method is useful for pilot studies, case studies, qualitative research, and for hypothesis development. A representitive study sample was selected based on the consideration of physical size of the facility, the services it offers, managing authority, and research logistic. According to Mugenda and Mugenda (1999) a researcher can purposefully select a population that has the information required by the researcher. By using this aurgument, one hospital, Kenyatta National Hospital was purposefully selected for this study.

Within the selected facility, the selected user population consisted of patients that were referred to the laboratory and visitors accompanying the patients to the laboratory facility.

5.5.3 The sample population

There is no maximum or minimum sample size in case study research (Yin, 2003). Simple random sampling was used to obtain the user population. The population sample size determination was made considering the population of 100 patients which is the mean number of patients visiting daily at one of the laboratories at Kenyatta National Hospital, the selected study area.

A sample size calculation was performed with a sample size calculator by Rasoft, Inc. (http://www.raosoft.com/samplesize.html). Sample size was calculated based on the following formulas where the sample size "n" and margin of error "E" are given by:

$$x = Z(c/100)^2 r(100-r)$$

$$n = Nx / ((N-1)E^2 + x)$$

$$E = \pm \sqrt{[(N-n)x / n(N-1)]}$$

Where N is the population size, r is the fraction of responses that you are interested in, and $Z(c/100)$ is the critical value for the confidence level c.

In this study, the margin of error was set to 5%, confidence level to 95%, assumed a population size of 100, and a response rate of 50%; thus, recommended sample size was 80.

5.5.4 Inclusion criteria

The research included the Kenyatta National Hospital as case study. The sample included patients of the hospital who had been referred to the laboratory for laboratory assays and any visitor accompanying the patient. The patients and visitors included in this study were those who were willing to participate and allow the researcher to investigate their their views on wayfinding. Patients and visitors included in this study were those eighteen years and above.

5.5.5 Exclusion critera

Excluded were all other hospitals in Kenya. Any patient or visitor accompanying the patient who was not willing to participate in this study was excluded. Any patient who was under eighteen years of age or who was not willing to participate in this study was also excluded from this study.

It was assumed that the working staff of doctors, nurses, technicians, administrative, and supporting staff are very familiar with the environment due to their inevitable interaction with it by virtue of their occupations, and were therefore excluded from this study.

5.6 Data collection methods

The data collection process commenced with an application for research authorisation to the Ministry of Education Science and Technology, Kenya. The application entailed the completion of an application form detailing the research purpose, funding, relevant population, intended geographical location; submission of the research proposal; and paying the prescribed fee (for this study Kenya Shillings 1,000 (US$16.13). The information submitted was then scrutinised for associated ethical or other considerations that may adversely affect the targeted population or the public.

Data was collected on two levels:- Firstly at the facility level, where primary data was collected in order to document the existing state of the wayfinding system within the hospital facility. Secondary was collected from literature, achivial documents such as building plans and any relevant government documents. The second level was at the user level, where data pertaining to user/facility interaction is collected. At the first

level, primary data was collected through the use of an Observation Protocol instrument that was tailored to assess the communicative aspects in the environment. The observer was able to make and record guided observations. A second instrument modelled along the lines of a Facility Inventory Questionnaire augmented the Observation Protocol instrument to cater for aspects that may not been initially obvious to the observer. This included questions to those percieved to be key informants within the facility, such as, the staff in charge of various laboratories. At the second level, user-centred data was collected. This was done by using questionnaires and interviews designed for patient using the hospital environment.

To avoid misunderstanding of any question the questionnaires were not self-administered but administered through interviews with the patients. Structured questionnaires were formulated to elicit data on user demographics, personal traits, effectiveness of user/ facility interaction and the user's perception of the environmental communication elements. The first benefit of a interview-administered questionnaire is that the researcher can collect the completed responses because it was delivered and collected by hand. Second, the researcher could clarify questions on the spot because the questionnaire was filled in the presence of the researcher or research assistant. Third, the researcher was afforded an opportunity to intrintroduce the research topic and motivate the respondents to offer frank answers.

5.6.1 Pre-testing, reliability and validity of instruments

The research instruments were pre-tested in a pilot study before use in the fieldwork to ensure that they are reliable and that mistakes or errors that may have occurred during their construction are detected and eliminated. The findings of the pilot study were used to refine the instruments in case of ambiguity by testing reliability, validity, understanding and the flow of questions as recommended by Mugenda & Mugenda, (1999).

Validity of the research instruments was thus through the pilot study. The questionnaires were pre-tested using randomly selected patients referred to the laboratory, to refine the instruments to ensure they collect the required data. The respondents who participated in the pre-testing of the questionnaires did not form part of the main sample frame of the study in order to avoid bias.

Creswell (2003) and Mugenda and Mugenda (1999) advise that validity can be achieved through organization of questions around the central themes of the research and by triangulation. The authors state that other steps used in validation include using member

checking, and using discrepant information. Towards this goal, triangulation of different data sources was used as the hospital workers were interviewed plus an observation checklist was used to foster this triangulation. Other steps taken to ensure validity were that the questionnaires were taken back to selected participants during three subsequent visits and the questions were organized around the four major themes of the research.

5.6.2 Personal characteristics

The influence of personal character aspects on the wayfinding process cannot be overlooked. Evidence suggests that individuals make important self-assessments based on their performance in wayfinding and spatial orientation (Weisman, 1981). Wayfinding is described as the actual behaviors people employ in finding locations in the environment. Orientation is the ability to know one's location in relation to other features in the environment. For this study the demographic information was collected by soliciting a response to the gender, age, and highest education level attained by the respondents. This aspect was deliberated repeated in the questionnaires administered as well as the wayfinding navigation test. Of all the many and influencing personal characteristics of an individual using an environment, this study has focused on only these three, which were easily attainable within the time frame of the study. Gender is easily captured in the first question in all questionnaires. Age tends to be not as direct to capture and therefore is solicited in corhorts. People are more comfortable revealing their age within a bracket rather than being specific. This was the system used in this study in all the questionnaires. The influence of the respondents education was deemed very influencial to wards environmental communication, visual comprehension, legibility, and wayfinding. The level of respondents education was captured on the three levels of Primary, Secondary, and University.

5.6.2.1 Pictographs

Another form education beyond formal education dependant on the written word of the alphabet is visual communication in the form of 'word pictures' or graphical symbols. Graphical symbols are vital for giving information when written words are not adequate (ISO, 2013). User comprehension of this form of communication was interrogated using a presentation of pictographs (word pictures), where they were required to state what they thought the image represented. The selection of pictorams was guided by Beneicke et al, 2003, 'Wayfinding and Signage in Library Design' and ISO (2013), 'The international language of ISO graphical symbols'. Eight pictographs were presented in Questionnaire 1 (Appendix B).

5.6.3 Legibility of the environmental communication

Aspects adapted and developed from the Site survey tool in the NHS Wayfinding (2005) document (Appendix A), were localized and used in the development of the three data collection instruments developed for this study to investigate the legibility of the environmental communication within the hospital. As cited in the NHS (2005) guideline, valuable information can be gathered by getting a variety of people who are not familiar with the site to follow routes around it and make notes on wayfinding aids. With this as the framework, the structured primary data collection instruments were develped geared towards soliciting specific responses from the participants with regard to architectural communication, graphic communication and visual access. Structured primary observation (Saunders et al., 2003) was an additional method for collecting primary data pertaining to the elements of wayfinding information.

5.6.4 Wayfinders use of wayfinding information

To investigate wayfinders use of wayfinding information, the instrument used was a questionnaire on user wayfinding within the hospital (Questionnaire 1). This was used to collect data on the availability and the usability of wayfinding information. To augment the data collected the wayfinding navigation tested conducted at the site. In addition an observation strategy involving an un-obtrusive observation by the researcher, as described by Zeisel (1980) informed the development of the study .

5.6.5 Legibility and wayfinding behavior

Data collection to investigate the influence of the legibility of the built environment upon wayfinding behavior in a hospital setting was collected by structured primary observation (Creswell 2003; Cozby 2004), using the questionnaire on user wayfinding within the hospital (Questionnaire 1). The legibility of the environment was informed through the interrogation of the the presence or absence of wayfinding information in the environment. The sources of environmental information was in the form of directory boards, designated information points such as information desks, receptions or customer care points. Signage and direction signs also contributed to the legibility of the environment. The behavior of the user of the environment corresponded to the availability and utilization of the necessary waayfinding communication at the point of need for the user.

5.6.5 Level of user satisfaction

Data collection to investigate the level of user satisfaction with the wayfinding experience in the hospital was collected using the instrument of a semi-structured questionnaire administered to visitors to the hospital environment as well as the patients waiting for their laboratory results who had time on their hands during the waiting period. Questionnaire 2 (Appendix C) pursued specifically the aspect of of user satisfaction within the hospital environment. It queries the users level of satisfaction with the information presented in the wayfinding system at decision points (question no. 9) and with the entire wayfinding experience (question 15). These aspects are also interrogated by questions 7 and 11 in the site survey tool that surveyed routes within the hospital environment (Appendix D).

5.7 Wayfinder navigation test

Wayfinding is classically described as a purposeful, directed, and motivated movement from an origin to a specific distant destination, which cannot be directly perceived by the traveler (Golledge, 1999).

This phase of the overall study evaluated the journey of the wayfinder from a start point to a pre-determined destinition within the hospital in order to investigate the role of environmetal communication for wayfinding behavior of users of the hospital environment. The findings gave an indication of the user performance in finding their way to a destination and the strategies they employed. By so doing this user navigation test addressed various aspects of the research objectives stated in chapter one of this thesis.

5.7.1 Description

For this test, participants, unfamiliar with a route within the hospital building were to travel to a pre-determined destination. From a common start point they were to find their way to this destination. They were briefed on how they were to record their observations about the environmental communication relating to wayfinding along their journey. They were introduced to terms used in wayfinding research, such as environmental communication, landmarks, signage, decision points, paths, and navigation. They were instructed on how to fill in a prescribed observation survey protocol (Appendix C), in order to record pertinent aspects of environmental communication within the physical environment of the building that impacted their wayfinding performance. This test was formulated along the lines of the research done by Baskaya

et. al. (2004) where participants explored spatial orientation and wayfinding behavior of new comers to an unfamiliar environment of polyclinics. Whereas their research focused on the importance of landmarks and spatial differentiation of plan configuration in the acquisition of environmental knowledge, the test in this study was to investigate how wayfinders use wayfinding information, such as spatial landmarks, signage and room numbers, in the built environment of the hospital to find their way to a pre-determined destination. By so doing, the influence of environmental communication upon the wayfinding behavior of the user is established and the level of user satisfaction with the wayfinding communication in the hospital is assessed. The aspect of participant unfamiliarity with the given setting was maintained because the degree of familiarity that an individual has with a given setting is one obvious and potentially powerful influence on wayfinding behavior (Baskaya et. al., 2004). It is known that in an unfamiliar environment complexity might be a serious problem, although initial difficulties in orientation can be overcome. Baskaya et. al (2004) further quote Bryant (1982) and O'Neill (1992) as stating that as familiarity with an environment increases, performance in wayfinding and spatial orientation tasks improve both in accuracy and latency, and the degree of complexity of the layout of the environment becomes less important. Therefore, in an environment not previously experienced, the ease with which one is able to find their way relies on numerous types of environmental information. Environmental psychologist Gerald Weisman (1979, 1981) has looked at the factors that influence wayfinding in buildings and found that plan configuration was the most influential, followed by spatial landmarks, spatial differentiation, and finally signage and room numbers (Baskaya et. al., 2004). This study investigates landmarks, signage and room numbers due to the fact that the plan configuration and spatial differentiation remained constant within the route.

5.7.2 Formulation of a journey

Making a journey within the built environment involves the process of using spatial and environmental information to find one's way (Brandon, 2009). Determining and traversing a path or route from one location to another is referred to as *wayfinding* (Golledge 1999a), *pathfinding* (Bovy and Stern 1990), or *navigating* (Kuipers 1978; Trullier et al. 1997). For this experimental section of the main research, the term navigation is introduced because it brings in the aspect of locomotion. Moving forward along the route path is considered part of the journey, even though it may be in the wrong direction,

whereas going back along the route already traversed is considered as backtracking. Backtacking has an impact on wayfinding behavior which may be considered as "double getting lost".

An example of a journey is illustrated in figure 5.5.

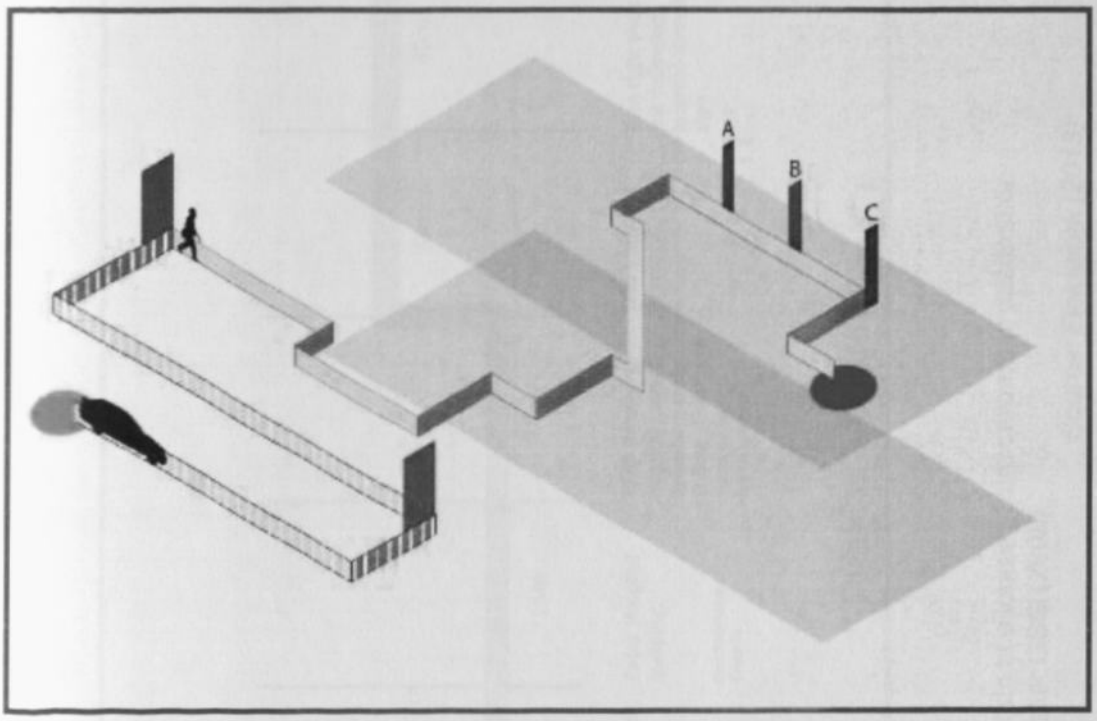


Figure 5.5: An graphic illustration of a journey from carpark to destination adapted from GSG (2008).

Source: Fieldwork (2013)

An illustration of a journey from outside the hospital, entering the hospital external environment, then the building interior to the destination is measured and described in figure 5.6. The environmental communication may be in the form of signage and verbal instruction

The journey for this section of the study was designed based on a typical patient routine that had been observed by the researcher during a preliminary visit to the hospital. The researcher had observed that a patient would enter the hospital and report to Casualty. From here they would be directed to various areas of the hospital (known within the

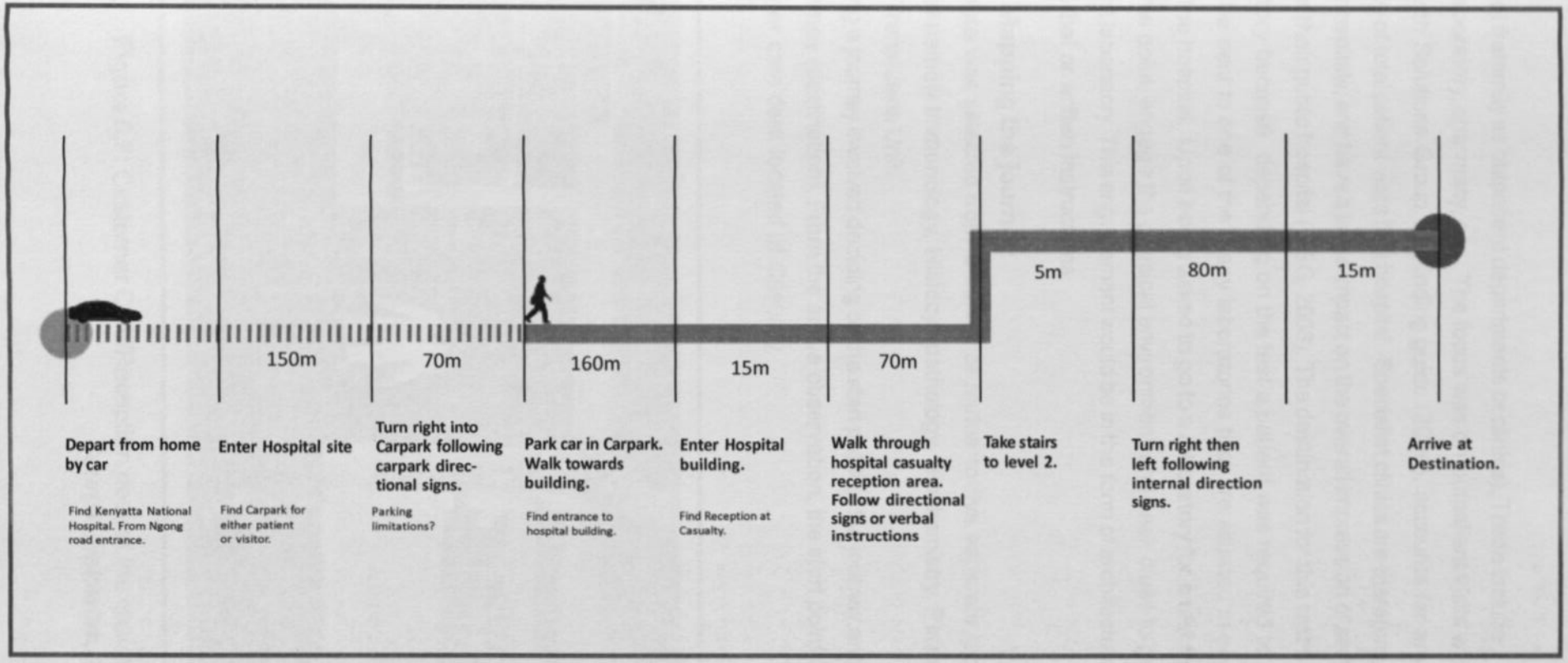


Figure 5.6: Navigation of a journey from carpark to destination drawn after GSG (2008).

Source: Fieldwork (2013)

medical fraternity as outpatient departments or clinics). These include x-ray, ultra sound, MRI, laboratory, pharmacy, etc.. The focus was on outpatient visits which according to a Growth Solutions Group wayfinding guide (2008), accounts for anywhere between 30-75% of total patient visits to a hospital. Specialist clinics are therefore key destinations within hospitals, and have a large impact on the overall impression of service that patients have of their public hospital (GSG, 2008). The destination for this test was therefore the laboratory because depending on the test a patient was required to undertake, they would be sent to one of the many laboratories that are situated in seperate locations within the hospital. Upon being asked to go to a laboratory for a test the patient would, from this point, engage the physical environment and seek clues to guide them to the relevant laboratory. This engagement would be in the form of architectural cues, signage, and verbal or written instructions.

5.7.3 Mapping the journey

The route was selected from a survey of routes to five seperate laboratories in the hospital namely Immunology, Histocytopathology, Biochemistry, Parasitology, and the Blood Transfusion Unit.

Mapping a journey involved deciding on the start point of the journey and the end point of the journey (destination). From the above observation, the start point was logically the customer care desk located at Casualty.

Figure 5.7: Customer Care/Reception desk at the casualty.
Source: Fieldwork, 2013.

Figure 5.7 shows the Reception/Customer Care point that is visually very accessible from the approach to the Accident and Emergency section. From here a number of journeys were investigated with the assistance of a group of students studying Laboratory Management at a local university who were undertaking their practicum in the various laboratories in the hospital.

5.7.4 The experiment

The experiment involved the tracing of the journey from the Casualty information desk to the predetermined destination of the Microbiology Laboratory in the hospital. By filling the Site Survey sheet provided (Appendix C), the participant noted their start location and the time and their time of arrival at the destination. Along the way the took note of any wayfinding information that may assist them towards the destination. At any point that they had to make a decision they recorded the presence and description of any such decision points. The first part of the experiment recorded the situation as it was without any intervention. For the second part of the experiment a discreet intervention was made with the inclusion of a very small hand drawn direction sign (see figure 5.8)

Figure 5.8: Paper direction sign to the Microbiology laboratory
Source: Fieldwork 2013.

5.7.5 Participants

The number of participants were recruited for the experiment on the basis of not having previous exposure to the site. Because familiarity, as noted earlier has a definate impact on wayfinding performence. Particpants were at least 21 years of age. They were not paid or given credit towards fulfilling a course requirement. Upon selection, a common briefing session was held at a central common venue in order to inform the participants of the the study. At this point no distinction was made between those who would take part in the first or second part of the experiment. The brief was the same and the only thing they knew was that the exercise would be carried out on two different days and that they would be informed on which of the two days they were to participate.

A total of 34 university students (14 female and 20 male) from various Universities in Nairobi were recruited. The requirement was that they had no previous experience in the task environment. Of these 34, they were divide into two groups. Group 1 with 20 taking part in section 1 of the experiment and group 2 with 14 members taking part in section 2 of the experiment. Table 5.3, shows the gender distribution of the total 34 students for the experiment. Of the 34 participants in the study, 34 completed the survey for a response rate of 100 percent. Respondents ranged in age from 21 to 35. The mean age is 23.5 and the median age is 24 years of age (Mdn = 24, SD = 8.03).

Table 5.3: Tabulation of participant gender distribution

Experiment	Sex		Total
	Male	Female	
Section 1	11 32.3%	9 26.5%	20 58.8%
Section 2	6 23.6%	8 17.6%	14 41.2%
Total	20 55.9%	14 44.1%	34 100.0%

Source: Fieldwork, 2013

5.7.6 The procedure

As participants reported for the exercise, they were first asked to read over their rights as participant, assigned a participant identification number and grouped by gender, which was also listed on the questionnaires they were to complete. They were instructed about their journey and provided with information about their destination. Both groups started their journeys from the front entrance of the hospital at the information desk and traveled to the Microbiology laboratory. Participants were permitted to stop and request directions from individuals in the hospital, including hospital staff and visitors. The number of times a participant stopped and requested directions was recorded. There were two independent coders, one undergraduate student and one graduate student, neither of whom knew about the purposes of the study. They were trained by the researcher. Their coding was identical 91 percent of the time, $r = .81$, $p < .001$. A third coder, settled disagreements. Completion of the surveys was regarded as giving consent.

The participant's gender, age, and educational level were collected on the survey. They were asked various questions regarding the environmental legibility and the ease of wayfinding that they experienced, how confident they felt when they became lost or disoriented, how useful were the environmental cues such as signage and path layout along their routes, and did these cues aid in their ease of wayfinding. At every decision point along this journey, the participant made observations regarding wayfinding communication and noted them on a semi-structured observation sheet (Appendix C). Next they described their situation in 3 open-ended items. The open-ended items were:

- If you could identify one critical wayfinding aid that you used to make your overall wayfinding journey easier, what would it be?;
- If you could identify one critical wayfinding obstacle that made your overall wayfinding journey more difficult, what would it be?; and,
- Are there any aspects of your wayfinding journey that impacted the ease of the journey that you feel are important wayfinding considerations that are not addressed in this survey – aids and/or obstacles?

Upon completion of the exercise, the participants were thanked, debriefed, and dismissed. Participation took no longer than a half hour. Information on the situational aspects of the wayfinding experience and on the participants' thoughts and behaviors were extracted from the surveys. Regarding the thoughts of the participants, the surveys were coded along three dimensions:

a) whether there were statements questioning their ease of wayfinding (e.g., frustrated with their own choices, questioning their own ability, describing the environment as too confusing for them);
b) whether they made statements about the legibility of the environment (e.g., feeling afraid, contemplating landmarks, districts, etc.); and
c) feeling anxious (e.g., feeling afraid, feeling anxious, or feeling stressed in the environment). The surveys were coded and analyzed for accuracy.

Although the main task was to navigate from the start point (Casualty) to the destination (Microbiology laboratory) with the participant making observations regarding wayfinding communication at every decision point along this journey, they were encouraged to discuss subjective observations by filling the 'Other (specify)' space provided in every question relating to a decision point. The time taken to complete the journey was also noted. Finally level of satisfaction was stated on a level of 5 (very satisfied) to 1(not satisfied). Provisional space was provided to note subjective comments if any. Visual comment was encouraged such as in question no. 8 in the main survey and question no. 4 in the subsequent survey sheets. In other words even though the participants were not drawn from the more visual disciplines such as Art, Design, Architecture, and Planning, etc. the aspect of visual representation was considered important for this study. Figure 5.9 shows an illustration of a sketch of the map of the route drawn by a participant.

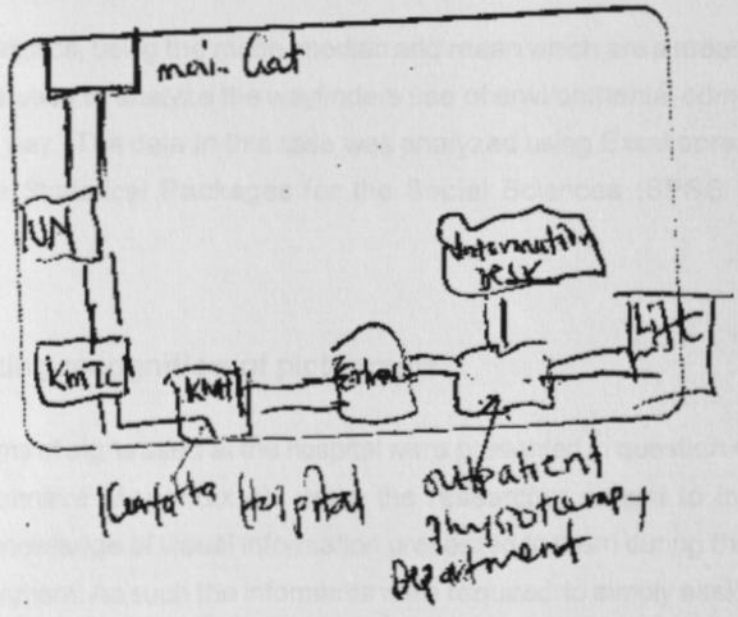


Figure 5.9: Sketch of map of the route drawn by a participant.
Source: Fieldwork, 2013.

5.8 Data analysis

The data analysis for all sections of this study was conducted concurrently with the data collection. Information from the questionnaires was analyzed using descriptive statistics with the aid of the Statistical Packages for the Social Sciences (SPSS for windows) programme. Observation analysis methods were used to analyze information gathered during the stages of participant observation and wayfinding observation survey. Data was analyzed using quantitative methods with the support of qualitative techniques. The combination of quantitative and qualitative methods is better than one method because of complimentation of data collected by both methods (Gall et al,1996). The data was presented in tables, figures and charts, and graphs.

5.8.1 Analyzing elements of environmental communication

Qualitative descriptive reporting of the data was used to analyzing elements of wayfinding information embedded in the physical properties of the hospital built environment in order to meet the first objective of this research data Some data, particularly visual data useful in assessing respondents' "cognitive maps", cannot be precoded (Zeisel, 1984).

5.8.2 Analyzing wayfinders use of environmental communication

Descriptive statistics, using the mode, median and mean which are a measure of central tendency were used to analyze the wayfinders use of environmental communication to navigate their way. The data in this case was analyzed using Excel spreadsheets and the aid of the Statistical Packages for the Social Sciences (SPSS for windows) programme.

5.8.3 Analyzing recognition of pictograms

Eight pictograms of signs used at the hospital were presented in question 4 of the users, survey questionnaire (Appendix A). Here the researcher sought to interrogate the respondents knowledge of visual information presented to them during their interaction with the environment. As such the informants were required to simply assign a semantic label to the pictogram that best reflects their understanding of the sign.

5.8.4 Analyzing the relationship between legibility and wayfinding behavior

To analyze the the relationship between legibility of the built environment and wayfinding behavior in a hospital setting, descriptive statistics, using the mode, median and mean which are a measure of central tendency were used to analyze the level of satisfaction with the wayfinding experience in the hospital. The data in this case was analyzed using Excel spreadsheets and SPSS version 19.

5.8.5 Analyzing the level of user satisfaction

In order to analyze the level of satisfaction with the wayfinding experience in the hospital, descriptive statistics, using the mode, median and mean which are a measure of central tendency were used to analyze the level of satisfaction with the wayfinding experience in the hospital. The data in this case was analyzed using Excel spreadsheets and SPSS version 19.

5.9 Ethical considerations

A study such as this involves many participants who's ehtical issues must be taken into account. For the researcher, ethical clearance for the study was obtained from the Ministry of Education Science and Technology Ethical Committee with the assurance that the data obtained would be used only for purposes of study. For the informants the following measures were taken to ensure their participation was ethical. No informants were not compelled into participating in the study. A signed consent form (Appendix E) was one of the pre-requisites for participation. Any informant who chose to withdraw from the study and revoke the information she/he supplied to the investigator was granted their wish without prejudice. Information collected was treated as confidential so as to protect the informants from any potential psychological harm. Information on personal details by informants was optional and where supplied was treated with due confidentiality. Any names of the informants (or their organisations) were not used in the findings if doing so could harm their reputation or jeopardise their work. The informants were not deceived but were told the truth about the intent of the study. Informants were not seduced into the research by giving them any incentives to participate in the study. Instead the importance of the study was emphasised to them. After analysing data and

finishing the report, the informants were provided with the findings so as to clear any misconceptions arising during the data collection phase.

5.10 Summary

This chapter discussed the research mothodology used for this study. It starts by arguing for the epistemological stance adopted for this research by discussing the theoretical perspective of research. The relationship between epistemology, theoretical perspective, and research methods is established. The research design for this study is discussed by laying out the framework for types of research designs. The research methodology is described giving rise to the data collection methods employed for the study. A case is made for the selection of the case study method for data collection. For the survey research method used to collect data, the questionnaire design is described. The data collection framework designed to collect data from the users of the hospital environment is presented. A description is the given of data collection using the method of observation. Observation of the users behavior within the environment. Other data collection methods such as the wayfinding test, desk review of available literature, and photographic registration are presented

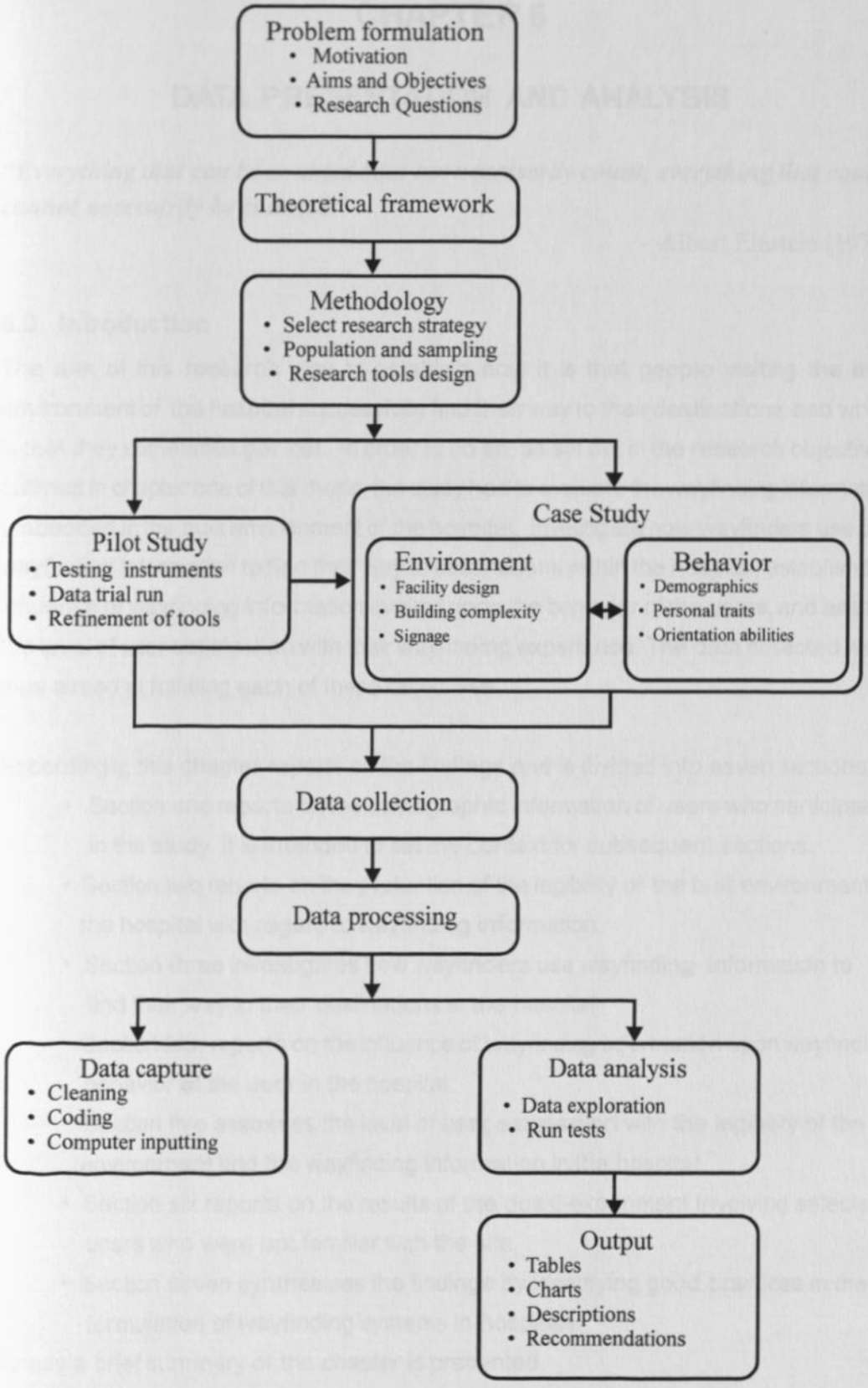


Figure 5.10: Model of the research Process
Source: Wachira (2008)

CHAPTER 6

DATA PRESENTATION AND ANALYSIS

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted."

- Albert Einstein (1971)

6.0 Introduction

The aim of this research was to establish how it is that people visiting the built environment of the hospital successfully find their way to their destinations and why it is that they sometimes get lost. In order to do so, as set out in the research objectives outlined in chapter one of this thesis, the study had to evaluate the wayfinding information embedded in the built environment of the hospital, investigate how wayfinders use this wayfinding information to find their way to destinations within the hospital, establish the influence of wayfinding information availed upon the behavior of the users, and assess the level of user satisfaction with their wayfinding experience. The data collected were thus aimed at fulfilling each of these objectives.

Accordingly, this chapter reports on the findings and is divided into seven sections:

- Section one reports on the demographic information of users who participated in the study. It is intended to set the context for subsequent sections.
- Section two reports on the evaluation of the legibility of the built environment of the hospital with regard to wayfinding information.
- Section three investigates how wayfinders use wayfinding information to find their way to their destinations in the hospital.
- Section four reports on the influence of wayfinding information upon wayfinding behavior of the user in the hospital.
- Section five assesses the level of user satisfaction with the legibility of the environment and the wayfinding information in the hospital.
- Section six reports on the results of the quasi-experiment involving selected users who were not familiar with the site.
- Section seven synthesises the findings by identifying good practices in the formulation of wayfinding systems in hospitals.

Finally a brief summary of the chapter is presented.

6.1 Demographic characteristics

The purpose of questions in this section was to collect general information and biographical data from the users of the hospital i.e. their gender, age and education levels. This information was intended to set the context for the questions in the subsequent sections. Demographic data was obtained from respondents to the questinnaire survey of hospital users which interrogated wayfinding behavior and user satisfaction. Out of a total of 80 questionnaires sent out, 75 were completed successfully indicating a 93.75% response rate. Demographic data was also obtained from participants of the route survey experiment. Here, all of the selected 34 participants responded indicating a 100% response rate. Of the total number of 109 respondents, 56 were male and 53 were female, 51.4% and .48.6% resectively. The mean of the age bracket range was 18 - 30 (40.5%), 31 - 50 (41.2%), 51 - 65 (15.5%) and Over 65 (2.7%). The mean level of education in categories was Primary (10.1%), Secondary (47.3%), University (39.9%) and Other (2.7%). Table 6.1 shows the demographic characteristics of the sample of 109 respondents..

Table 6.1: Demographic characteristics of respondents.

		Male %	Female %	Mean %	Total %
Gender		51.4	48.6		100
Age bracket	18 - 30	43.6	37.4	40.5	
	31 - 50	42.3	40.1	41.2	
	51 - 65	15.1	16.0	15.5	
	Over 65	3.8	3.5	2.7	
					100
Education level	Primary	10.5	9.7	10.1	
	Secondary	48.5	46.1	47.3	
	University	40.1	39.7	39.9	
	Other	1.5	3.9	2.7	
					100

Source: Fieldwork data, 2013

According to the 2009 census, the total population of Kenya was 38,610,097 (ILO, 2013). The gender distribution is 19,192,458 (49.7%) Male and 19,417,639 (50.3%) Female. The gender distribution captured in this study is comparable to the 2008-09

Kenya Demographic and Health Survey (KHDS) see table 6.2. Also according to the same survey, Kenya is characterised by a youthful population. Projections show about 43 percent of the population is younger than 15 years (CBS, 2006). This implies that over three-fifths of Kenya's population, or about 25 million people in 2009, were less than 25 years old. With such a large percentage of the national population being in the youth category there are serious implications for the health sector of the country due to the fact that health services are sought more as a person ages.

Table 6.2: Household population by age, sex and residence

Table 2.1 Household population by age, sex, and residence

Percent distribution of the de facto household population by five-year age groups, according to sex and residence, Kenya 2008-09

	Urban			Rural			Total		
Age	Male	Female	Total	Male	Female	Total	Male	Female	Total
<5	14.3	13.0	13.6	17.1	15.4	16.2	16.6	14.9	15.7
5-9	12.4	11.0	11.6	17.2	15.1	16.1	16.3	14.3	15.2
10-14	8.1	9.6	8.9	15.2	14.8	15.0	13.8	13.7	13.8
15-19	8.0	9.0	8.5	11.2	9.7	10.4	10.6	9.5	10.0
20-24	10.8	14.6	12.8	7.3	8.0	7.6	8.0	9.3	8.6
25-29	10.9	13.5	12.2	5.6	6.5	6.0	6.6	7.8	7.2
30-34	10.3	8.1	9.1	4.7	5.9	5.3	5.8	6.3	6.0
35-39	7.1	6.1	6.6	4.1	4.5	4.3	4.7	4.8	4.7
40-44	6.6	4.6	5.6	3.6	3.9	3.8	4.2	4.1	4.1
45-49	4.1	2.8	3.5	3.2	3.8	3.5	3.4	3.6	3.5
50-54	2.2	2.9	2.6	2.7	3.3	3.0	2.6	3.2	2.9
55-59	2.1	1.9	2.0	2.0	2.3	2.2	2.0	2.3	2.2
60-64	1.5	1.4	1.4	2.0	2.1	2.0	1.9	1.9	1.9
65-69	0.5	0.5	0.5	1.4	1.6	1.5	1.2	1.4	1.3
70-74	0.5	0.1	0.3	1.1	1.4	1.3	1.0	1.1	1.1
75-79	0.3	0.6	0.4	0.7	0.7	0.7	0.6	0.7	0.6
80 +	0.1	0.4	0.3	1.0	1.2	1.1	0.8	1.1	1.0
Don't know/missing	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	3,586	3,830	7,416	14,917	15,686	30,602	18,503	19,516	38,019

Source: 2008-09 KDHS (2010)

6.1.1 Gender

During the past decade, the case has been made that gender is one of our culture's two or three primary frames for organizing the physical environment (Ridgeway 1997, 2007). Lawton and Kallai (2002) examined gender differences and how women and men, on average process spatial information as a way to better understand spatial skills and wayfinding stategies. The existence of gender differences in spatial and directional tasks has been documented in a large number of experimental studies. For example, a meta-analysis by Byrnes, Miller, and Schafer (1999) reviewed over 150 studies on gender differences and spatial perception. They concluded that the literature "clearly" indicated that "males are more likely to perform better than females in spatial and directional tasks." For this study that investigated the interraction of users and the environment for wayfinding, it is important to take note of any factors that may have been influenced by gender. This being the case, the findings did not indicate any results that were attributed to gender differences.

6.1.2 Age

The effect of age on wayfinding performance is noted as being significant in a study of age related wayfinding differences undertaked by Taillade et al (2013) . For this study, the ages of the respondents were grouped into four age brackets, namely 18 - 30 years, 31 - 50 years, 51 - 65 years , and over 65 years. The distribution from the respondents showed 40,5 % in the 18 - 30 years category, 41.2% in the 31 - 50 years category, 15.5% in the 51 - 65 years category and 2.7% in the Over 65 years category (Figure 6.1). This distribution revealed a higher proportion of the respondents being in the lower two age brackets with the 31 - 50 age bracket being just slightly higher than the 18 - 30 age bracket. Taken together the 18 - 30 years bracket and the 31 - 50 years bracket account for an 81.7% share of the respondents.

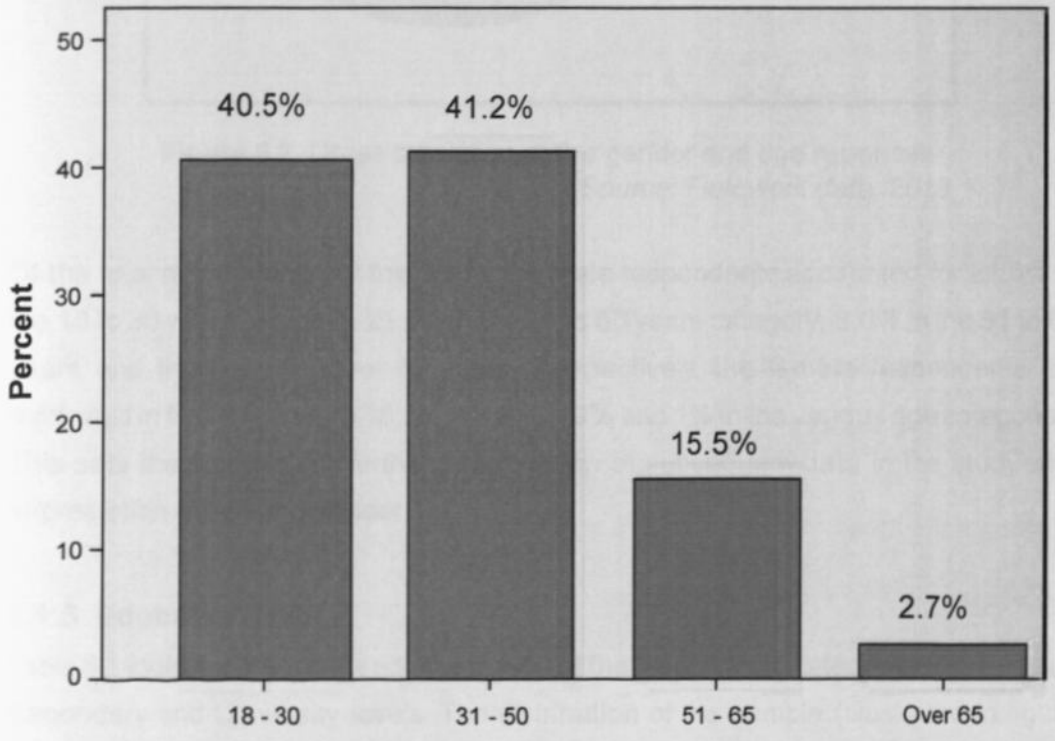


Figure 6.1 Sample distribution by age clusters
Source: Fieldwork data, 2013

The reason for this skew may be attributed to the fact that the sample selection was drawn from out-patients and visitors to the hospital. It did not consider the in-patients population in the wards due to ethical considerations.

A further interrogation of the data by cross tabulation of the gender and age reponses reveals the following breakdown shown in figure 6.2.

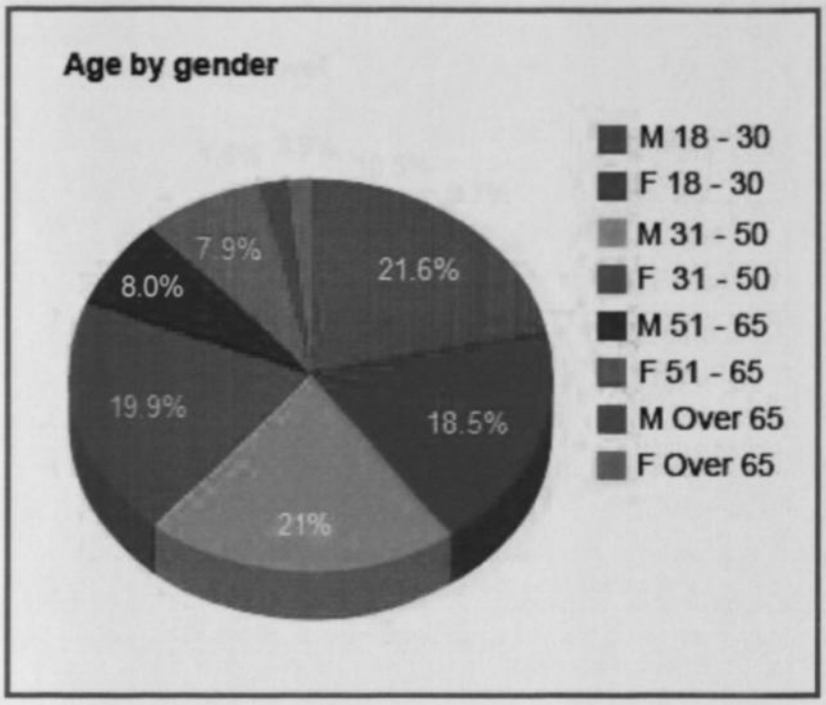


Figure 6.2 Cross tabulation of the gender and age reponses
Source: Fieldwork data, 2013

Of the total respondents for this study, the male respondents accounted for 21.6% in the 18 to 30 years category, 21.0% in the 31 to 50 years category, 8.0% in the 51 to 65 years and finally 2.0% Over 65 years. Respectively, the female respondents (as illustrated in figure 6.2) were 18.5%, 19.9%, 7.9% and 1% in the various age categories. This sets the platform for further interrogation of subsequent data in the study with appreciation of age and gender.

6.1.3 Education level

Table 6.1 indicates the formal education level of the respondents categorized as Primary, Secondary and University levels. The distribution of the sample (illustrated in figure 6.3) was 10.1% for Primary level, 47.3% for Secondary level, and 39.9% for University level. There, however, emerged a fourth category under Other. Without too much prodding, it may be assumed that this category represents a section of respondents with minimal or no formal education, because any respondent with higher than what is generally considered to be university education i.e. undergraduate level, were categorized in the University category. It is a human tendancy the persons with minimal formal education would rather not state it openly. However, since a large portion of wayfinding aids assume a level of education, those without basic education are disadvantaged.

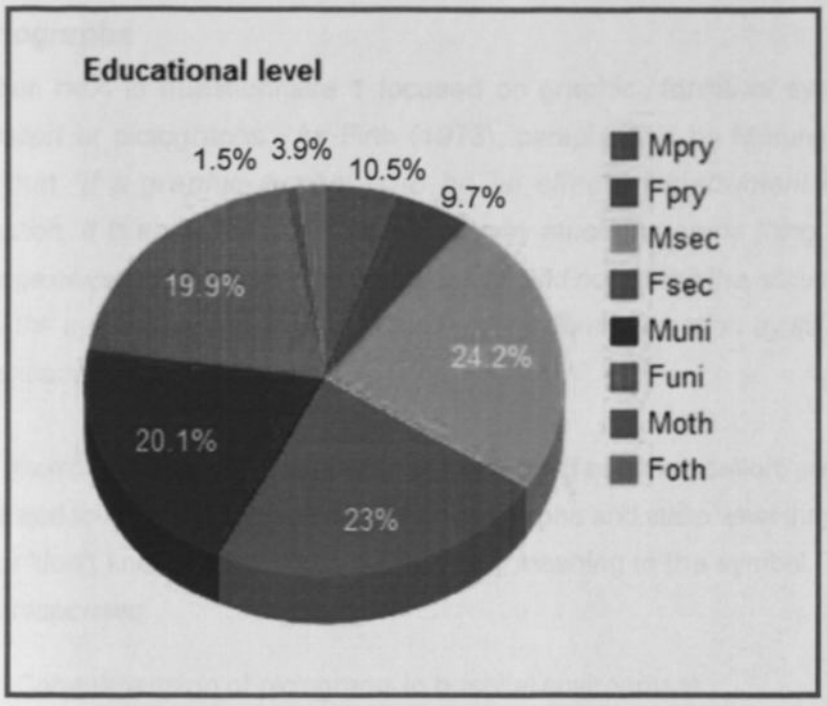


Figure 6.3 Sample distribution by education level and gender.

Source: Fieldwork data, 2013

Kenya has a 67.6% literate population according to the 2009 Kenya population census (Table 6.2) of this 34.2% is male and 33.4% female. This means that 32.4% of the population is illiterate. This is a significant proportion of the population that is likely to impact a study on environmental communication and wayfinding. Long before the existence of written language, pictographs (word pictures) served as a means of communication. As societies grew and written languages developed, pictographs were employed to provide information to people who were largely illiterate (Hablamos Juntos, 2010). Where there is a number of users with Limited English Proficiency (LEP) the design community is challenged to wayfinding systems that mitigate against limited literacy access to health services.

Table 6.3 : Literacy levels in Kenya

Literacy levels, 2009

	Male	Female	Total
Elementary school level – ability to read and write (age 7 and over)	13 209 238	12 888 199	26 097 437
Literacy (% of population)	34.2%	33.4%	67.6%
Labour force	Not available	Not available	15 800 000*
Labour force % of population			41%

*Kenya population census, 2009.

Source: ILO, 2013

6.1.4 Pictographs

The question no.4 in questionnaire 1 focused on graphic forms of symbols for communication or pictographs. As Firth (1973), paraphrazed by Murungi (2003), observes that *"if a graphic symbol is to be an effective instrument of visual communication, it is essential that it should convey much the same thing to users, and the range of variation in user interpretations should not inhibit the action desired, nor should the symbol design, in and of itself, inhibit communication by its failure to constrain extraneous interpretations."*

In order to interrogate user comprehension of this form of communication, participants were requested to examine each of the eight pictographs and state what they thought it means, or 'don't know' if they could not assign a meaning to the symbol. Table 6.3 shows the responses.

Table 6.4: Comprehension of pictograms in hospital environment.

	Correct		Incorrect		Don't Know		Total	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Pictogram 1	44	58.7%	8	10.7%	23	30.6%	75	100%
Pictogram 2	43	57.3%	15	20.0%	17	22.7%	75	100%
Pictogram 3	11	14.7%	33	44.0%	31	41.3%	75	100%
Pictogram 4	49	65.3%	5	6.7%	21	28.0%	75	100%
Pictogram 5	24	32.0%	13	17.3%	38	50.7%	75	100%
Pictogram 6	73	98.2%	2	1.8%	0	0.0%	75	100%
Pictogram 7	74	99.0%	1	1.0%	0	0.0%	75	100%
Pictogram 8	28	53.1%	24	46.9%	23	30.6%	75	100%
Mean	43.3	57.7%	12.6	16.8%	19.1	25.5%	75	100%

Source: Fieldwork data, 2013

Analysis of the data indicates an average of 57.7% rate of comprehension for the selected pictograms. This finding was not altoghether unexpected because the selected composition required the respondent to engage a more analytical approach to the exercise. This means that in the case that they may not have seen the particular pictogram, an intelligent or logical conclusion was sufficient for a response. Following is a more specific analysis.

Pictograph 1

Pictograph 1 showed an exterior road traffic sign that is used to indicate the prohibition of parking. As a common sign encountered where cars may tend to park, it was a common enough sign to be included in the test selection.

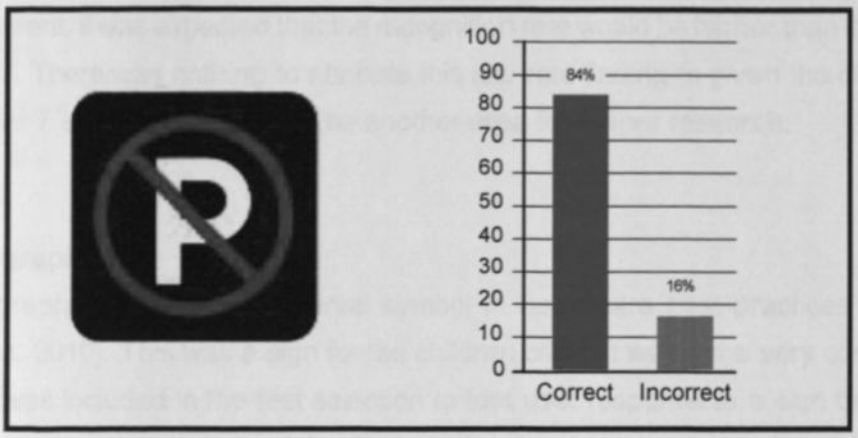


Figure 6.4: Recognition rate of No Parking pictograph
Source: Fieldwork data, 2013

As shown in figure 6.4, 84% of the respondents recognized this roadsign and gave the correct interpretation to it. 16% either did not recognize it or gave the wrong interpretation to it. This was not unusual and was attributed to the fact that a certain proportion of the population does not drive and, therefore, may not be aware of road signs that do not concern them.

Pictograph 2

Pictograph 2 showed another road traffic sign that is used to indicate a road that forks out to the left. It is an information sign that uses arrows to communicate that ahead there is a branch of the road. The user may them make the decision to continue on ahead or turn left.

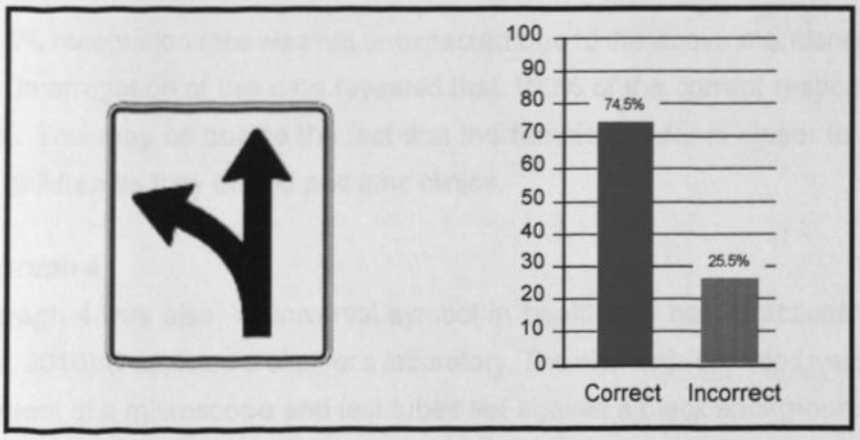


Figure 6.5: Recognition rate of Left turn pictograph
Source: Fieldwork data, 2013

As shown in Figure 6.5, 74.5% of the respondents recognized this roadsign and gave the correct interpretation to it. 25.5% either did not recognize it or gave the wrong interpretation to it. This was an interesting finding due to the fact that arrows are used to communicate information of movement. Since arrows are frequently used to guide movement, it was expected that the recognition rate would be higher than the recorded 74.5%. There was nothing to attribute this low rate finding to given the discussion in chapter 7 of this thesis. It may be another area for further research.

Pictograph 3

Pictograph 3 depicted a universal symbol in healthcare best practices (Hablamos Juntos, 2010). This was a sign for the children clinic. It was not a very common sign, but it was included in the test selection to test user response to a sign they may not have previously experienced, but by deduction would have interprated.

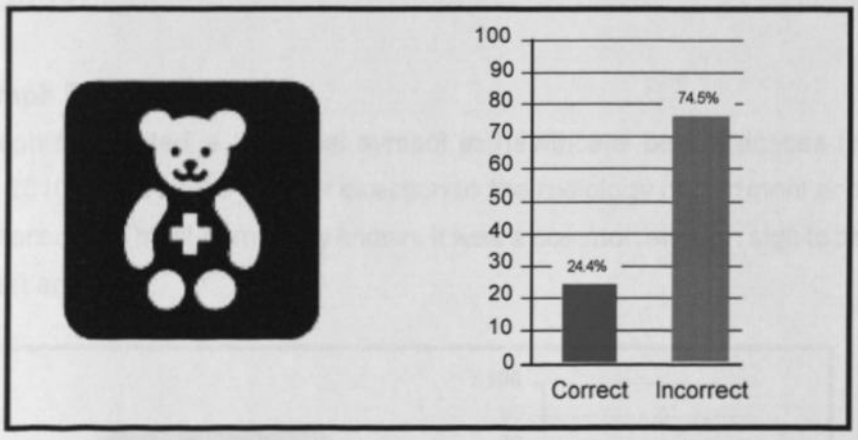


Figure 6.6: Recognition rate of Children clinic pictograph
Source: Fieldwork data, 2013

A 24.4% recognition rate was not unexpected due to the above mentioned reason. A closer interrogation of the data revealed that 100% of the correct respondents were female. This may be due to the fact that the female gender is closer to babies and small children as they attend pediatric clinics.

Pictograph 4

Pictograph 4 was also a universal symbol in healthcare best practices (Hablamos Juntos, 2010). It depicted a sign for a laboratory. The elements depicted were laboratory equipment of a microscope and test tubes set against a black background.

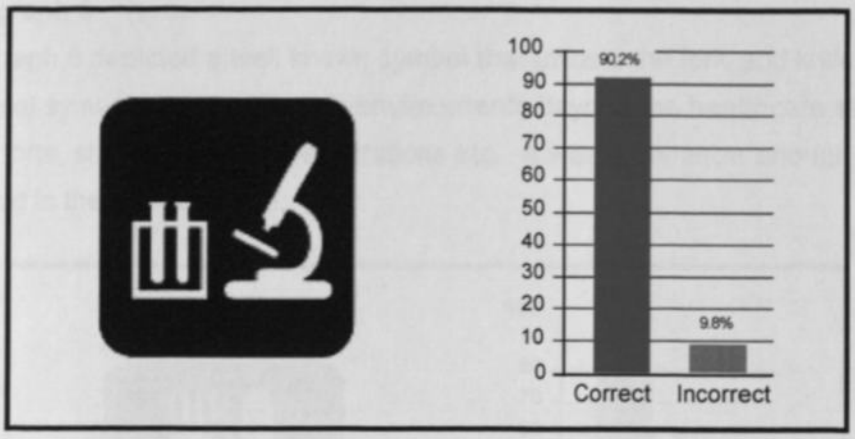


Figure 6.7: Recognition rate of Laboratory pictograph
Source: Fieldwork data, 2013

A 90.2% recognition rate was very good. This pictograph may prove to be more effective and efficient in communication than written words because users may find it easier to see and understand. This is the essence of a universal symbol (Hablamos Juntos, 2010).

Pictograph 5

Pictograph 5 depicted a universal symbol in healthcare best practices (Hablamos Juntos, 2010). This was a sign for direction to the radiology department or the X-Ray department as it is most commonly known. It was a common enough sign to be included in the test selection.

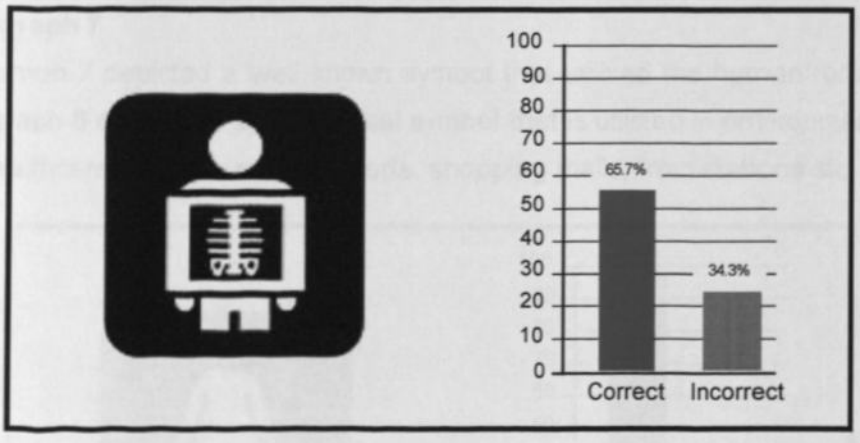


Figure 6.8: Recognition rate of X-Ray pictograph
Source: Fieldwork data, 2013

As shown in figure 6.8, this pictograph recorded a 65.7% respondent recognition rate. This was a fair proportion of the population. A more detailed examination of the response data indicated that this pictograph returned the most diverse interpretation of the eight presented. The 34.3% represents an interesting set of interpretations.

Pictograph 6

Pictograph 6 depicted a well known symbol that utilized the fork and knife. This is a universal symbol that is utilized in environments beyond the healthcare setting such as airports, shopping malls, train stations etc. It was a common enough sign to be included in the test selection.

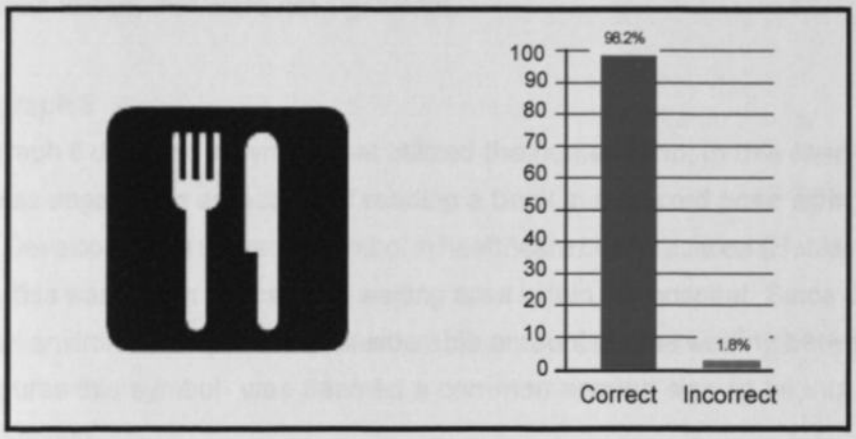


Figure 6.9: Recognition rate of Dining area pictograph
Source: Fieldwork data, 2013

As shown in figure 6.9, this pictograph recorded a 98.2% respondent recognition rate. This was a very large proportion of the population. This places this pictograph firmly in the cateory of truly universal symbols. It means that it can comfortably be used in any wayfinding scheme to guide people to areas set out for the dining activity. The 1.8% return is small and may be attributed to various factors that were not too significant.

Pictograph 7

Pictograph 7 depicted a well known symbol that utilized the human form. Also like pictograph 6 above this is a universal symbol that is utilized in environments beyond the healthcare setting such as airports, shopping malls, train stations etc.

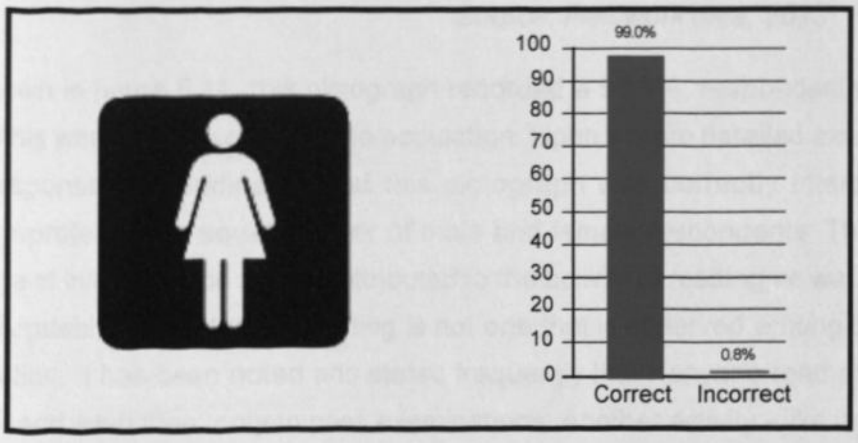


Figure 6.10: Recognition rate of Ladies washroom pictograph
Source: Fieldwork data, 2013

As shown in figure 6.10, this pictograph recorded a 99.0% respondent recognition rate. This was an almost a total proportion of the population. Again like pictograph number 6 this places this pictograph firmly in the category of truly universal symbols. It means that it can comfortably be used in any wayfinding scheme to guide people to areas set out for the dining activity. The 0.8% return is small and may also be attributed to various factors that were not significant.

Pictograph 8

Pictograph 8 depicted a symbol that utilized the human form. In this case the human form was engaged in an activity of reading a book in a relaxed pose sitting in an arm chair. Developed as a universal symbol in healthcare best practices (Hablamos Juntos, 2010), this was a sign indicating a waiting area within the hospital. Since users of the hospital environment spend an considerable amount of time waiting between various procedures this symbol was deemed a common enough sign to be included in the test selection.

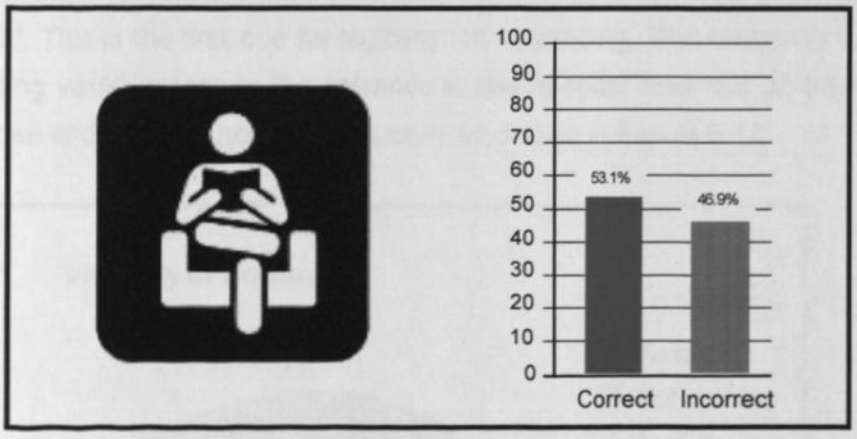


Figure 6.11: Recognition rate of Waiting room pictograph
Source: Fieldwork data, 2013

As shown in figure 6.11, this pictograph recorded a 53.1% respondent recognition rate. This was just above half of the population. Upon a more detailed examination of the response data indicated that this pictograph was correctly interprated and misinterprated by an equal number of male and female respondents. The relatively low rate of interpratation may be attributed to the activity of reading as way of passing time. Arguably, the culture of reading is not one that is observed among the Kenyan population. It has been noted and stated frequently that Kenyans read only when is school and even then, only to pass examinations. Another activity - like laying on the grass - may have produced a better recognition rate.

6.2 Legibility of the environmental communication

This second section reports on the evaluation of the legibility of the built environment of the hospital with regard to wayfinding information as stated in objective one of this study. Information is a collection of facts from which conclusions may be drawn; or still, the knowledge acquired through study, experience or instruction (Collins English Dictionary, 2003). This forms the intimate link between what defines "legibility" and "environmental information" as defined in this study.

6.2.1 Visual access to entrance

At the first exposure to a building, visual access to the main destinations increases the patients' use and facilitates wayfinding (Baskaya et al, 2004) .

The four main criteria in wayfinding design are: architectural clues, graphic communication, audible communication, and tactile communication (Muhlhausen, 2000). Architectural clues include the provision of visual access to the entrance of the hospital building from the point at which one enters the physical environment of the hospital. This is the first cue for legibility for wayfinding. The response to the query regarding visual access to the entrance to the hospital drew out an 83.4% positive response and a 13.6% negative response as shown in Figure 6.12.

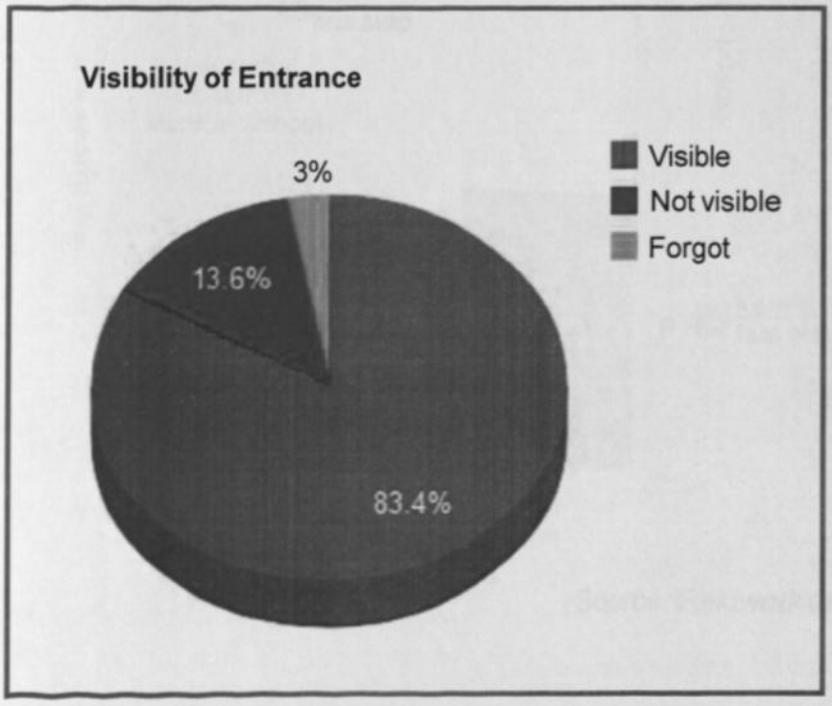
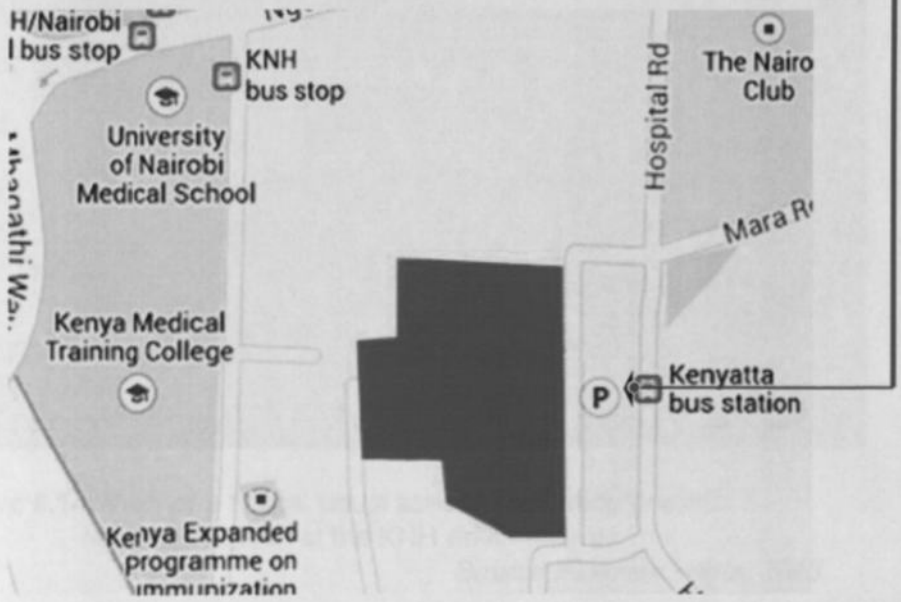


Figure 6.12 Visual access to the hospital entrance(s).
Source: Fieldwork data, 2013

This very high positive reponse was attributed to the layout of the hospital environment. As shown in Figure 6.13 and 6.14, at the first exposure to the hospital environment, from the main bus station entrance, visual access to various destinations is facilitated by graphic information (identified by the corporate two shade sky blue color).

Figure 6.13 View of KNH from entrance gate from the "No. 7" Bus station



Source: Fieldwork data, 2013

Figure 6.14 View of a typical visual assess facilitating graphic communication at the KNH environment.
Source: Fieldwork data, 2013

The13% negative reponse was attributed to the fact that there are two approaches to the hospital. The western approach from the Ngong road bus stop (University of Nairobi side) provides a less clear visual access to the hospital (as shown in Figure 6.14). It was assumed that the respondents who gave a negative response used this approach.

Figure 6.15: Entrance to hallway to KNH from UON side

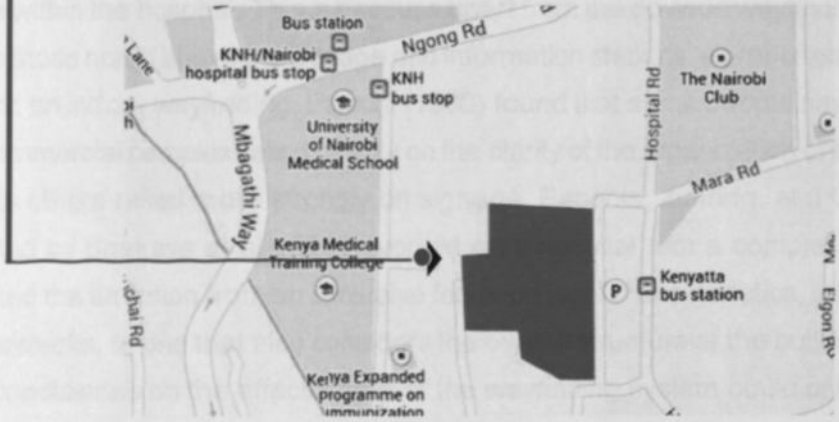


Figure 6.14: Entrance to KNH from the western side
Source: Fieldwork data, 2013

6.2.2 Wayfinding information

Upon entry through the hospital entrance participants were asked to identify any wayfinding system in sight that they would use to direct them towards their destination. Table 6.5 shows the sources of wayfinding information immediately available to them. The largest proportion 38% reported there being no source of wayfinding information in sight. Of sources available the direction board system had the higher response of 21.3%, followed by the information desk with 18.7%. Direction signage recorded a 17.4% response.

Table 6.5: Available sources of wayfinding information

Information source	Frequency	Percent
Directory board	16	21.3
Information desk	14	18.7
Direction signage	13	17.4
No information available	29	38.6
Other	3	4.0
TOTAL	75	100.0

Source: Fieldwork data, 2013

With 38% of the respondents reporting the lack of any source of wayfinding information in sight has an appreciable impact on the legibility of the built environment of the hospital. At this point it was too early to draw conclusion on the state of the wayfinding system in place within the hospital. This is because apart from the obvious wayfinding systems such as those noted above i.e. signage and information stations, as reported in previous research on indoor wayfinding, Passini (1980) found that some people navigating in a large commercial complex relied heavily on the clarity of the organization of the building, whereas others relied more strongly on signage. Peponis, Zimring, and Choi (1990) as quoted by Baskaya et al. (2004) worked on a hospital with a complex layout and redirected the attention from an exclusive focus on local characteristics, such as signs and landmarks, to one that also considers the overall structure of the building. For this study, conclusions on the effectveness of the wayfinding system could only be drawn after consideration of the user wayfinding performance later in the thesis. Table 6.5 shows the availability of wayfinding information at the hospital.

6.2.2.1 Directory board

21.3% of the respondents reported the presence of Directory boards such as illustrated in figure 6.14. Such boards were situated at strategic places within the hospital building. Their effectiveness in facilitating successful wayfinding is discussed elsewhere in this thesis.

Figure 6.16 A typical directory board at KNH
Source: Fieldwork data, 2013

The way information is organised on a direction board is critical to speed of understanding. The Growth Solutions Group (2008) sets the following principle guidelines for the design of effective directory boards.

- Signs are easiest to read and understand when they are uncluttered and the information is presented in a logical, sequential layout.
- Directional signs should contain a maximum of five destinations.
- Key hospital hub destinations should be listed at the top of the hierarchy or highlighted as primary information. Secondary destinations should be presented lower in the information hierarchy.

- Destinations on signs should be grouped and ordered with a logic relevant to the destinations listed: either by alphabetical order (for a longer list), by the direction to the destination in clockwise order, or by the order of distance to destination (closer destinations first).
- It is important that people can quickly connect the destination with the directional arrow - ensure labels are visually connected to the arrows.

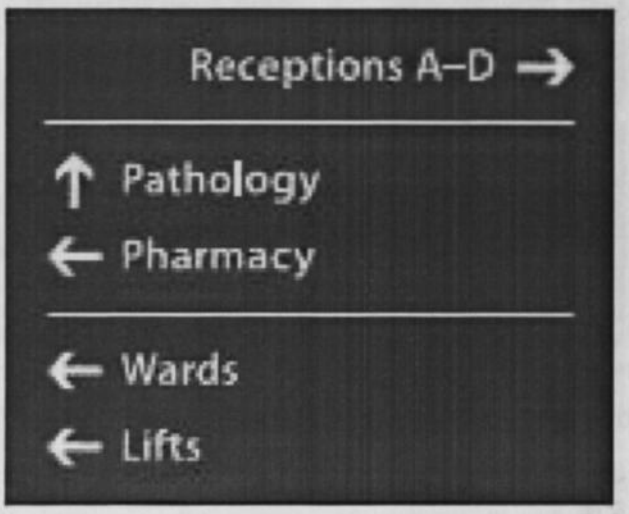


Figure 6.17: An example of sign content for a directory board.
Source: Growth Solutions Group (2008)

Assessing the directory boards in KNH (exemplified in Figure 6.14) against the above standard exposes a glaring deficiency in sign content and design, which would have a negative impact on wayfinding communication. Subsequently user wayfinding performance is compromised.

6.2.2.2 Information desk

18.7% of the respondents reported the presence of an information desk in sight. This may be attributed to the situation of a Reception-cum-Information desk at the entrance of the casualty section of the hospital (Figure 16.6). An information desk or customer services desk in any setting tells the wayfinder that help is available should they need it (Rooke, 2012). Verbal information or direction is provided by trained staff such as a Receptionist. The social practice of giving directions verbally is prevalent in every setting be it hotel, hospital, or airport (ibid). However, in extremely complex settings people continue to be lost no matter how good the verbal directions are.

Figure 6.18 Reception-cum-Information desk at KNH Accident and Emergency section.
Source: Fieldwork data, 2013

During the fieldwork at KNH the researcher witnessed an exchange of conversation between a visitor and the receptionist at the information desk. After trying and failing to make sense of the directions the visitor walked away saying *"Asante, lakini bado nitapotea"* (Thank you, but I shall still get lost). This is because KNH is a complex setting.

6.2.2.3 Direction signage

17.4% of the respondents sighted Directional signs upon entry to the hospital. Directional signs indicate the direction of a destionation by means of a text message and an arrow (NHS, 1999). Direction signs are a key part of a wayfinding system and are used extensively to provide important wayfinding information. The low percentage of feedback for direction signage is an indication of the lack of this mode of wayfinding communication. A physical survey of the availability of direction signage at KNH confirms this position. Of the few that were available, figure 6.19 shows one example. This located near the waiting area and the use for it should be to direct users to other areas of the hospital.

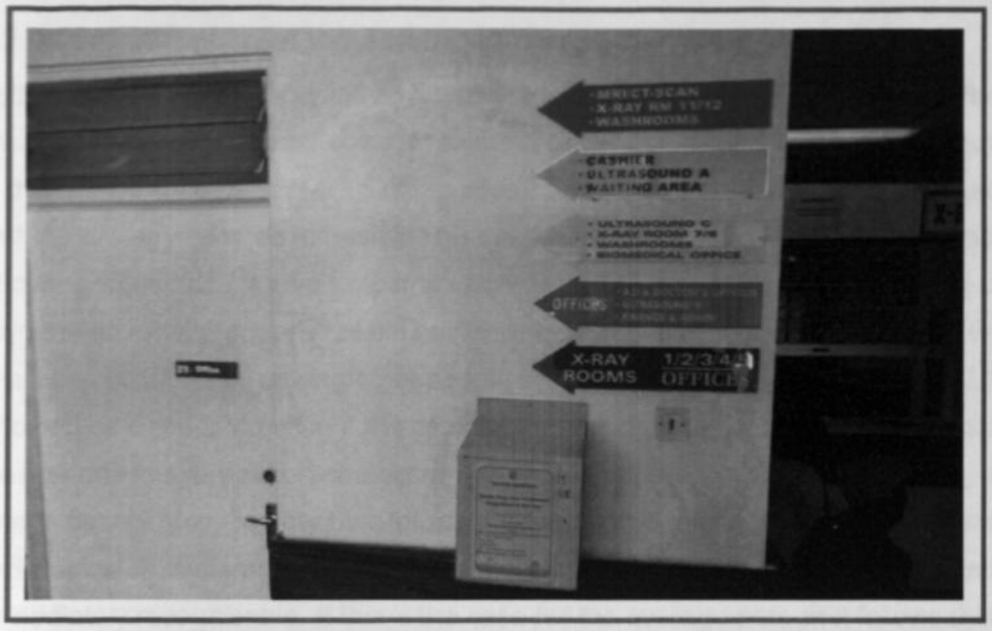


Figure 6.19: Direction signage to various points in the hospital.
Source: Fieldwork data, 2013

Upon closer examination of this direction signage a number of issues relating to its design are noted. As shown in figure 6.20, directional arrow signs in four colours point users to X-Ray rooms (on 3 arrows + Background sign), Ultrasound A, B & C on 3 arrows, MRI/CT Scan, Washrooms, Cashier, Waiting area, Biomedical office and A.D. & Doctor offices. The clarity and effectiveness of this signage is clearly lacking.

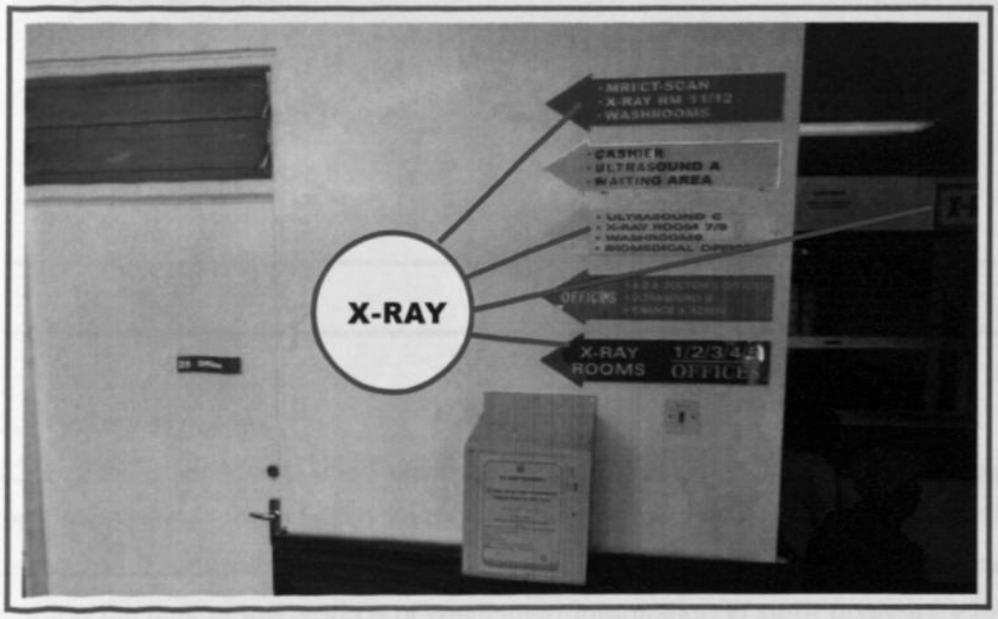


Figure 6.20: Interrogation of one direction signage in place at KNH.
Source: Fieldwork data, 2013

6.3 Wayfinders use of wayfinding information

User navigation of the hospital environment required the use of available wayfinding information to formulate strategies to reach the desired destination. Questions pertaining to the availability or lack of wayfinding information were asked in the previous section and the strategy adopted to navigate queried. From the data collected 15.3% reported following signs, 13.7% used other environmental cues e.g. visual access and clues from the physical properties of the built environment, 25.7% and 21.6% used verbal directions provided by asking other people and official personnel respectively. 14.3% followed other people, while 7.4% backtracking along their journey. Table 6.4 shows the respondents navigation strategies. It is also important to note that only a very short time is usually given to scanning information and if this information is not immediately understood it is disregarded, and the person continues to search for something immediately recognisable. If this is the case for the average person it follows that the needs of people with sensory/cognitive and physical impairments, including cultural, language and other differences need more detailed consideration (NSW Health, 2008).

Table 6.6: User navigation strategy using wayfinding information

Information source	Frequency	Percent
Follow signs	10	13.3
Environmental cue	9	12.0
Ask other people	21	28.0
Ask official personnel	17	22.7
Backtrack	6	8.0
Follow other people	9	12.0
Other	3	4.0
TOTAL	75	100.0

Source: Fieldwork data, 2013

6.3.1 Follow signage

13.3% of the respondents used available signage to assist them with their navigation towards their destinations within the hospital. This proportion of response is not entirely unexpected. From the previous section it was noted that 38% of the respondents reporting the lack of any source of wayfinding information in sight upon entry to the hospital building. An equal proportion (38.7%) responded to signage in the form of Directory boards or Directional signage.

6.3.2 Environmental cues

12.0% of the respondents used environmental to assist them with their navigation towards their destinations within the hospital. As noted earlier in this study, Passini (1980) found that some people navigating in a large commercial complex relied heavily on the clarity of the organization of the building to find their way around. The KNH is an old hospital that has "grown" over the over 100 years of it's existance. For this reason some areas of the building are easier to navigate than others because they have better visual access to intended destinations from decision points. According to Carpman, Grant, and Simmons (1985), the wayfinding behavior of people initially entering a hospital was influenced more by visual access to the destination than by available signage

6.3.3 Verbal directions

By far the largest proportion of the respondents used verbal direction to assist them with their navigation towards their destinations within the hospital. 28.0% asked other people, most likely, other wayfinders,while 22.7% asked "official personnel". Official personnel included staff manning designated and identified Reception or Information desk. It also included "a person wearing a white lab coat". Many visitors and patients consider people dressed in white lab coats to be doctors at the hospital and are therefore knowledgable about the layout of the hospital. KNH encourages people to seek verbal direction by positioning portable signboards at stategic points within the hospital corridors, welcoming people and requesting the to seek directions from "The Safety Officer" (Figure 6.17)

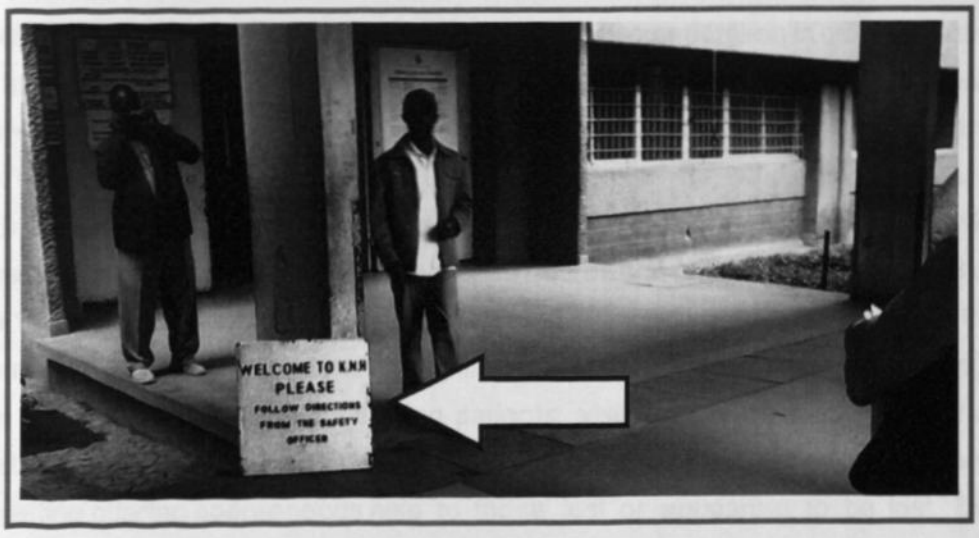


Figure 6.21 A portable instruction signboard at KNH positioned at strategic points within the hospital.

Source: Fieldwork data, 2013

The researcher came across four of these communication devices strategically positioned at various areas within the hospital. Figure 6.18 shows the Safety Officer who is in fact a scurity guard who by virtue of the uniform give him status of an information source.

Figure 6.22 The official uniform donned by the Saftety Officer at KNH.

Source: Fieldwork data, 2013

For ethical and security reasons this photograph was discreetly taken in order to illustrate just the visual impact of the uniform in emphasizing the official capacity of the wearer. This wayfinding strategy adopted by KNH may explain the frequency of respondants (22.7%) answering that they used "Official Personnel" for wayfinding assistance. Further interrogation of the data collected revealed that apart from these, 12.4% of those who responded that they used direction boards and other signage indicated that after following directions given therein, they also eventually asked for directions from official hospital personel. At KNH, any interested observer who stops long enough soon becomes aware that wayfinding patients, visitors and members of staff are constantly giving directions. It is also common to find other more experienced users of the setting offering spontaneous help to those lost or appearing to be lost. Even those lost stop to help each other, finding comfort in complaining about how confusing the place is.

The data collected was further analyzed taking into account the individual characteristic of gender. Figure 6.19 shows the findings. During the past decade, the case has been made that gender is one of our culture's two or three primary frames for organizing the physical environment (Ridgeway 1997, 2007). It has been suggested by Lawton and Hatcher (2005), that organizations need to develop methods for improving the 'ease of wayfinding' based on gender.

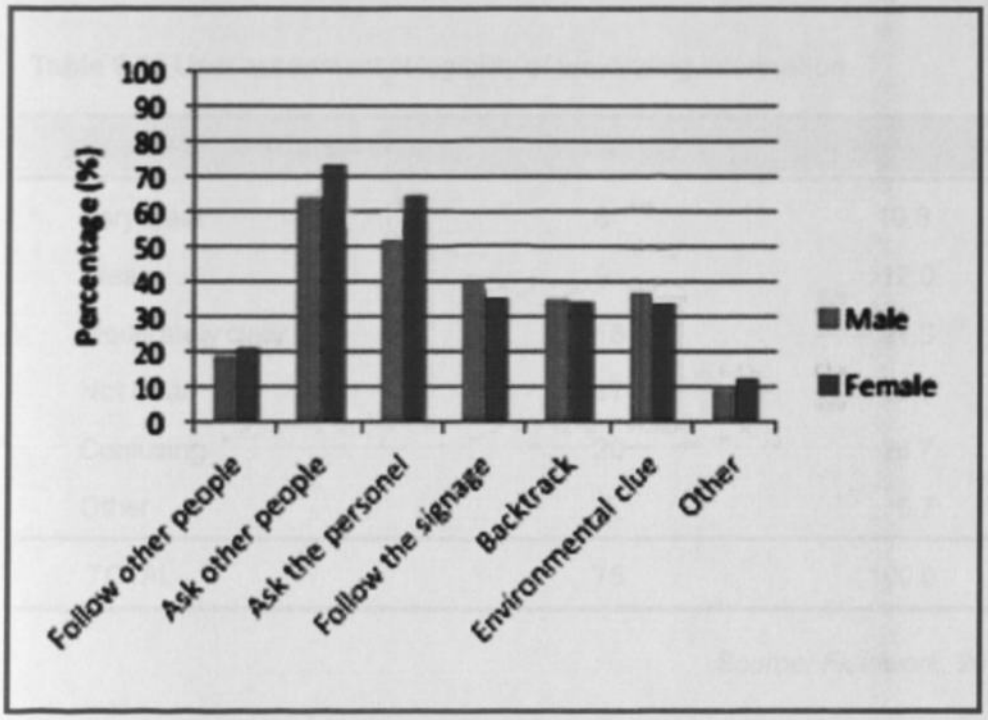


Figure 6.23 User wayfinding strategies by gender.
Source: Fieldwork data, 2013

Figure 6.19 shows a greater percentage of female respondents asking for directions from other people as well as from official personnel. They are also very slightly higher in following other people. Male respondents score higher in following available signage and environmental cues. The score is equal for backtraking. This finding aligns with the study by Lawton (2002) which revealed that men reported greater preference for a strategy of orienting to global reference points, whereas women reported greater preference for a strategy based on route information. In terms of particular strengths, men generally tend to include a higher frequency of references to cardinal directions, distance information (for example, the estimation of distances to landmarks), and serial orientation (using words to describe the steps of the directions as a series: "first," "second," etc.).

6.4 Legibility of wayfinding information and wayfinding behavior

One should be able to guage legibility by assesing the ease with which wayfinding information is used to lead one to their destination. Table 5.4 shows 26.7% find it confusing while 10.6% find it very clear. 21.3% find it moderately clear, while 12.0% and 22.7% find it clear and not clear respectively.

Table 6.7: User assesment of legibility of wayfinding information

Response to information	Frequency	Percent
Very clear	8	10.6
Clear	9	12.0
Moderately clear	16	21.3
Not clear	17	22.7
Confusing	20	26.7
Other	5	6.7
TOTAL	75	100.0

Source: Fieldwork, 2013

User assessment of the legibility of wayfinding information is an indication of the clarity of the wayfinding information presented in the wayfinding system. From the data gathered it shows that 26.7% of the respondents found the information presented confusing. If one analyzes the data in terms of three categories of "Clear", "Not clear", and "Moderately clear" it would place the "Very clear" and the "Clear" categories together and the "Not clear" and "Confusing" categories together. This would give the clear category a 12.6% response and the Not clear category 49.4%, leaving the Moderately clear category with 21.3%. Figure 6.24 illustrates this position. Just under half the population of users visiting this hospital environment found the wayfinding information to be illegible and confusing. This points to a great failure of the wayfinding system in place at KNH. Since it shows that the system is in place, the issue is to establish what reasons make it illegible to such a large percentage.

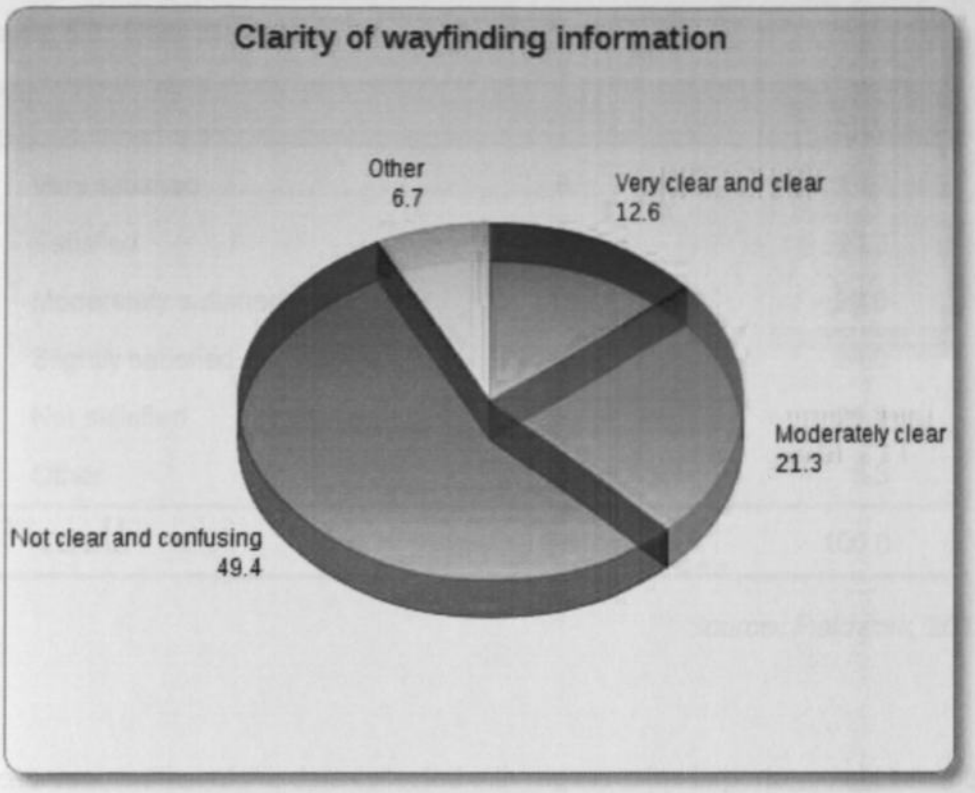


Figure 6.24: Clarity of wayfinding information
Source: Fieldwork data, 2013

6.5 Level of user satisfaction with wayfinding system.

User satisfaction is otherwise known as customer saftisfaction. Customer satisfaction is the outcome felt by those that have experienced a company's performance that have fulfilled their expectations (Angelova & Zekiri, 2011). Satisfied customers form the foundation of any successful business as customer satisfaction leads to repeat purchase, brand loyalty, and positive word of mouth (ibid). For this study customer satisfaction is noted as user satisfaction. "The ability to find one's way into, through, and out of a building is clearly a prerequisite for the user satisfaction of higher goals," according to Weisman (1981).

User satisfaction with a wayfinding system cumulates from the availability, appropriate positioning and legibility of wayfinding information. Data of user satisfaction with finding their way within the hospital was collected from three points in the questionnaires. Query on satisfaction with information presented at a decision point along the journey, query on usefulness of information available and finally a direct query on self assessment of satisfaction with hospital visit. Table 6.8 shows the response to user satisfaction.

Table 6.8: User satisfaction with wayfinding information

User satisfaction	Frequency	Percent
Very satisfied	8	10.7
Satisfied	10	13.3
Moderately satisfied	15	20.0
Slightly satisfied	18	24.0
Not satisfied	20	26.7
Other	4	5.3
TOTAL	75	100.0

Source: Fieldwork, 2013

A close examination of the data collected with regard to the importance of customer or user satisfaction reveals a very poor outcome. As illustrated in figure 6.25 over half of the users of the KNH environment reported dissatisfaction with their wayfinding experience.

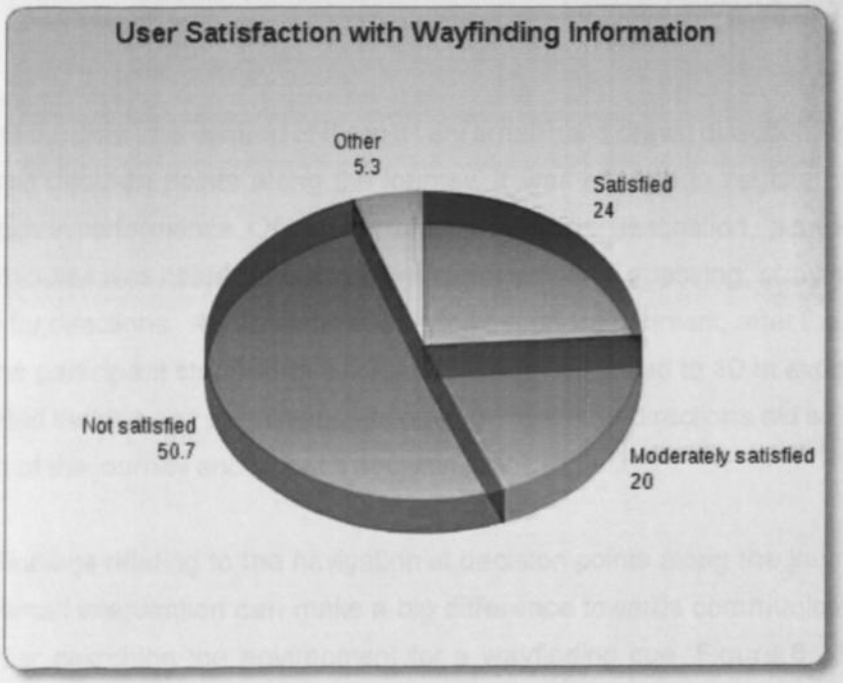


Figure 6.25: User satisfaction with wayfinding information
Source: Fieldwork data, 2013

6.6 Wayfinder navigation test

The experiment involved the tracing of the journey from the Casualty information desk to the predetermined destination of the Microbiology Laboratory in the hospital. This test was conducted in two phases. The first part of the experiment,unertaken by 20 participants, recorded the situation as it was without any intervention (Experiment 1). For the second part of the experiment (Experiment 2), undertaken by 14 participants, a discreet intervention was made with the inclusion of a very small hand drawn direction sign (see figure 5.10). Table 6.9 shows the comparison between the two tests in terms of the time taken to reach the destination and the number of times a wayfinder had to ask for directions.

Table 6.9: Wayfinder navigation test elements

Information source	**Experiment 1** 20 participants	**Experiment 2** 14 participants
Mean time taken	16.4 min.	12.3 min.
Number of decision points	3	3
No. of direction signs	1	4
No. of times asked for direction	10	1

Source: Fieldwork data, 2013

With the discreet intervention of three a very small hand drawn direction sign placed at the three decision points along the journey, it was enough to register a significant difference in performance. Of the time taken to reach the destination, a mean difference of 4.1 minutes was noted. The wayfinder spent less time guessing, straying, or asking people for directions. At the same time, in the second experiment, after the intervention only one participant stopped to ask for directions compared to 10 in experiment 1. It was noted that the one participant who stopped to ask for directions did so at a random section of the journey and not at a decision point.

Other findings relating to the navigation at decision points along the journey indicate that a small intervention can make a big difference towards communicationg with a wayfinder searching the environment for a wayfinding cue. Figure 6.26 shows the comparison of the experiments with regard with the wayfinders next course of action at a decision point.

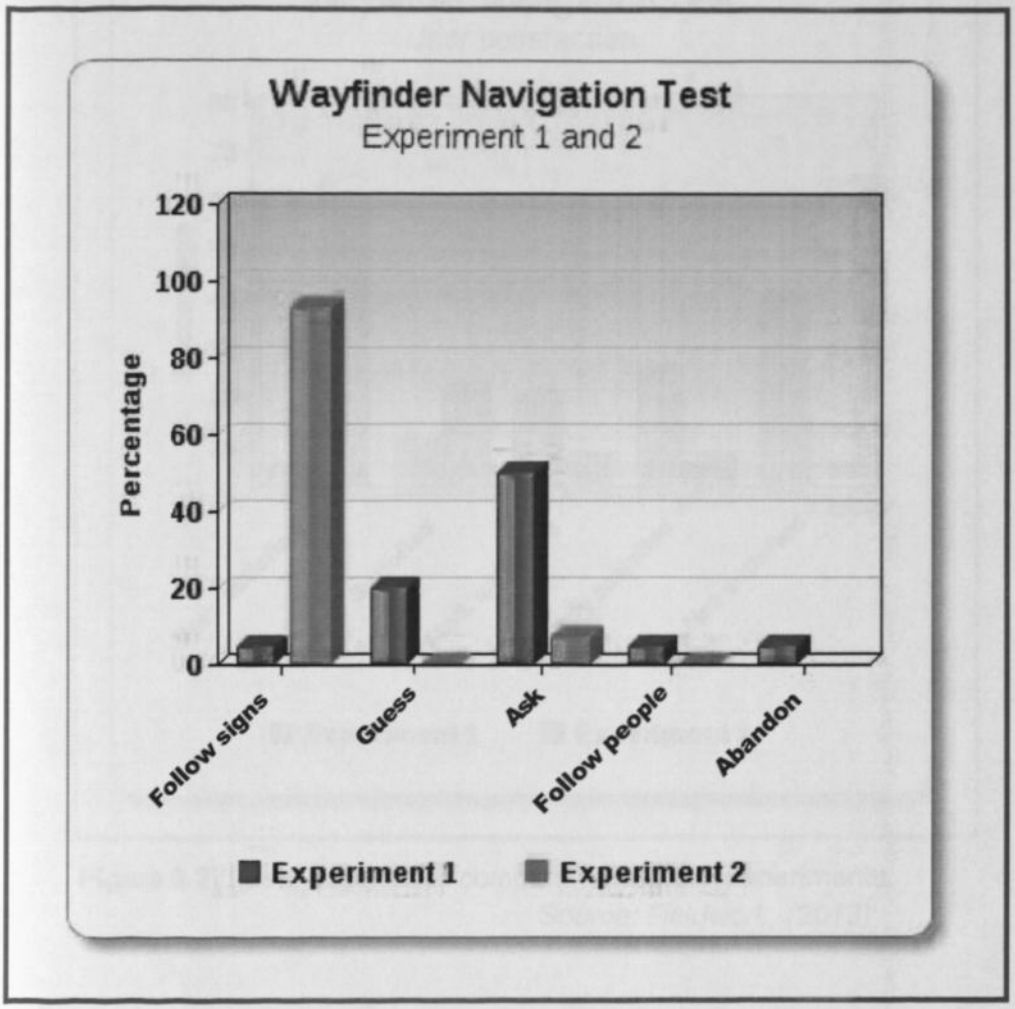


Figure 6.26: Wayfinders course of action at decision points.
Source: Fieldwork, (2013)

Whereas only 5.0% of the participants followed signs in the first experiment, a 92.9% did so in the second experiment. This hugh peak can only be attributed to the placement of a sign at the decison points along the journey. Likewise no participant abandoned the journey in the second experiment as occurred in the first experiment where 5.0% did. Also the level of asking people, guessing the way, and following other people was significantly lower in the second experiment. Figure 6.27 shows The differnce in user satisfaction following the placement of a simple sign.

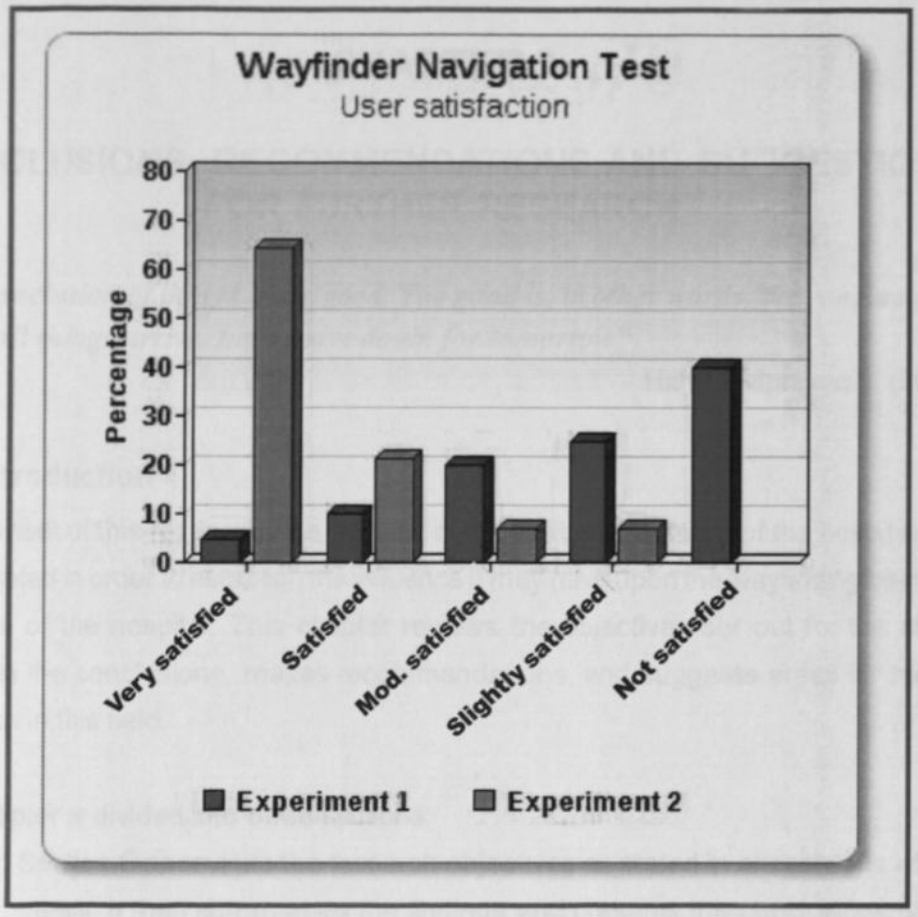


Figure 6.27: User satisfaction comparison between experiments
Source: Fieldwork, (2013)

6.7 Summary

This chapter presented and analyzed the data collected during the fieldwork of this study. Starting with the demographic data collected, it was interrogated further to reveal the make up of the gender, age, and educational background. These were considered important for the study because these factors have implications towards successful wayfinding. With the aim of fulfilling the stated objectives of this study, each objective was reported upon. These were the evaluation of the legibility of the hospital, use of wayfinding information, the influence of wayfinding information, and user satisfaction with their wayfinding experience. An overall statement of the findings was arrived at that showed a very poor performing wayfinding system at KNH.

CHAPTER 7

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

"The conclusion of things is the good. The good is, in other words, the conclusion at which all things arrive. Let's leave doubt for tomorrow"

- Haruki Murakami, (2013)

7.0 Introduction

At the onset of this research, the legibility of the built environment of the hospital was investigated in order to establish the influence it may have upon the wayfinding behavior of users of the hospital. This chapter reviews the objectives set out for the study, presents the conclusions, makes recommendations, and suggests areas for further research in this field.

The chapter is divided into three sections:

- Section One revisits the research objectives as stated in chapter one of this thesis. It then summarises the findings and presents the conclusions. In addition the hypothesis is tested and implications of the findings on the hypothesis are explained.
- Section Two proposes recommendations to the improvement of accessibility and usability of the wayfinding system to users, which in turn should impact positively on service delivery and customer satisfaction.
- Section Three outlines limitations to the study and suggests areas for further research in this field.

7.1 Revisiting the research objectives

The intent of this study was to investigate wayfinding in the hospital environment in relation to the legibility of environmental communication. By extensive review of the literature which explored how people find their way in both physical and virtual environments it was noted that disorientation may lead to growing levels of anxiety, depression, stress, agitation, emotional exhaustion, among others, and can occur if the surroundings are not appropriately designed for ease of wayfinding for users. This is accentuated if the environment is badly or insensitively designed. Because a hospital's primary function is to provide healing, it is crucial to investigate and understand

factors that may adversely impact this noble function with the aim of making corrections. Accordingly, the problem statement of this research as stated in chapter one of this thesis was:

Despite the impressive developments in wayfinding research and application, hospital users continue to be frustrated by wayfinding systems designed to assist them in finding their way. This may be due to a number of factors, chief among them being illigibility of the system. This leads to the inability of the intended user to interact and respond to the wayfinding information presented in the system. Since the ease of wayfinding has been shown to contribute positively to wellbeing and healing, whereas difficulty in wayfinding (or getting lost) leads to frustration and anxiety, the problem identified for this study is to interrogate the legibility of the hospital environment and its influence upon user wayfinding behavior. In Kenya, difficulty in wayfinding is evident from conversations with the general public about their experiences of interacting with the hospital environment. In addition to this, evidence from extensive literature reviewed for this study revealed the lack of wayfinding research in Kenya. This gap in knowledge impedes the formulation of meaningful interventions by stakeholders in the delivery of effective wayfinding systems.

To address the problem, the following research questions were posed. (section 1.4):

1. What wayfinding information is present in the built environment of the hospital?
2. How do wayfinders use wayfinding information present in the hospital to find their way to their destinations?
3. How does wayfinding information present in the hospital influence wayfinding behavior of the user?
4. What is the level of user satisfaction with the wayfinding information in the hospital?

The research objectives were set as follows (section 1.5):

1. Evaluate the wayfinding information in the built environment of the hospital
2. Investigate how wayfinders use wayfinding information to find their way to their destinations in the hospital.
3. Establish the influence of legibility upon wayfinding behavior of the user in the hospital.
4. Assess the level of user satisfaction with the use of wayfinding information in the hospital.

The the following section elaborates on the specific conclusions linked to the research objectives.

7.2 Summary of findings

The findings presented here represent a substantive increase in the knowledge and understanding concerning the nature of wayfinding taking place in the Kenyan hospital environment. This enables the facilitation and the formulation of meaningful interventions by stakeholders in the creation of user friendly wayfinding systems thereby validating the research problem for this study.

7.2.1 Personal characteristics

Although the personal characteristics of the respondents were not stated as part of the study objectives, gender,age and education have a bearing on the user's personal traits and ability to perform wayfinding tasks as noted in the conceptual framework illustrated in section 1.9 of this thesis. They therefore formed part of the data collected and analyzed.

The data on the personal characteristics of the respondents in this study were collected and presented as the response to questions regarding the gender, age, and highest education level attained by the respondents. With personal attributes of the wayfinder being important to the wayfinding process, only three aspects were interrogated in this study. A more extensive study would include physical attributes such as visual and physical abilities for navigation. Even though these are discusses with regard to universal access to environments, a broader enquiry is suggested for further study.

The responses were considered against the perspective of the National statistics on age, sex, and literacy as sourced from Kenya National Bureau of Statistics.

7.2.1.1 Gender

With a total 52% and 48% male and female distribution respectively the variance from the National statistics on household population was 5.4. This was attributed to the random selection of the users and was not considered to have a significant impact on the findings.

7.2.1.2 Age

The age distribution with 81.7% of the respondents being between 18 to 50 years of age was not unusual. This was because persons under the age of 18 years were not

included in the study for ethical reasons within hospital environments. From the National statistics the Kenyan population below 19 years of age accounts for 54.7% of the total population (KDHS, 2010). Whereas this does not have an impact on this study, the implications of an aging population on the national healthcare provision may be of future concern and research (Collins et al., 1996).

7.2.1.3 Education level

The education level of the respondents categorized in three cohorts of Primary, Secondary, and University recorded a 97.3% literacy response. This was attributed to the urban setting of the study site. According to the 2009 Kenya population census (ILO, 2013), 32.4% of the population is illiterate. The data collected for this study failed to show this, but revealed a 2.7% response rate that was assumed to be illiterate. As a study conducted in an urban setting which is assumed to have relatively higher literacy rate than a rural setting, this finding was not unusual.

7.2.2 Pictographs

The findings from this set of questions on pictographs ranged from an almost 100% recognition rate (for dining and washroom pictographs) to a 14.7% and 32.0% recognition rate (for pediatric clinic and X-Ray pictographs respectively). In the same trend, the response rate to the questions registered a corresponding feedback with the most poorly responded to question being the question relating to pictograph no. 5 (X-Ray) followed by pictograph no. 3 (Pediatric clinic). The highest responded to questions were those relating to pictographs nos. 6 and 7 respectively (Dinning and Washroom). In total the mean correct rate was 59.8% against 40.8% for incorrect. Compairing this finding to the national statistic on literacy does not register a wide varience. As previously mentioned 67.6 of theKenyan population is literate with 32.4% of the population being illiterate (ILO, 2013). The conclusion for this section, therefore, is that this study is a close reflection of the national statistics on the three selected aspects of wayfinder personal characteristics.

7.2.3 Legibility of the environmental communication

The legibility of the environmental communication within the built environment of the hospital with regard to wayfinding information was investigated by interrogating the visual access to the hospital, availability of sources of wayfinding information in the hospital, and the users' utilization of that wayfinding information for navigation of the hospital environment. As the users interracted with the hospital environment during

wayfinding, their assessment of the wayfinding system present was an indicator of the legibility of the environment. From the findings presented in table 6.7, only 12.6% of the respondents found the hospital environment legible. 49.4% of the respondents found the hospital environment illegible.

7.2.4 Wayfinders use of wayfinding information

The manner in which wayfinders use wayfinding information was interrogated using a questionnaire on user wayfinding within the hospital, the wayfinding navigation tested conducted at the site and by an un-obtrusive observation by the researcher. From the data collected as shown in Table 6.4, 15.3% of the respondents reported following signs, 13.7% used other environmental cues e.g. visual access and clues from the physical properties of the built environment, 25.7% and 21.6% used verbal directions provided by asking other people and official personnel respectively. 14.3% followed other people, while 7.4% backtracking along their journey. The finding that 15.3% of the respondents reported following signs and 13.7% used other environmental cues shows that 29.0% of the respondents responded to environmental communication within the built environment of the hospital. This is evidence that there is a wayfinding system in place to which a significant segment of the user population utilizes. However, 47.3% of the respondents asked for directions. This points to the dysfunctionality of the wayfinding system. This finding was expected, Rooke, (2012) observes that "the social practice of giving directions verbally is prevalent in every setting be it hotel, hospital, or airport".

7.2.5 Legibility and wayfinding behavior

The influence of the legibility of the environment upon the wayfinding behavior of the user was guaged by assesing the ease with which wayfinding information is used to lead one to their destination. Legibility of wayfinding information was assessed by the respondents by the description of the level clarity of the wayfinding information present. This influenced the wayfinding strategies adopted by the user to navigate the environment. Some of the respondents reported following other people (12.0%), asking directions from other people and official personnel (28.0% and 22.7% respectively), following the signage and other environmental cues (13.3% and 12.0% respectively), and finally 8% of the respondents reported backtracking along the routes. Backtraking reveals a level of frustration with the wayfinding experience.

7.2.6 Level of user satisfaction with wayfinding system

Data on user satisfaction, otherwise known as customer saftisfaction was collected from users of the hospital using the semi-structured questionnaires. Data of user satisfaction with finding their way within the hospital was collected from three points in the questionnaires. Query on satisfaction with information presented at a decision point along the journey, query on usefulness of information available and finally a direct query on self assessment of satisfaction with hospital visit. Table 6.4 presented the users response to the user satisfaction queries. From this the finding showed that over half of the users of the hospital environment (50.7%) were not satisfied with their wayfinding experience at the hospital.

7.2.7 Wayfinding navigation test

Data from the wayfinding navigation test indicated a direct relation between legibility of the environment and ease of user wayfinding. The two experiments recorded the time taken to complete the journey and the number of times the participants stopped to ask for directions during the journey. The number of decision points along the journey were similar. The only difference along the journey was an additional three directional signs placed at specific points along the route of the journey. This being the modified variable in the experiment, the interest was on the difference noted in the time taken to complete the journey and the number of times a participant stopped to ask for directions during the journey. As shown in table 6.9 during the experiments, the difference of the mean time taken by a participant was 4.1 minutes. The difference between the mean number of times a participant asked for directions during the journay was 9. The conclusion from the results indicated an improvement in wayfinding performance as a result of an intervention in the environmental communication in the form signage.

As shown in figure 6.26 the participant's actions during the journey in the two experiments may be attributed to the manipulated variable. The percentage of participants following signs rose by 87.9%. Those guessing the way, asking for directions, following other people dropped drastically. Whereas 5.0% abandoned the journey in the first experiment, no participant in the second experiment did.

User satisfaction comparison between the two experiments is shown in figure 6.25. The rate of participants who expressed "very satisfied" with the journey rose by 58.0% while those "not satisfied" dropped to zero from nearly 40%. This Wayfinder Navigation Test pointed towards the confirmation of the hypothesis formulated for this research as stated in section 1.6.

7.2.8 Test of the study's hypothesis

The hypothesis for this study to be tested was;

H_a : The legibility of the hospital environment facilitates ease of wayfinding for the users of the hospital.

H_o : The legibility of the hospital environment does not facilitate ease of wayfinding for the users of the hospital.

Null hypothesis significance testing is arguably the most widely used approach to hypothesis evaluation among behavioral and social scientists. The rejection of the Null hypothesis means the acceptance of the alternative hypothesis. It was therefore necessary to set the decision point at which to accept or reject the Null hypothesis based on the mean variable score. This significance level (α) cutoff was set at 0.05 .

The study's hypothesis was tested using a chi-square test for independence and a correlation test. The Chi-Square test is applied when you have two categorical variables from a single population. It is used to determine whether there is a significant association between the two variables. The determination was done using enterprises data set with Q11 (legibility) as the dependent variable and Q12 (ease) as the independent variable.

From the table 7.1, a Pearson Chi-Square value of 96.197 and a P-value (2-sided) of .000 was noted. The null hypothesis is rejected because the significance level of the test = .000>.05.

Table 7.1: Chi-Square Tests of legibility and ease of wayfinding

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	96.197(a)	16	.000
Likelihood Ratio	88.956	16	.000
Linear-by-Linear Association	42.426	1	.000
N of Valid Cases	67		

a 21 cells (84.0%) have expected count less than 5. The minimum expected count is .36.

The output from the correlation test is shown in table 7.2. In this test both the Pearson's R correlation and the Spearman Correlation indicate the signicance level to be .000. It reconfirms the rejection of the null hypothesis for the study.

Table 7.2: Symmetric Measures of legibility and ease of wayfinding

	Value	Asmp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Interval by Interval Pearson's R	.802	.054	10.816	.000(c)
Ordinal by Ordinal Spearman Correlation	.801	.055	10.791	.000(c)
N of Valid Cases	67			

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.
c Based on normal approximation.

7.3 Conclusions

The conclusions are presented in relation with the study objectives and hypothesis tested.

7.3.1 The wayfinding information in the built environment of the hospital

The first objective was: *To evaluate the wayfinding information in the built environment.* The information for wayfinding availed in the environmental communication of the built environment of the hospital works towards the legibility of the environment. This begins with visual access to the main destinations such as entrances from which one enters the physical environment of the site. The findings from the data collected showed an 83.4% positive response from the respondents with regard to visual access to entrances. This indicated that the aspect of visual access was well catered for at KNH and that the architectural cues were well positioned. As one enters the environment of the hospital one was able to visually identify the main entrances. However, upon entry into the interior of the buliding of the hospital, the verdict on legibility changes greatly. Here only 12.6% of the users found the communication legible. 49.4% reported finding the communication on wayfinding illegible. This was about half of the respondents. The conclusion, therefore, was that there was need to address this anomaly because illegibility of the environment leads to the negative aspects of wayfinding coming to the fore and the users becoming dissatisfied with their wayfinding experience.

7.3.2 Wayfinders use of the wayfinding information

The second objective was: *To investigate how wayfinders use wayfinding information to find their way to their destinations in the hospital.*

The users of the hospital environment rely on the presence and clarity of wayfinding information to find their way to their destinations within the hospital. Data gathered revealed that there was wayfinding information in place in the form of direction boards, information/recption desks, and direction signage. However, in spite of this presence 49.4% of the respondents reported that they resorted to asking wayfinding information from fellow wayfinders or from "official personnel". The official personnel included anybody in a white laboratory overcoat. 7.4% of the respondents also reported that they had to backtrack along sections of their journey. The conclusion drawn from these findings points towards a failure of a large proportion of the users to utilize the wayfinding information in the environment.

7.3.3 Influence of the legibility on wayfinding behavior of the users

The third objective was: *To establish the influence of legibility upon wayfinding behavior of the user in the hospital.*

The legibility of the hospital environment has an impact on the wayfinding behavior of the users. The illegibility or lack of wayfinding inormation results in people using any means to find their way to their destinations. From this study the most common means was to ask for directions. This form of direction seeking was evident even in the presence of wayfinding information. Frustration with the wayfinding system was indicated by users backtracking during their journey (7.4%). Although this may seem like a small proportion of the respondents, it should be of concern to any hospital administrator that some users who have travelled to their hospital has had to backtrack, with some abandoning their quest and going away. The conclusion drawn from these findings on the influence of the legibility of the hospital environment upon the wayfinding behavior of the users was that there was a follow through effect from a dysfunctional wayfinding system.

7.3.4 User satisfaction with the wayfinding system

The fourth objective was: *To assess the level of user satisfaction with the use of wayfinding information in the hospital.*

The findings for user satisfaction with finding their way to destinations within the hospital revealed that just over half (50.7%) of the respondents registered dissatisfaction. This

finding was not unexpected following previously noted findings on legibility of the hospital environment and wayfinding behavior. The conclusion from the user satisfaction survey is that with such a large proportion of respondents registering dissatisfaction, there is a definate need for an intervention.

7.4 RECOMMENDATIONS

From the conclusions, the following recommendations are offered:

- A wayfinding system should be considered that takes into account the various elements of good practice to enable legibility of the hospital environment at KNH.
- Since the existing wayfinding system is found to be dysfunctional, a comprehensive overhaul is recommended to incorporate points noted in this and other studies.
- Because the most common form of communication by users was to ask for directions, this should be supported with the introduction of a system to facilitate it and capitalize upon it.
- The level of user satisfaction with regard to wayfinding should be investigated further and the noted shortfalls addressed in order to create a user friendly environment.
- Increase awareness, on the part of key decision makers, of the need to design a wayfinding strategy and system that ensures that the right information in the right form is in the right place, thus communicating with the right people at the right time.
- Finally all stake holders of the hospital environment should be represented in the discussion on the creation of an effective wayfinding system. According to the Auditor General report quoted in the study, Kenyatta National Hospital has not established and documented important operational standards and guidelines essential for efficient delivery of its services. Among the missing operational standards would be those on wayfinding as well as policies and guidelines on patients and visitors satisfaction with the environment.
- In the absence of measurable targets for efficient service delivery, the management of the Hospital cannot effectively monitor, evaluate and control performance of the specialized health-care and other departments or units of the Hospital. The recommendation, therefore, is the call for a stakeholders conference to deliberate on these issues.

Effective wayfinding guidelines aimed at improving wayfinding performance in such settings can be derived from a careful real-time observation and analysis of the behaviour of wayfinders.

7.5 Contribution to knowledge

This research makes both academic and practical contribution towards improving the quality of hospital wayfinding design. It builds on the premise that the quality of the design of physical environments can affect patient medical outcomes and care quality. The growing international awareness of healthcare facility design has been mounting scientific evidence that certain environmental design strategies can promote improved outcomes whereas other approaches can worsen patient health.

By studying a large hospital in the Kenyan healthcare context, this study opens an area that has not been previously studied. This is a great contribution to knowledge in this field and further research is required.

7.6 Areas for further study

In order to improve the environmental communication within hospital environments the following are suggested as areas for further research:

- With the personal attributes of the wayfinder being important to the wayfinding process, only three aspects were interrogated in this study. A more extensive study would include physical attributes such as visual and physical abilities for navigation.
- A study of the society's visual culture in relation to orientation and wayfinding.
- Even though this study has made mention of universal access to environments, a broader enquiry is suggested for further study taking into account the full spectrum of persons with physical challenges of vision and navigation/ ambulation.
- Whereas Kenyatta National Hospital has formed the background for this study, its sheer size and complexity call for further study that goes beyond the scope covered by this research.

  While doing this one would seek to find answers to the following questions:

- Who is responsible for designing wayfinding systems/strategies in hospitals and who makes the decisions on the type of information to be included in a wayfinding system?
- Who is responsible for the physical placing and positioning of wayfinding information in relation to the physical layout of the environment over the building's life cycle?
- Given the extent of extension, upgrading and demolition that has occurred throughout the long life cycle of KNH buildings, who is charged with the responsibility for ensuring that wayfinding information is clear and updated?
- How is any existing guidance document currently used to support decision making and how could it be improved?

7.7 SUMMARY

This research represents a significant contribution to knowledge and understanding of environmental communication and wayfinding in the hospital environment in Kenya. This chapter begun by revisting the research problem as well as the objectives for the study. It then summarized the findings based on the objectives, whereby the objectives were fulfilled. Conclusions were drawn from the findings and recommendations suggested to create or improve the wayfinding strategy at the hospital. The contribution of this study to knowledge was discussed and areas for further research suggested. A broader study was suggested for the old and complex institution of Kenyatta National Hospital, which has physically been expanded over a long period of time. Specific questions have been suggested for such a study.

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APPENDIX A: SITE SURVEY TOOL
From NHS, (2005)

Guidelines on how to use this site survey tool

Identify the routes to be surveyed

These may be routes that you know people have problems following, or heavily-used routes such as the main public car park to Out-patients, or the most commonly-used bus stop to Maternity.

Photocopy the site survey tool

The person surveying your site will need a copy of the following two pages for each point where they make a decision as to which way to go next. This could be a corridor junction, inside a building entrance or outside a lift.

Six copies of the two pages, per route to be surveyed, should be sufficient, though the number will vary depending on the length and complexity of the route, so include a few extra copies.

Who should carry out the surveys of your site

People who are unfamiliar with your site will provide the most helpful information when carrying out a site survey, as they have no prior knowledge of the site and its layout. However, you will find it useful to survey routes around your site yourself, though be aware that people who are first-time visitors may make different decisions along the route from those you make, with your knowledge of the site.

The Disability Discrimination Act (DDA) requires your site to be accessible to all users. Disabled people should be asked to carry out site surveys to find out what they use to find their way, and to see whether they rely more heavily on different wayfinding aids and site features than people without disabilities. These site users should include people with visual, hearing or mobility impairments and people who use a wheelchair. It is important that people with all types of impairment who visit your site are considered and consulted to ensure your site is accessible for all site users. 1.4

The needs of people of all ages should be considered, and ideally, they should all be asked to carry out site surveys, including older people and people with toddlers and pushchairs. Also, people who do not speak the language used on signs should be consulted, although it would prove difficult for them to fill in the site survey sheets unless they are translated.

Ask the person surveying your site to note their observations

By filling in the site survey sheets people will notice the various wayfinding aids at your site and evaluate them as a site user. People with visual impairments would usually need someone to fill in the pages for them, and other people such as older site users may also find it difficult to follow the route whilst taking notes.

Talk-aloud site surveys

An alternative way of recording people's comments is to ask them to talk aloud whilst they follow the routes and either make notes, or use a tape recorder to record their comments.

Using information from the site surveys

Read through the survey sheets, follow the routes that were surveyed and identify the key problem areas that the people surveying your site experienced. Use the information from the site surveys to improve your wayfinding system for all site users.

5.3

Site survey tool

Valuable information can be gathered by getting a variety of people who are unfamiliar with your site to follow routes around the site and make notes on the wayfinding aids.

Carrying out site surveys using this tool should highlight key problem areas and ineffective wayfinding aids.

Surveying your site

Complete these two pages at each decision point along the route you are surveying

Completed by: time: date:

Route followed *from:* *to:*

Is the decision point: ☐ internal ☐ external

Describe where you are, or mark it on a map:

Survey sheet/decision point number ☐

1 Mode of transport

☐ Car ☐ Bus/taxi
☐ Foot ☐ Train

2 Obstructions and visual clutter

Are there elements making it difficult to see the route or sign system?

☐ No visual clutter
☐ Yes, elements are distracting and obscuring the route/sign

If yes, please indicate the obstruction:

☐ Trees
☐ Other signs
☐ Vehicles
☐ People
☐ Buildings
☐ Other, *please specify*

3 Landmarks

Are there any prominent landmarks that people may use to remember a location or route?

☐ No
☐ Yes

If yes, please describe

4 Entrances

Is there a building or department entrance clearly identifiable from this decision point?

☐ No
☐ Yes

If yes, which entrance(s) is/are identifiable?

5 Directional signs

Is there a directional sign visible at this decision point?

☐ Yes
☐ No *go to question 6*

Is the text legible from this decision point?

☐ Yes
☐ No

Is your destination mentioned?

☐ Yes
☐ No

Is the direction indicated clearly?

☐ Yes
☐ No

Is the sign positioned in an appropriate location where the information is needed?

☐ Yes
☐ No

Comments

6 Locational signs

Is there a locational sign visible at this decision point?

☐ Yes

☐ No *go to question 7*

Is the text legible from this decision point?

☐ Yes

☐ No

Is it clear which building or location the sign is referring to?

☐ Yes

☐ No

Is the sign positioned in an appropriate location where the information is needed?

☐ Yes

☐ No

Comments

7 Maps

Is there a map visible at this decision point?

☐ Yes

☐ No *go to question 8*

Does the map show where you are?

☐ Yes

☐ No

Does the map make the site or building easy to understand?

☐ Yes

☐ No

Is your destination mentioned on the map?

☐ Yes

☐ No

Is the map positioned in an appropriate location where the information is needed?

☐ Yes

☐ No

Comments

8 Directory

Is there a directory visible at this decision point?

☐ Yes

☐ No *go to question 9*

Is the text legible from this decision point?

☐ Yes

☐ No

Is your destination mentioned?

☐ Yes

☐ No

Is it easy to find the destination on the directory?

☐ Yes

☐ No

Is the sign positioned in an appropriate location where the information is needed?

☐ Yes

☐ No

Comments

9 Staff assistance

Is there a member of staff at this decision point to ask for directions?

☐ No

☐ Yes

If yes, ask for directions:

Are the directions given clear and easy to follow?

☐ Yes

☐ No

Did staff offer to escort you to your destination?

☐ Yes

☐ No

Comments

Use the available wayfinding information to find the route to your destination and, at each point you need to make a decision about which way to go, complete another survey sheet.

APPENDIX B: QUESTIONNAIRE 1
WAYFINDING WITHIN THE HOSPITAL
A SURVEY OF USERS OF THE HOSPITAL ENVIRONMENT

Dear Sir / Madam

This study is being conducted to find out how people find their way within this hospital building environment. Your participation in this study will contribute to improving our understanding of human wayfinding in the hospital and hence recommend improvement to the wayfinding system for this hospital as well as other hospitals in Kenya.

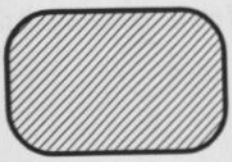
We are not asking for your name, so your ansers will be completely anonymous.

BACKGROUND INFORMATION

Q-1 Sex M ☐ F ☐

Q-2 How old are you? **(Optional)** Indicate exact age

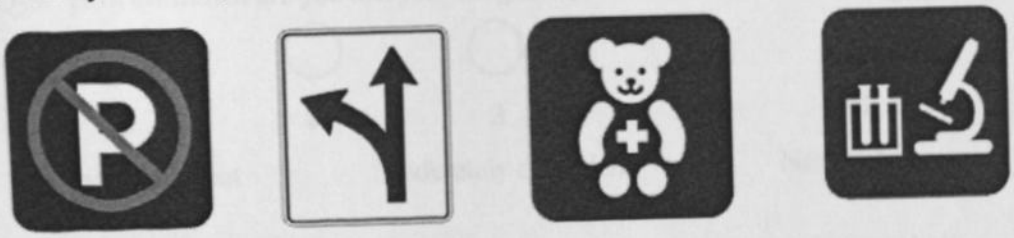
☐ 18 - 30 years
☐ 31 - 50 years
☐ 51 - 65 years
☐ Over 65 years



Q-3 Indicate your education level

Primary (Std 1 - Std 8)
☐ Secondary (Form 1 - Form 4)
☐ University (Undergraduate - Postgraduate)
☐ Other (Specify) _____

Q-4 Can you identify the meaning of the signs below?



1. _____ 2. _____ 3. _____ 4. _____

5. _____ 6. _____ 7. _____ 8. _____

Q-5 Why are you here?

- ☐ I am a patient
- ☐ I am visiting
- ☐ Other reason _____

WAYFINDING INFORMATION

Q-6 Before today, how many times have you been to this hospital in the past year?

- ☐ None
- ☐ Once
- ☐ 2 - 4 times

Q-7 Would you consider yourself familiar with the hospital? Rate from 5 - 1

○	○	○	○	○
5	**4**	**3**	**2**	**1**
Very familiar	Moderately familiar		Not familiar	

Q-8 Did you come alone or did you come with someone to assist you?

- ☐ Alone
- ☐ With a relative
- ☐ With a friend
- ☐ Other (please specify) _____

Q-9 How confident are you that you will get to your destination? Rate from 5 - 1

○	○	○	○	○
5	**4**	**3**	**2**	**1**
Very confident	Moderately confident		Not confident	

Q-10 Before you came today, were you given any directions or information to help you find your way to the hospital? **Yes** ☐ **No** ☐

Q-11 If yes, which of the following?

- ☐ Map
- ☐ Written directions
- ☐ Spoken directions

Other (please specify) _____

Q-12 Who gave you the information?

- ☐ A relative
- ☐ A friend
- ☐ A person I don't know (specify) _____
- ☐ Other (please specify) _____

Q-13 Was the information given useful and easy to understand?

Yes it was ☐ No it was not ☐

If not, give reason _____

Q-14 When you arrived at the hospital was the entrance easy to see?

○ Yes it was ○ No it was not ○ Can't remember

Q-15 Once at the hospital what was your destination?

_____

Q-16 Had you been there before? Yes ☐ No ☐

Q-17 Did you find your way there easily? Yes ☐ No ☐

If no, give reason _____

APPENDIX C: QUESTIONNAIRE 2

USER ENVIRONMENTAL SATISFACTION SURVEY

A SURVEY OF USER SATISFACTION WITH THE HOSPITAL VISIT

I. BACKGROUND INFORMATION

Q-1 Sex M ☐ F ☐

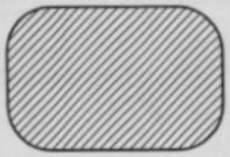
Q-2 How old are you? **(Optional)** Indicate exact age

☐ 18 - 30 years

☐ 31 - 50 years

☐ 51 - 65 years

☐ Over 65 years



Q-3 Indicate your education level

☐ Primary (Std 1 - Std 8)

☐ Secondary (Form 1 - Form 4)

☐ University (Undergraduate - Postgraduate)

Other (Specify) _____

II. EASE OF WAYFINDING

Q-4 Upon entry through the hospital entrance, what was your destination?

☐ Casualty / Outpatient

☐ Clinic

☐ Wards

Other (specify) _____

Q-5 Upon entry through the hospital entrance, was there any wayfinding information system in sight to direct you towards your destination? **Yes** ☐ **No** ☐

Q-6 If Yes which was it?

☐ Directory board

☐ Information desk

☐ Directional signage

Other (specify) _____

Q-7 If there was no wayfinding information system, what did you do next?

☐ Guess the direction

☐ Ask someone for directions

☐ Follow people moving in a direction

☐ Abandon the journey

Q-8 Was the information presented in the wayfinding system helpful in directing you to your destination?

Yes ☐ **No** ☐

Q-9 What is your level of satisfaction with the information given at this point?

○ 5	○ 4	○ 3	○ 2	○ 1
Very satisfied		Moderately satisfied		Not satisfied

Other comment _____

Q-10 Were there signs or other cues along the paths to your destination?

Yes ☐ **No** ☐

Q-11 Was the information presented along the paths clear and legible?

○ 5	○ 4	○ 3	○ 2	○ 1
Very clear		Moderately clear		Confusing

Other comment _____

Q-12 Did the signs or other cues along the paths assist you to reach your destination easily?

○ 5	○ 4	○ 3	○ 2	○ 1
Useful signage		Moderately useful		Not useful

Other comment _____

Q-13 Is there ONE element of wayfinding that stood out along the route to your destination?

Yes ☐ **No** ☐

If Yes, please describe the outstanding element.

_____

_____

Q-14 Would you remember it as a guide for a future visit to the hospital?

○ 5	○ 4	○ 3	○ 2	○ 1
Very memorable		Moderately memorable		Not memorable

Other comment _____

Q-15 How would you rate your level of satisfaction with the wayfinding system at the entire hospital?

○ 5	○ 4	○ 3	○ 2	○ 1
Very satisfied		Moderately satisfied		Not satisfied

Other comment _____

APPENDIX D: SITE SURVEY

A SURVEY OF ROUTES WITHIN THE HOSPITAL

BY WAYFINDERS WHO ARE NOT FAMILIAR WITH THE SITE

I. BACKGROUND INFORMATION

Q-1 Sex **M** ☐ **F** ☐

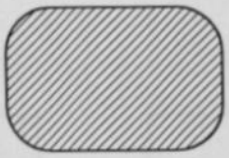
Q-2 How old are you? **(Optional)** Indicate exact age

☐ 18 - 30 years

☐ 31 - 50 years

☐ 51 - 65 years

☐ Over 65 years



Q-3 Indicate your education level

☐ Primary (Std 1 - Std 8)

☐ Secondary (Form 1 - Form 4)

☐ University (Undergraduate - Postgraduate)

Other (Specify) _____

II. SITE SURVEY

Using the existing wayfinding information presented to you, find your way to the given destination. At each decision point along the route make a decision about which way to go. Complete a seperate survey sheet for each new decision point.

Q-4 What is your start location? _____ **Start time:** ☐

Q-5 What is your destination? _____ **End time:** ☐

Decision point number ☐

Q-6 Is there any information leading you to your destination? **Yes** ☐ **No** ☐

Q-7 If **Yes**, describe briefly _____

Q-8 If visual make a quick sketch of it here. ☐

Q-9 If **No**, briefly describe your next course of action. _____

_____

Q-10 What is your next move from this point?

☐	☐	☐	☐	☐
Follow instructions from sign	Guess the direction	Ask someone for directions	Follow people moving in a direction	Abandon the journey

Q-11 What is your level of satisfaction with the information given at this decision point?

○	○	○	○	○
5	**4**	**3**	**2**	**1**
Very satisfied		Moderately satisfied		Not satisfied

Other comment _____

..... / Move on to the next decision point ▶

Supplementary survey sheet

Complete a seperate survey sheet for each new decision point.

Q-1 What is your destination? _____

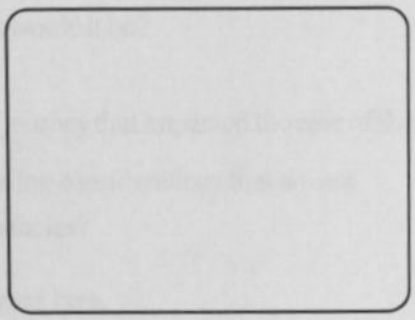
Decision point number ☐

Q-2 At this point is there any wayfinding information leading you to your destination?

Yes ☐ **No** ☐

Q-3 If **Yes**, describe briefly _____

Q-4 If visual make a quick sketch of it here.



Q-5 If **No**, briefly describe your next course of action. _____

_____

Q-6 What is your next move from this point?

☐	☐	☐	☐	☐
Follow instructions from sign	Guess the direction	Ask someone for directions	Follow people moving in a direction	Abandon the journey

Other (specify) _____

Q-7 What is your level of satisfaction with the information given at this decision point?

○	○	○	○	○
5	**4**	**3**	**2**	**1**
Very satisfied		Moderately satisfied		Not satisfied

Other comment _____

..... / **Move on to the next decision point** ▶

Final sheet

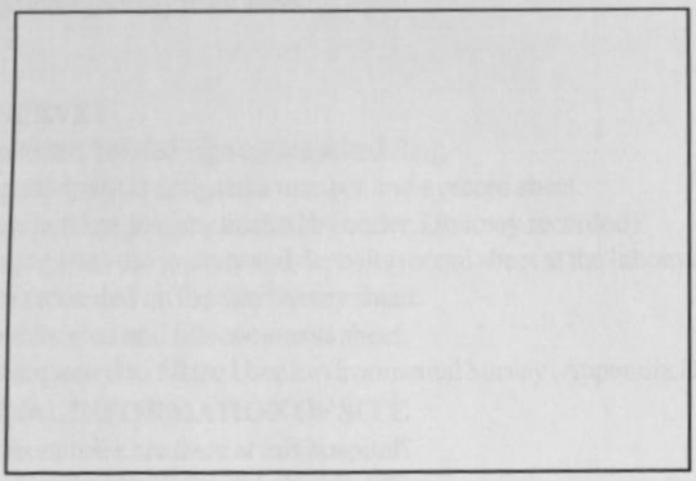
Complete this sheet at the conclusion of your journey when you arrive at the destination.

Q-1 If you could identify one critical wayfinding aid that you used to make your overall wayfinding journey easier, what would it be?

Q-2 If you could identify one critical wayfinding obstacle that made your overall wayfinding journey more difficult, what would it be?

Q-3 Are there any aspects of your wayfinding journey that impacted the ease of the journey that you feel are important wayfinding considerations that are not addressed in this survey – aids and/or obstacles?

Q-4 If visual make a quick sketch of any of these here.



APPENDIX E:
WAYFINDER NAVIGATION TEST
A SURVEY OF USER JOURNEY TO SELECTED DESTINATION

I. BACKGROUND INFORMATION
The objective of this test is to evaluate the involvement of the environmental communication in the hospital in the navigation of the wayfinder to an agreed destination within the hospital. For this purpose, a typical patient routine is proposed whereby the patient would enter the hospital and report to Casualty. From here they would be directed to a laboratory for a test. Depending on the test required, the patient would engage the environment and seek clues to guide them to the relevant laboratory. The first engagement may be in the form of verbal or written instructions.
This test is designed to track this journey from a known point (Casualty) to selected points (Laboratories) within the hospital.

II. PREPARATORY WORK
1. Identify the start point for the journey.
2. Identify the destination laboratory.
3. Map out the journey from Start to Finish, descriptively and graphically.
4. Identify decision points along the route of the journey. (These are very important points)
5. Mark the decision points descripively and on the map.
6. Prepare Wayfinder journey track sheet.
7. Train coders

III. ROUTE SURVEY
1. Participant selected, briefed, sign up and scheduling.
2. On the day, participant is assigned a number and a record sheet.
3. Participant undertakes journey tracked by coder. (Journey recorded)
4. Participant completes the journey and deposits record sheet at the laboratory.
5. Overall time is recorded on the Site Survey sheet.
5. Participant is debriefed and fills comments sheet.
6. Participant is requested to fill the User Environmental Survey (Appendix B) ????

IV. ADDITIONAL INFORMATION OF SITE
1. How many laboratories are there at this hospital?
2. What is the major function of each Laboratory?
3. Where is each located relative to Casualty? (descriptive and graphic)
4. What is the distance?
5. Suggest other scenarios for navigation test.

APPENDIX F: RESULTS OF THE WAYFINDING QUESTIONNAIRES

In this section the survey results for every question in the questionnaires are presented. The results are categorised as per the output obtained from the Statics Package for Social Sciences (SPSS). These results highlight the outputs as discussed in the data analysis.

Questionnaire 1

Gender

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	36	48.0	50.7	50.7
	Female	35	46.7	49.3	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Age

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 30	23	30.7	32.4	32.4
	31 - 50	36	48.0	50.7	83.1
	51 - 65	12	16.0	16.9	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Education level

EDU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	7	9.3	9.9	9.9
	Secondary	40	53.3	56.3	66.2
	University	21	28.0	29.6	95.8
	Other	3	4.0	4.2	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-4 Can you identify the meaning of the signs below?

PICTO1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	44	58.7	84.6	84.6
	Incorrect	8	10.7	15.4	100.0
	Total	52	69.3	100.0	
Missing	System	23	30.7		
Total		75	100.0		

PICTO2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	43	57.3	74.1	74.1
	Incorrect	15	20.0	25.9	100.0
	Total	58	77.3	100.0	
Missing	System	17	22.7		
Total		75	100.0		

PICTO3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	11	14.7	25.0	25.0
	Incorrect	33	44.0	75.0	100.0
	Total	44	58.7	100.0	
Missing	System	31	41.3		
Total		75	100.0		

PICTO4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	49	65.3	90.7	90.7
	Incorrect	5	6.7	9.3	100.0
	Total	54	72.0	100.0	
Missing	System	21	28.0		
Total		75	100.0		

PICTO5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	24	32.0	64.9	64.9
	Incorrect	13	17.3	35.1	100.0
	Total	37	49.3	100.0	
Missing	System	38	50.7		
Total		75	100.0		

PICTO6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	62	82.7	100.0	100.0
Missing	System	13	17.3		
Total		75	100.0		

PICTO7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	62	82.7	100.0	100.0
Missing	System	13	17.3		
Total		75	100.0		

PICTO8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Correct	28	37.3	53.8	53.8
	Incorrect	24	32.0	46.2	100.0
	Total	52	69.3	100.0	
Missing	System	23	30.7		
Total		75	100.0		

Q-5 Why are you here?

USER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Patient	22	29.3	31.0	31.0
	Visitor	26	34.7	36.6	67.6
	Other	23	30.7	32.4	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-6 Before today, how many times have you been to this hospital in the past year?

VISITS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	15	20.0	21.1	21.1
	Once	14	18.7	19.7	40.8
	2 - 4 times	42	56.0	59.2	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-7. Would you consider yourself familiar with the hospital? Rate from 5 - 1

FAMILIAR

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not familiar	16	21.3	22.5	22.5
	Slightly familiar	9	12.0	12.7	35.2
	Moderately familiar	18	24.0	25.4	60.6
	Familiar	7	9.3	9.9	70.4
	Very familiar	21	28.0	29.6	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-8 Did you come alone or did you come with someone to assist you?

ACCOMP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Alone	47	62.7	66.2	66.2
	With relative	5	6.7	7.0	73.2
	With friend	19	25.3	26.8	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-9 How confident are you that you will get to your destination? Rate from 5 - 1

CONFI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not confident	4	5.3	5.6	5.6
	Slightly confident	13	17.3	18.3	23.9
	Moderately confident	28	37.3	39.4	63.4
	Confident	12	16.0	16.9	80.3
	Very confident	14	18.7	19.7	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-10 Before you came today, were you given any directions or information to help you

INFO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Given directions	39	52.0	54.9	54.9
	Not given directions	32	42.7	45.1	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q-11 If yes, which of the following?

TYPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Spoken directions	43	57.3	100.0	100.0
Missing	System	32	42.7		
Total		75	100.0		

SOURCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	By relative	7	9.3	16.7	16.7
	By friend	28	37.3	66.7	83.3
	Another person	7	9.3	16.7	100.0
	Total	42	56.0	100.0	
Missing	System	33	44.0		
Total		75	100.0		

Q-13 Was the information given useful and easy to understand?

VALUE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Useful information	36	48.0	85.7	85.7
	Useless information	6	8.0	14.3	100.0
	Total	42	56.0	100.0	
Missing	System	33	44.0		
Total		75	100.0		

Q-14 When you arrived at the hospital was the entrance easy to see?

ENTRA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Can't remember	2	2.7	2.9	2.9
	Not visible	10	13.3	14.5	17.4
	Visible	57	76.0	82.6	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

Q-15 Once at the hospital what was your destination?

DESTIN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Laboratory	23	30.7	33.3	33.3
	Outpatient	34	45.3	49.3	82.6
	Wards	1	1.3	1.4	84.1
	4	7	9.3	10.1	94.2
	5	3	4.0	4.3	98.6
	6	1	1.3	1.4	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

Q-16 Had you been there before?

PREV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Been there	34	45.3	49.3	49.3
	Not been there	35	46.7	50.7	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

Q-17 Did you find your way there easily?

EASE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Easy find	34	45.3	49.3	49.3
	Difficult find	34	45.3	49.3	98.6
	3	1	1.3	1.4	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

If no, give reason _____

COMMT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		44	58.7	58.7	58.7
	!	31	41.3	41.3	100.0
	Total	75	100.0	100.0	

Questionnaire 2

Gender

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	37	49.3	51.4	51.4
	Female	35	46.7	48.6	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Age

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 30	52	69.3	72.2	72.2
	31 - 50	12	16.0	16.7	88.9
	51 - 65	8	10.7	11.1	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Education level

EDU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	1	1.3	1.4	1.4
	Secondary	17	22.7	23.6	25.0
	University	54	72.0	75.0	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Q-4 Upon entry through the hospital entrance, what was your destination?

DESTIN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Casualty / Outpatient	30	40.0	41.7	41.7
	Clinic / Laboratory	21	28.0	29.2	70.8
	Wards	21	28.0	29.2	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Q - 5 Upon entry through the hospital entrance,was there any wayfinding information system in sight to direct you towards your destination?

VISINFO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	35	46.7	48.6	48.6
	No	37	49.3	51.4	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Q - 6 If Yes, what was it?

TYPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Directory board	19	25.3	52.8	52.8
	Info desk	14	18.7	38.9	91.7
	Direction signage	3	4.0	8.3	100.0
	Total	36	48.0	100.0	
Missing	System	39	52.0		
Total		75	100.0		

Q - 7 If there was no wayfinding information system, what did you do next?

WTNXT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Guess direction	1	1.3	1.9	1.9
	Ask someone	40	53.3	76.9	78.8
	Follow people	11	14.7	21.2	100.0
	Total	52	69.3	100.0	
Missing	System	23	30.7		
Total		75	100.0		

Q - 8 Was the information presented helpful in directing you to your destination?

HELPFUL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	55	73.3	80.9	80.9
	No	13	17.3	19.1	100.0
	Total	68	90.7	100.0	
Missing	System	7	9.3		
Total		75	100.0		

Q - 9 What is your level of satisfaction with the information given at this point?

SATISFAC1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not satisfied	5	6.7	6.9	6.9
	Slightly satisfied	16	21.3	22.2	29.2
	Moderately satisfied	20	26.7	27.8	56.9
	Satisfied	13	17.3	18.1	75.0
	Very satisfied	18	24.0	25.0	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

Q - 10 Were there signs or other cues along the path to your destination?

SIGNS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	42	56.0	60.9	60.9
	No	27	36.0	39.1	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

Q - 11 Was the information presented along the path legible?

LEGIBILITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Confusing	9	12.0	13.0	13.0
	Not clear	9	12.0	13.0	26.1
	Moderately clear	26	34.7	37.7	63.8
	Clear	6	8.0	8.7	72.5
	Very useful	19	25.3	27.5	100.0
	Total	69	92.0	100.0	
Missing	System	6	8.0		
Total		75	100.0		

Q - 12 Did you use the signs or other cues along the path to help you reach your destination?

ASSISTEASE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not useful	14	18.7	20.0	20.0
	Slightly useful	4	5.3	5.7	25.7
	Moderately useful	19	25.3	27.1	52.9
	Useful	8	10.7	11.4	64.3
	Very useful	25	33.3	35.7	100.0
	Total	70	93.3	100.0	
Missing	System	5	6.7		
Total		75	100.0		

Q - 13 Was there ONE element of wayfinding that stood out along the route to your destination?

LANDMARK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	41.3	43.7	43.7
	No	40	53.3	56.3	100.0
	Total	71	94.7	100.0	
Missing	System	4	5.3		
Total		75	100.0		

Q - 13b If YES, Please describe the outstanding element.

DESCRIP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		44	58.7	58.7	58.7
	3	31	41.3	41.3	100.0
	Total	75	100.0	100.0	

Q - 14 Would you remember this element as a guide at a future visit to the hospital?

RECALL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not memorable	10	13.3	15.6	15.6
	Slightly memorable	4	5.3	6.3	21.9
	Moderately memorable	13	17.3	20.3	42.2
	Memorable	9	12.0	14.1	56.3
	Very memorable	28	37.3	43.8	100.0
	Total	64	85.3	100.0	
Missing	System	11	14.7		
Total		75	100.0		

Q-15 How would you rate your level of finding your way to your destination?

EASE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very difficult	10	13.3	13.9	13.9
	Difficult	10	13.3	13.9	27.8
	Normal	28	37.3	38.9	66.7
	Easy	7	9.3	9.7	76.4
	Very easy	17	22.7	23.6	100.0
	Total	72	96.0	100.0	
Missing	System	3	4.0		
Total		75	100.0		

APPENDIX G: RESULTS OF WAYFINDERNAVIGATION TEST

Experiment 1

Gender

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	11	55.0	55.0	55.0
	Female	9	45.0	45.0	100.0
	Total	20	100.0	100.0	
Missing	System	0	0		
Total		20	100.0		

Age

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 30	20	100	100	100
	31 - 50	0	0	0	100
	51 - 65	0	0	0	100.0
	Total	0	0	100.0	
Missing	System	20	0		
Total		0	100		
		20			

Education level

EDU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	0	0	0	0
	Secondary	0	0	0	0
	University	20	100	100	100
	Other	0	0	0	0
	Total	20	100	100	100
Missing	System	0	0		
Total		20	20		

Q-4 What is your start location?

STAT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	Out patient	20	100	100	100
	Total	20	100	100.0	
Missing	System	0	0		
Total		20	100		

Q-4 What is vour destination?

END

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Microbiology Lab	20	100	100	100
	Total	20	100	100.0	
Missing	System	0	0		
Total		20	100		

Q-4 Is there any information leading you to your destination?

INFO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	10	10	100
	No	18	90	90	100.0
	Total	20	100	100.0	
Missing	System	0			
Total		20	100.0		

Q-10 What is your next move from this point?

NXTMV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Follow sign	1	5	5	5
	Guess direction	4	20	20	25
	Ask someone	10	50	50	75
	Follow people	4	20	20	95
	Abandon journey	1	5	5	100.0
	Total	20	100	100.0	
Missing	System	0	0		
Total		20	100.0		

Q-11 What is your level of satisfaction with the information at this decision point?

SATISFAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very satisfied	1	5	5	5
	Satisfied	2	10	10	15
	Moderately satisf	4	20	20	35
	Slightly satisfied	5	25	25	60
	Not satisfied	8	40	40	100.0
	Total	20	100	100	
Missing	System	0	0	0	
Total		20	100.0		

Wayfinder Navigation Test

Experiment 2

GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	6	42.9	42.9	42.9
	Female	8	57.1	57.1	100.0
	Total	14	100.0	100.0	
Missing	System	0	0		
Total		14	100.0		

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 30	14	100	100	100
	31 - 50	0	0	0	100
	51 - 65	0	0	0	100.0
	Total	0	0	100.0	
Missing	System	14	100		
Total		0	100		
		20			

EDU

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	0	0	0	0
	Secondary	0	0	0	0
	University	14	100	100	100
	Other	0	0	0	0
	Total	14	100	100	100
Missing	System	0	0		
Total		14	14		

Q-4 What is your start location?

STAT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	Out patient	14	100	100	100
	Total	14	100	100.0	
Missing	System	0	0		
Total		14	100		

Q-4 What is your destination?

END

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Microbiology Lab	14	100	100	100
	Total	14	100	100.0	
Missing	System	0	0		
Total		14	100		

Q-6 Is there any information leading you to your destination?

INFO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	13	92.9	92.9	92.9
	No	1	7.1	7.1	100.0
	Total	14	100	100.0	
Missing	System	0			
Total		14	100.0		

Q-10 What is your next move from this point?

NXTMV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Follow sign	13	92.9	92.9	92.9
	Guess direction	0	0	0	92.9
	Ask someone	1	7.1	7.1	100.0
	Follow people	0	0	0	100.0
	Abandon journey	0	0	0	100.0
	Total	14	100	100.0	
Missing	System	0	0		
Total		14	100.0		

Q-11 What is your level of satisfaction with the information at this decision point?

SATISFAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very satisfied	9	64.3	64.3	64.3
	Satisfied	3	21.4	24.4	85.7
	Moderately satisf	1	7.1	7.1	92.8
	Slightly satisfied	1	7.1	7.1	100.0
	Not satisfied	0	0	0	100.0
	Total	14	100	100	
Missing	System	0	0	0	
Total		14	100.0		

APPENDIX H: RESEARCH PERMIT AND AUTHORISATION

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

GPK 6055—3m—10/2003

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS—*see* back page)

PAGE 2

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss GACHIE STEVE NJOROGE.

of (Address) UNIVERSITY OF NAIROBI, P.O. BOX 30197, NAIROBI.

has been permitted to conduct research in

.....Location,

NAIROBI .....District,

NAIROBI .....Province,

on the topic ENVIRONMENTAL GRAPHIC COMMUNICATION: A STUDY OF WAY FINDING IN KENYAN HOSPITALS.

for a period ending 31st DECEMBER 2010.

PAGE 3

Research Permit No. NCST/5/002/R/004=C

Date of issue 11TH DECEMBER, 2008.

Fee received KSHS.1000/=

Applicant's Signature

Permanent Secretary Ministry of Science and Technology

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
Telephone: 254-20-241331, 241349,
254-20- 241761, 241376,
Fax: 254-20- 213215
When replying please quote

P. O. Box 30623 –00100
NAIROBI- KENYA

REF: NCST/5/002/C/004 - E.

11th December, 2008.

Gachie Steve Njoroge,
University of Nairobi,
P.O. Box 30197,
NAIROBI.

Dear Sir,

RESEARCH AUTHORIZATION

Following your application for Authority to Conduct Research on: - "**Environmental Graphic Communication: A Study of Way finding in Kenyan Hospitals,**" I am pleased to inform you that you have been authorized to undertake your Research in Nairobi for a period ending 31st December, 2010.

You are advised to report to the director of medical Services and the Directors of the Hospitals you intend to visit before embarking on your Research Project.

Yours Faithfully,

Jane L. Chokaa
FOR: SECRETARY

cc: -The Director of Medical Services,
Ministry of Health.

-The Director,
Kenyatta National Hospital.

-The Director,
Agakhan Hospital.

-The Director,
Nairobi Hospital