Personal Space

In a

Public Space

In context to its optimal use

(Case Study Karlplatz, Bernburg, Germany)

Bernburg
Dessau
Köthen

Hochschule Anhalt (FH)
Anhalt University of Applied Sciences

MASTER THESIS

Tariq Mushtaq

4061253

1St Supervisor: Prof. Dr. Mathias Pietsch

2nd Supervisor: Prof. Dr. Nicole Uhrig

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Declaration of Authorship

Personal declaration: This thesis for the master degree is the result of independent research under the supervision of my supervisors. Any views expressed in this, thesis are those of personal work, except where the thesis specifically states them to be the views of other people's outstanding work. All the significant contributors for the research have been clearly stated in the thesis already. I totally realized that the legal result of this declaration which will be taken on behalf of myself. This Master Thesis has not been submitted for the award of any other degree or diploma in any other institution.

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Abstract

Keywords

Personal space, Public space, Edward T.Hall's (1966) model of interpersonal distances, Public Land consumption, Public land management, spatial analysis, spatio-temporal analysis, Public space behavior, Personal postures, urban ecology

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We are living in a globalized world which is highly volatile demographically. The demographic instability of the world can be seen everywhere from far Eastern and south Asian countries, where demographic instability is due to population growth rate, urbanization and migration. European demographics are also changing very quickly due to civil war in Middle East. Due to this abrupt population change public land consumption is also set to change. In order to keep continuous supply of land, future lies in a better public land management. This research project is based on similar concept to explain certain public space parameters like occupancy, capacity and sufficiency especially in context to its optimal use.

The phenomena of personal space have been in the discussion for quite some time but mostly studied by sociologist and psychologists. Personal space has psychological as well as physical meanings. It has a certain spatial radius and has already been defined by Edward T.Hall (1966) in his model of interpersonal distances. The title chosen for this study "Personal Space in a Public Space" means that personal space in a physical or material context. In this study personal space, Edward T.Hall 1966 model of interpersonal distances) has been tested, validated and used to analyze public space.

The context of the study is the optimal use of public space, in spatial terms but not in behavioral terms though some local behavioral aspects have been used to analyze use of public space. The thesis has a proper scientific structure where a research question has been devised with four hypothesis statements. Each statement then proved right or wrong on the basis of experimentation, calculation, and results. Field study is based on reconnaissance survey, Questionnaire, tape measurements, photography, satellite imaging. It also involves public space behavior study to understand the use of public space. Interviews are also part of studying local public space behavior. Personal posture was observed and consulted with TSS LA[1] (Charles & Nicolas, 1998) for available information and for unavailable information, new postures information has also been defined. Personal postures with their relative ground impacts were calculated and compared with the personal space impact defined by Edward T.Hall (1966) to validate whether personal space is suitable enough space required for a person in a public space, or not. This personal space when proved enough then further used in spatiotemporal analysis, spatial analysis to further define occupancy, capacity, and sufficiency of a public space taken as a case study i.e. Karlsplatz, Bernburg, Germany. Some of the results of this study are universal in nature and can be applied anywhere in the world in a similar context but others may need local considerations.

Results of the study may help to better understand small urban spaces, to understand their composition, need for space, useable spaces, local culture of public space use and several other aspects of urban ecology.

[1] Times Savers Standards for Landscape Architecture

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Chapter 1. Introduction

Landscape architecture defines the art of living for the human being from a home garden to public space. There are two very general kinds of spaces i.e. private space and a public space. A human being is highly adaptive and keeps on changing its psychological approach with the change of space but some traces of its psychological urge remains unchanged and therefore it exhibits some intricate psychological phenomena which lead to change its approach in public spaces. As soon as human moves out from a private space to a public space, it starts wearing intimate, personal, social space bubble as a protection to its self-intimation.

In an urban environment, human interacts with each other as well as with their surroundings as a part of the urban ecology. Human interaction among themselves and with space provides impetuous in this study to improve public spaces in reference to personal space.

The World can be divided into two types of countries; firstly, countries with low population and flourishing economies and secondly, countries with exploding population and developing economies. The first type of countries have a very high quality of life and they have created means to manage the high quality of life as they were not facing the challenges of abrupt population growth; like countries in EU and USA. The second type of countries are with very high economic growth but they are also facing massive population growth challenges. They are facing challenges to handle the hurdles in order to achieve the quality of life. A quality of life is next highest demand in these developing economies. For example China, India, Pakistan, Bangladesh etc. China is a unique example in such a way that it is economically highly developed country but due to unequal population distribution between western China and rest of China makes her vulnerable to similar density problems faced by other developing economies like India and Pakistan. Once the phenomena of the quality of life demand find a way into these societies, it could create immense public space planning opportunities. Quality of a life is directly related to the quality of public spaces. High population, handsome buying power will not only affect the supply of land in these countries but it will also affect the demand and supply of land.

Land management is one of the most prominent aspects which can adhere the challenges and opportunities, related to post economic boom and the quest for quality of life. Public spaces are different in the sense that they come with the public rights of handling and provisions. Public spaces are not mere spaces but spaces with communal public interests. Therefore dealing with public spaces require public participation and public interests. Public interests to handle a public space is a two prong phenomena, firstly, what people think about public spaces? And secondly, what they actually do or want to do in public spaces? Therefore in order to study public spaces or to deal with a public space, local behavior also play very important role in decision making and reaching any decisive conclusion.

Edward T. Hall (1914-2009) was an American anthropologist and cross-cultural researcher. He is remembered for developing the concept of proxemics[2] and exploring cultural and social cohesion and describing how people behave and react in different types of culturally defined personal space.

“Proxemics is the study of the spatial requirements of humans and animals and the effects of population density on behavior, communication, and social interaction”.[3] Edward T. Hall (1966), the cultural anthropologist who coined the term in 1963, defined proxemics as "the interrelated observations and theories of man's use of space as a specialized elaboration of culture."[4]

Public space, in its provision, design, law and use, is a neutral Space. What makes a Space neutral or un-neutral in order to find out we need to look into different social experiments performed by various sociologists on human behavior in public space especially Edward T. Hall ,(1966).

In this project, a small public space, Karlplatz, located in Bernburg, Germany is being studied in context to its optimal use on the basis of personal space as a tool to define occupancy, capacity, and sufficiency of a public space. All three are the main reflectors of the quality of a healthy social life.

1.1 **Target group**

This thesis audience is landscape architects and urban planning students in general and public administration, public bodies, municipalities in particular.

1.2 **Personal motivation**

I would like to explain my educational and professional background to give a glimpse of actually who am I? I studied pre-medical in high school and intended to be a medical physician but soon I realize I am more comfortable with engineering rather medical but at least, I have a reasonable botany and zoology background. I joined engineering university and chose to study City and Regional Planning being a new field in my country. After doing my Bachelor’s degree, I worked in Geomatics, from town mapping to road surveys, dam surveys and moved abroad in a company based in Saudi Arabia and continued as a project manager in a geomatics and GIS-based company. I have a reasonable background in sociology, economics, geomatics and geography for planners. I feel comfortable in interdisciplinary research because it provides more space for reasoning. It also provides an ample opportunity to implement techniques learned from one discipline to another discipline. My personal intent is to use my interdisciplinary approach in this project because this topic provides an opportunity to implement some of those techniques.

[2] Edward T.Hall (1966). The Hidden Dimension. ISBN 0-385-08476-5. P.1

[3] http://www.dictionary.com/browse/proxemics?s=t; Retrieved on March 14, 2017

[4] Edward T.Hall (1966) (1966). P.1

1.3 **Proposal**

1.3.1 Research Questions:

How can personal space phenomena be used to determine certain Public Space parameters in context to its optimal use?

a) Occupancy of a Public Space
b) Capacity of a Public Space
c) Sufficiency of useable Space

Use of public space has definitely something to do with human psychology. In my personal view, the public spaces should be defined by personal space phenomena rather just spaces. In this research I will try to create a link between personal space and public space and to find out physical occupancy at a certain point of time through spatiotemporal technique, capacity of a public space by GIS spatial analysis technique, sufficiency of useable space in a public space by simple geomatics technique, sun penetration, availability of infrastructure, availability of sufficient space, personal interests, availability of vistas and space level of invitation to user, connectivity of different types of public spaces in a certain proximity?

1.3.3 Hypothesis

There are four research questions which are very interdependent, one can avoid limiting the hard work. In this project, all four have been taken into account, as these may facilitate to supplement each other to resolve thesis.

Statement 1:

a. Personal space changes with the change of personal posture[5].

"It is assumed that people in different posture occupy different space, therefore each distinctive posture[6] should be measured and compared with standard personal Space."

Statement 2:

b. Occupancy of a public space can accurately be determined only by considering corresponding personal space posture.

5 Personal space: In this project, it can be defined as the position in which someone holds their body when standing or sitting with or without some aid (walking, sitting, walking trolley, bicycle, mechanized chair, baby stroller etc.)
6 Posture: the position in which someone holds their body when standing or sitting.
"I got out of the car in an alert posture" Synonyms: position, pose, attitude, stance

"If personal space changes with a change in personal posture, then occupancy based on personal posture should be different from standard personal space[7]."

Statement 3:

c. The actual capacity of a public space can be determined on the basis of personal space.

"If personal space applied to a public space, actual capacity can be determined."

Statement 4:

d. Personal space can be used to determine the sufficiency of a public space.

"If personal space applied to occupancy and capacity of a public space it can also determine the sufficiency of a public space"

1.4 Research Method

There are three main approaches used in this project first Analysis of personal posture, second GIS mapping and analysis and third personal questionnaire from the people present in public space.

1.4.1 Personal Posture Analysis

Personal postures will be analyzed from TSS for LA[8] (Charles, W., & Nicolas, T. (1998)) and some of the manufacturer specifications if not available in the TSS for LA.

1.4.2 GIS Techniques:

1.4.2.1 Spatial analysis

Google OSM[9] data will be used to perform and separate different functional spaces in public spaces. OSM data will also be enhanced by further mapping in order to perform required spatial analysis inside the public space.

1.4.2.2 Spatio-temporal analysis

This analysis may involve two types of data from

a) Infrastructure and green infrastructure Mapping
b) Mapping of People Project

[7] Standard personal space: It is personal space radius defined by Edward T.Hall (1966) in his model.

[8] Times Saver Standards for Landscape Architecture (Charles, W., & Nicolas, T. (1998))

[9] Google Open Street Map

Firstly, Mapping of all types of infrastructure in public space so that it can be cross investigated with people presence. Secondly, recording of people presence in public spaces at a particular point of time for example morning, afternoon or evening, on the same day through photographic technique and then it will be converted to map form to study people presence. The second method is to find or develop a basic custom mapping product to map people in public space. Thirdly, people can be mapped by just marking on the hard map in the field. It can help to study people to people and people to space interaction and ultimately can help to draw some useful information. A most potent method will be adopted which can help ultimately record people positions and could be used in the project.

1.4.3 Psycho spatial analysis (Questionnaire)

A small questionnaire will also be conducted to know what people think about public space use and results will be compared with what actually people do in public spaces regarding occupancy, presence, personal posture, peak hour, the frequency of visit, and purpose of presence.

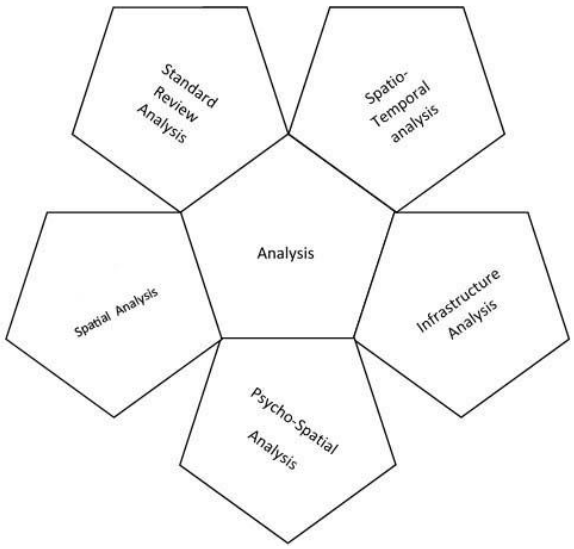

Fig: 1 Analysis matrix

1.5 Challenges

Human behavior is the most profound attribute to study but studying it in relation to space make it more intricate to draw comprehensible conclusions.

Man mapping is a second immense challenge in this project. There are several digital techniques being discussed these days, for example, mobile phone geo-location live data and mobile phone passive data from phone company servers.

Man mapping task is tedious but in this project, it will be achieved from site photography and then it will be reduced by marking it in digital vector drawing in GIS software.

Another challenge is to analyze man mapping data for interaction, proximity, and in personal space context.

1.6 Objectives & Scope

Personal Space is, though a psychological frame of mind but it sometimes exists physically. Therefore public space in relation to personal space will be sought to study in this project.

There are four major objectives of this project;

1.6.1. Occupancy of a Public Space:

In this project occupancy of a public space will also be measured and a relationship between capacity and occupancy be established.

1.6.2. The capacity of a Public Space:

The global population is on the way to growth and demand for public space is also increasing. It is a fact that in both established economies like China, and emerging economies like India, Indonesia, Brazil, Pakistan and Bangladesh public space demand is very high. Therefore there should be some established criteria to find out the actual capacity of a public space so that it can be managed according to a number of users. This project is one of such effort to measure actual capacity of a useable public space.

1.6.3. Sufficiency of useable Space:

Capacity and occupancy of a public space will help to clear the picture that either available space is sufficient or not.

1.7 **Structure of the Report**

Chapter 1. It is about the introduction of this thesis project, its background and reason for the choice of this topic. It is the summary of my project, including target group, my personal motivation, project proposal, research question, statement of hypothesis, research methods adopted, all expected challenges, objectives, and scope of this work, and structure of report for each chapter content.

Chapter 2. It is about "Related literature and theoretical focus". This chapter has nine sections. Each section explores a very close relevant book to this project and theoretically picks one of the ingredients of this project and try to prove it.

This chapter is to discuss a theoretical support of the research questions. As the first step in section 2.1, where the idea of this project came from is explained under "Inspiration".

Section 2.2, discusses the human nature of being a social animal from Aristotle book 1 named "Politics". A human being a social animal and how it behaves and should behave and should be dealt with the landscape, social studies and design process.

Section 2.3 is about personal space derivatives using the research of a renowned sociologist book" The hidden Dimensions" (Edward T.Hall 1966). It will discuss, the concept of critical distance, Personal distance, social distance and social environment in animals based on that a set of phenomena personal space and public space has logically been elaborated for understanding. Major discussion on this topic is to prove that

what is different psychological forms of spaces and what is their interactive relationship from animal to the human level.

In Section 2.4 of this chapter “Public Space Status of Commercial Streets and Unban Square” has been discussed and proved from the book “The sociology of urban public spaces”(Stéphane Tonnelat 2010) It is also a real matter of concern that whether the site selected for this project proved to be a Public space or not. In this topic evidences of proof has been brought together that a commercial street and an urban square or a small market place fits the status of Public Space as it fulfills all required sets of parameters for its qualification.

In Section 2.5 of the chapter “People Distribution in Public Spaces” has been discussed in the light of “The Social Life of Small Urban Spaces” (H. Whyte 1980). There are certain distribution parameters which help to understand public spaces and their use. What are the favorite spaces for users? How they occupy spaces? What are available choices and their preferences? What are possible positions and locations? For instance standing in groups and crowding, sitting at stairs and plaza ledges or sitting on the front and the back.

In Section 2.6 of the chapter “Temporal character of public spaces and occupancy” has been discussed in the light of the book:” Image of the City, by Kevin Linch(1960)”. Secondly, a need for public spaces as a mean to satisfy emotional desire has also been discussed with its achievements and failures in the form of a comparison. Public participation is also very important while designing new public spaces as well as managing existing. A need for public participation with some of its implications has also been discussed.

In Section 2.7 social Identity of public spaces on the basis of six important characters has been discussed.

In Section 2.8 Personal space postures and their standards have been discussed in the light of TSS for LA [10] and some from the field study and research.Some postures were not included in the TSS for LA, therefore has been searched from other sources.

In Section 2.9 Some uses of GIS and its criticism has been discussed in the light of GIS best practices.

Chapter 3. It is about details of methods applied in the project and their particular analysis. In the first section, a process chart with herircy of the steps, a personal posture analysis is discussed in the compliance with TSS for LA[11]. In the second section, spatial analysis is discussed. In the third section, spatiotemporal analysis is discussed. In section four psych spatial analysis, which is actually a questionnaire has been discussed.

Chapter 4. It is about the case study,introduction to the selected site, and descriptions of the functions of different areas.

[10] Charles, W., & Nicolas, T. (1998)
[11] Charles, W., & Nicolas, T. (1998)

Chapter 5. It is about data processing, calculations, assessment and Results. Structure of this chapter is based on the hypothesis statements and corresponding data and analysis are in it contents under each hypothesis statement in order.

Chapter 6. This chapter is about discussion and recommendations.

Chapter 7. It is about conclusions of the project.

Chapter 8. It is about future prospects of this research and what further could be done in this regards.

Chapter 2. Related literature and theoretical focus

2.1 Inspiration

We are living in an era of the information highway, where we come across an abundant amount of knowledge and information. We have a lot of knowledge about things around us but there are some areas still shadowed. These areas leave open ended questions which are yet to be answered. These open-ended questions sometimes are very easy to answer but because of different reasons, have remained untouched. The reason could be internal disciplinary barriers, technical knowledge barriers, reasoning, dimensions of the researchers or sometimes interdisciplinary buffers zones. Knowledge in the interdisciplinary gray areas as shown in the (Fig.2) leaves open-ended questions. In this thesis again the research question may look very simple and easy but is of profound importance and practical importance. The results may impact the economy of the land use, the cost of land, space use, space behavior etc.

Lygometry ("lygo": latin for shadow or darkness "Metry": Measurement) so lygometry is a process where you measure things you know that you do not know, questions on knowledge that you know you don't have, it's like searching or asking the questions about those dark or shadowy places which you know nothing about. It is newly coined term by a Harvard University Scholar named Amin Tuofani. "Amin is the Vice President of Strategic Relations and Director of the strategy at Singularity University. He brings a unique set of technological, entrepreneurial and policy perspectives to the dialogue of innovation on campus."[12]

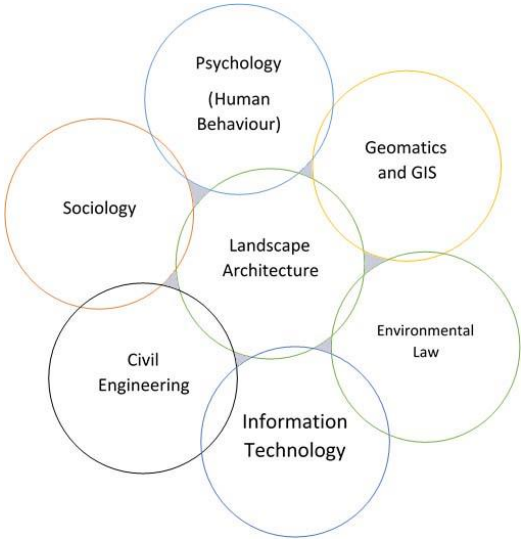

Fig: 2 Interdisciplinary knowledge and grey areas

I used his idea of "lygometry" to explore the world around me to find something interesting for me to work on. I studied personal space in sociology and public space in landscape architecture and combined both in this project to find something interesting and meaningful. A nascent idea is that as personal space is a space required by each person, it should be used as a yardstick to measure the use of space in public spaces. Above Fig: 2 is a graphical form to explain the idea of lygometry as understood.

[12] Introduction of Amin Tuofani _ https://su.org/about/team/amin-toufani/

2.2 **Human Status as a Social Animal**

Book **"Politics Book I"** Aristotle (384 BC – 322 BC)

Aristotle (384–322 BC) is one of the first intellectual to study man in context to society and he mentioned in his Book I: Politics

"……man is by nature a political animal, and a man that is by nature and not merely by fortune city less is either low in the scale of humanity or above it."[13]

If the man is a social animal, what is the level of his want for personal space in public space? Human is a social animal according to Aristotle and being a social animal human has quiet intricate psychology. Human likes to live alone as well as likes to interact. Animals are usually born with many instincts like how to walk, what to eat etc.

The term "instinct" in psychology was first used in the 1870's by Wilhelm Wundt a German Psychologist and the father of experimental psychology. An Instinct is "A behavior that is genetically programmed into an entire species"[14]. Thus, the behavior is not the result of learning and can be seen in all the members of a species. For example, there is specific nest building behavior that is part of different species of birds. If you hatch one of these birds in captivity and raise it without any contact with any other members of its species, it will still do those species-specific nest building behavior."[15] Therefore we can say that Instinct is those which certain species carry by birth and are not required to learn from their environment. It is an innate characteristic in nature. In terms of genetics, it is in blood and genes of a species.

Whereas a "Behavior is the range of actions and mannerisms made by individuals, organisms, systems, or artificial entities in conjunction with themselves or their environment, which includes the other systems or organisms around as well as the (inanimate) physical environment. It is the response of the system or organism to various stimuli or inputs, whether internal or external, conscious or subconscious, overt or covert, and voluntary or involuntary". [16]

Fig: 3 Western lady in South Asian dress

Behavior is what species learn from their environment or the world outside. Unlike other animals human is born without many such instincts rather human is dependent on parents and society to learn, therefore it becomes behavior. Behaviour is actually a species characteristic which subjects

[13] (Aristotle, 384-322 BC) Aristotle, Politics1; 1253a Chapter 2 (9)

[14] https://www.alleydog.com/glossary/definition.php?term=Instinct

[15] Elizabeth A. Minton, Lynn R. Khale (2014). *Belief Systems, Religion, and Behavioral Economics*. New York: Business Expert Press LLC. ISBN 978-1-60649-704-3.

[16] Elizabeth A. Minton, L. R. (2014). *Belief Systems, Religion, and Behavioral Economics.* New York: Business Expert Press LLC. ISBN 978-1-60649-704-3

Fig:3 https://www.jovago.net/blog/wp-content/uploads/2016/07/12248084_991940730870697_2419579201336298369_o-1024x683.jpg

it to evolution and an initiation of the environmental development process. It is because of the behavior that human living apart in geography behave quite differently, towards their environment as well as species. They follow different norms and values, cultures and traditions, rules and regulations. They have devised different sets of lifestyles and even foods and tastes.

For example, Chinese eat and wear differently than Europeans. Mexican and Indians use different spices than rest of the world. Middle Eastern have different laws and justice system than rest of the world, the whole world has different religion and lifestyle. While living one's own culture other cultures look so odd but after spending some time in other culture one start wearing and eating same clothes and food and start appreciating that culture. This is just by the virtue of "behavior" learning from society and environment.

2.3 **Personal Space Derivatives**

Book **"The Hidden Dimensions,** (Edward T.Hall 1966)

Space has two theoretical narratives, Physical and psychological. The physical narrative is quite known and understood by masses but the psychological narrative is not well known and not discussed often. This section will shed light on the psychological state of space and its physical narrative. Personal space has previously discussed in it psychological manifestation but in this section, it will be rediscovered as a physical space. Space is discussed by psychologists and sociologists in different ways than geographers and landscape architects. It will bring both views at a unified point of mutual interest and understanding. Edward T.Hall (1966) in his book "The Hidden Dimensions" discussed space in distance context.

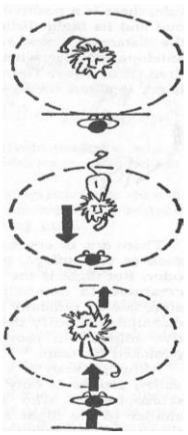

Fig: 4 Critical Distance Circle (Edward T.Hall 1966)

2.3.1 Critical Distance:

Spaces are subject to measure and the measure changes according to the psychology, use and sometimes size of the user. People with longer legs may need more space than a normal person. People may also have psychological inclination to occupy extra space, for relieving, safety or just solitude.

Critical distance could be that immediate circle within which one may feel a compound solitude satisfying his personal space occupancy,

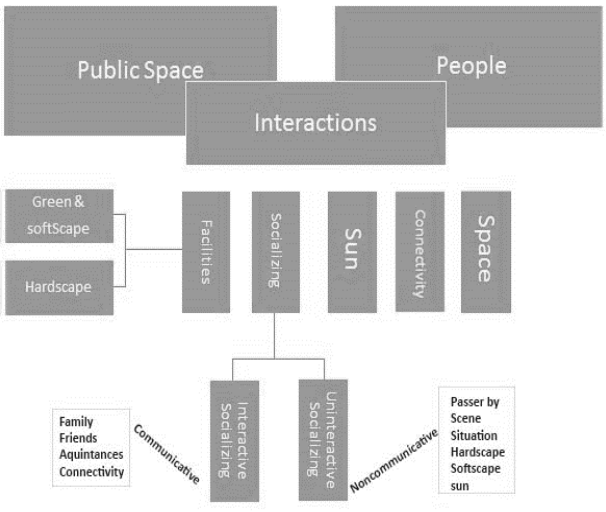

Fig: 5 Derivative steps of Space Concept

sufficiency, relieve and safety. “Hediger (1955) says the critical distance for the animals he has knowledge of is so precise that it can be measured in centimeters”[17]. According to Edward T.Hall (1966) “Critical distances or zones apparently are present wherever and whenever there is a flight reaction. “Critical distance” encompasses the narrow zone separating flight distance from attack distance”[18].

2.3.2 Personal Distance:

“Personal distance is the term applied by Hediger (1955) to the normal spacing that noncontact animals maintain between themselves and their fellows. This distance acts as an invisible bubble that surrounds the organism. Outside the bubble, two organisms are not as intimately involved with each other as when the bubbles overlap. Social organization is a factor in personal distance.”[19] Critical distance evolves into the personal distance which becomes the basis to define personal space. Human beings as social animals have learned and adapted to adjustment in this minimal essential distance.

2.3.3 Interaction:

In a compound environment where living and non-living coexist interaction may occur. Interaction is a phenomenon of personal space sharing. In a human subject environment this interaction generally extra personal and especially interpersonal. Extra personal interaction is the interaction of the human with everything living and non-living in the surrounding. For example human interaction with plants, space, facilities, the sun, and shade etc.

Interpersonal Interaction is between and among human beings themselves. These interactions are sometimes based on space sharing but sometimes without sharing any physical space.

Interactions could be communicative like space sharing, chatting or coming close together in any possible form or manifestation and non-communicative like watching passer-by, scene or situation. People use their senses while interacting in both forms explained by Edward T.Hall (1966); “…….How the senses are used by different peoples, as they interact with their living and non-living environment, provides concrete data on some of the differences”.[20]

“This implicit (and often explicit) belief concerning man's relation to experience was based on the assumptions that, when two human beings are subject to the same "experience," virtually the same data are being fed into the two central nervous systems and that the two brains record similarly”[21].

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[17] Edward T.Hall (1966). The Hidden Dimension. ISBN 0-385-08476-5; P 12
[18] Edward T.Hall (1966). P 12
[19] Edward T.Hall (1966). P 13-14
[20] Edward T.Hall (1966). P 3
[21] Edward T.Hall (1966). P 2

2.3.4 Social Distance:

A human being social animal "Social animals need to stay in touch with each other. Loss of contact with the group can be fatal for a variety of reasons including exposure to predators. Social distance is not simply the distance at which an animal will lose contact with his group—that is, the distance at which it can no longer see, hear, or smell the group—it is rather a psychological distance, one at which the animal apparently begins to feel anxious when he exceeds its limits. We can think of it as a hidden band that contains the group"[22]

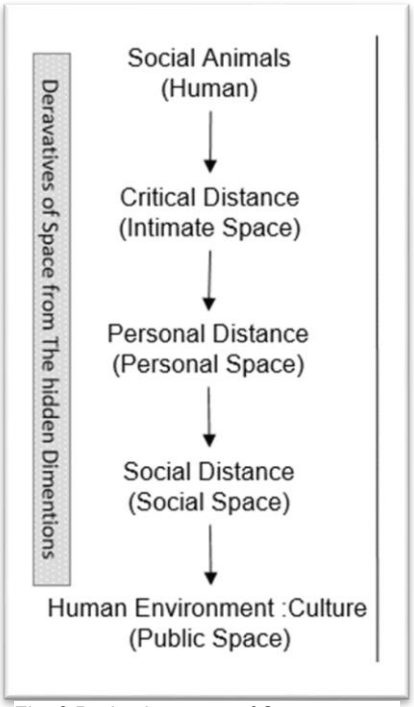


Fig: 6 Derivative steps of Space Concept; Derived Edward T.Hall (1966)

2.3.5 Human Environment:

Human interaction with its surroundings is a ground rule to form an environment which could be termed as a culture. According to Edward. T.Hall (1966); "Man has created a new dimension, the cultural dimension, of which proxemics is only a part. The relation-ship between man and the cultural dimension is one in which both man and his environment participate in moulding each other"[23]

The pattern of human living in its much-created environment is human culture. According to John Christian and V. C. Wynne-Edwards. "As man developed culture he domesticated himself and in the process created a whole new series of worlds, each different from the other. Each world has its own set of sensory inputs so that what crowds people of one culture does not necessarily crowd another"[24].(Wynne-Edwards, 1962) "He is distinguished from the other animals by virtue of the fact that he has elaborated what I have termed extensions of his organism. By developing his extensions, man has been able to improve or specialize various functions. The computer is an extension of part of the brain, the telephone extends the voice, and the wheel extends the legs and feet. Language extends experience in time and space while writing extends the language. The man has elaborated his extensions to such a degree that we are apt to forget that his humanness is rooted in his animal nature"[25]. "In creating this world he is actually determining what kind of an organism he will be".[26]

[22] Edward T.Hall (1966) P 14
[23] Edward T.Hall (1966) P 4
[24] As cited John Christian and V. C. Wynne-Edwards by Edward T.Hall (1966). P 6
[25] Edward T.Hall (1966). P 3
[26] Edward T.Hall (1966). P 4

2.3.6 Space Derivatives Learned from The Hidden Dimensions:

This book "The Hidden Dimensions" has proved very valuable to determine the core dimensions of space and relationship between human and space. As shown in (Fig.6) personal space derivative has been determined from the book "The Hidden Dimensions" Edward T.Hall (1966).

2.4 **Public Space Status of Commercial Streets and Urban Square**

Book **"The sociology of urban public spaces** (Stéphane Tonnelat 2010)

2.4.1 What is a Public Space?

First of all determinant of a public space is required and then the question arises that whether a commercial street and a square fit to the criteria of a public space or no. In the following discussion, a commercial street and a public square will be proved as a public space.

"In urban planning, public space has historically been described as "open space", meaning the streets, parks and recreation areas, plazas and other publicly owned and managed outdoor spaces, as opposed to the private domain of housing and work."[27]

"However, the recent evolutions of the forms of urban settlement and the growing number and variety of semi-public spaces managed by private-public or entirely private partnerships questions this notion inherited from a legal perspective. Somehow today, public space needs to be understood as different from the public domain of the state and its subdivisions, but rather as a space accessible to the public. In terms of law, it is perhaps closer to the older concept of the "commons", although we have to recognize that today, at least in the western world, every bit of land is now regulated by the laws of property making it difficult to consider anything as common without encountering an entitled owner and manager"[28]. "In fact, the notion of public space is perhaps better captured by the social sciences. Here two separate conceptions have been until now leading an almost independent existence". In political philosophy, the concept of the public has drawn an important inspiration from the notions of the Greek agora and the Roman forum, taken as ideal models of public areas where the public affairs of the city are discussed among an assembly of equal citizens." [29]

"For, our western civilizations have only gone down since this golden age of democracy".[30] However, "for building on Immanuel Kant's work, forums of public discussion have re-emerged in the 18th century under

[27] Tonnelat, S. (2010). The sociology of urban public spaces. *SFURP, Sino French Urban Planning Conference* ;P 1. Paris: Atlantis Press.

[28] Tonnelat, S. (2010). The sociology of urban public spaces. ;P 1

[29] As cited Blackmar, 2006 by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 1

[30] As cited (Hannah, 1958) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 1

the guise of the bourgeois salons, thus re-enacting a public sphere, of course less situated in space than the agora, but able to question and challenge the actions of the monarchs and the state".[31]

"Sociology has paid more attention to the physical venues of the city and the daily interactions of the citizenry. More than the possibility for a debate or a discourse, public space is measured according to its accessibility, both physical and psychological".[32]

2.4.2 Commercial Centers as Public Spaces

Personal space phenomena in a public space are basically kind of space in context to law and personal rights. In order to look into personal space in a public space of a new in its context and kind that is a commercial street and a public square. Let us investigate Commercial Street and an urban square are also a public space. Commercial streets and urban squares are also public spaces of a new kind and the following discussion is to prove this argument sufficiently. Different researchers and sociologist have been working on it and tried to prove that commercial streets and urban squares are also public spaces.

"The challenge today for planners and researchers on public space lies mostly in the difficult encounter of these two main visions of public space defended by the social sciences:

- The public sphere and
- The publicly accessible spaces"[33]

(Blackmar, 2006)

The first one can be summed up by the concept of the conversation and debate whereas the second one is best said as a question of mobility. The first one raises the important and ever pressing question of participative democracy, whereas the second one lends more attention to the idea of individual liberties, notably under the form of a "right to the city"[34]. Commercial streets and urban squares are also proved to be public spaces of a new kind and the discussion above and following proves this argument.

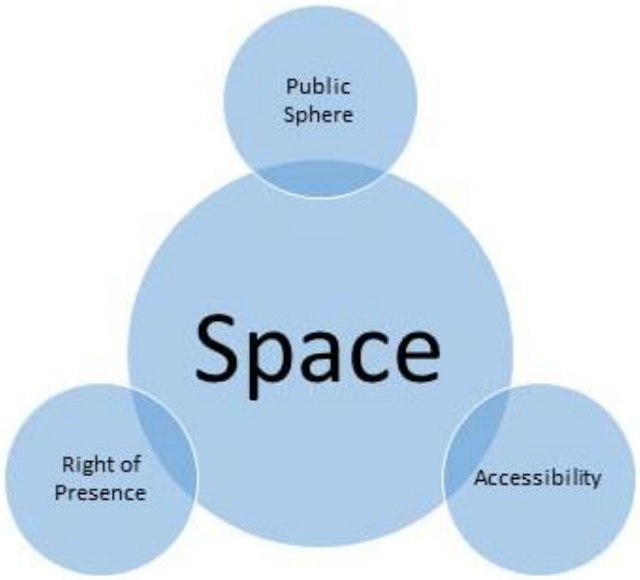


Fig: 7 Basics of a Public Space

[31] As cited (Habermas, 1989) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 1
[32] As cited (Joseph, 1998) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 2
[33] Tonnelat, S. (2010). The sociology of urban public spaces. ;P 2
[34] As cited (Lefebvre, 1968);(Mitchell, 2003) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 2

"Both of these approaches also touch upon the question of the form of the city and its representations both for inhabitants and visitors, in terms of a quality of life, but also in the realm of entrepreneurship and city management, under the pressure of urban competition".[35]

Fig: 8 Commercial Street in Bernburg, Lindenstraße

Commercial urban squares possess a strong magnet which on one hand attract people but at the same time there is a very strong adhesion is developing in context to security and surveillance. The commercial magnet attracts people but at the same time, people shy away because of intrusion of the third eye. People care about their privacy and lot of people do not like at all to be in a surveillance even for any of the good reasons.

"Some have decided to take Gareau's claim seriously and to verify if commercial centers and their parking lots are the new public spaces of the suburban western city. In the US, this critic has been mostly carried out by sociologists who see in the "mallification of America" a loss of authentic spaces".[36]

"Surveillance and technologies of control in commercial centers sort the population and force them to behave in a way that is all oriented toward a consumerism not conducive to encounters and debate". [37]

"The public sphere dimension is thus excluded from these environments. However, in suburban territories dominated by car traffic, commercial centers still represent some of the most accessible spaces for a wide variety of people. Despite control by private guards, access is usually granted to everybody, with the notable exception of homeless, drunken persons and beggars. We will return the question that this exclusion raises".[38]

According to, "public spaces are the realm of unfocussed interactions between anonymous strangers. The chief rule is one of "civil inattention," which helps people grant one another the right to be present and go about their own business. Inattention is not complete indifference, as it requires a set of rules aimed at easing interactions. Indeed, strangers have to cooperate in order to walk and not bump in one another".[39]

"This is how (Lofland, 1998) calls "cooperative motility[40]." "In addition, passers-by are also available, under certain circumstances for a "restrained helpfulness", such as giving the time or directions. They are also

[35] Tonnelat, S. (2010). The sociology of urban public spaces. ;P 2
[36] As cited (Hannigan, 1998);(Zukin, 1995) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[37] As cited (Lofland, 1998) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[38] Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[39] As cited (Goffman, 1971) Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[40] Term used by (Lofland, 1998)

engaged in what she calls an "audience role prominence" which sets up the people as a spectator of the urban scene, fulfilling the condition of public visibility necessary for a public space".[41]

According to above-mentioned criterions, parking lots and commercial streets and urban squares can be considered public spaces. If we go one step further and enter a mall and judge it on the same criteria, it also proves to be a public space even though these may own by a private company or a consortium. People can enter such spaces with their wheelchairs, baby strollers, and mobility scooters. If we look at the futuristic depictions new malls are being designed where people will be able to do shopping while riding their cars.
"Samuel Bordreuil (2000), a French sociologist, studied unfocussed interactions in a large shopping mall near Marseille, France, and found that basically the same rules of conduct apply as in the more classic streets. Regular patrons of stores and their workers also sometimes managed to establish familiar relations, especially in the cafes and restaurants".[42]

2.5 **People Distribution in Public Spaces**

Book **"The Social Life of Small Urban Spaces"** H.Whyte (1980)

2.5.1 Children play in streets

When occupancy of a public place like streets is discussed one of the major users of such a space are children. Reason being proximity to their living places, friendships and close acquaintances to neighbors. In the case of commercial streets, parents spare children to take advantage of public space and let them enjoy.

Fig: 9 Children like to play in streets. H.Whyte (1980)

"It is often assumed that children play in the street because they lack playground space but many children play in the streets because they like to".[43]

[41] Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[42] As cited Bordreuil (2000) by Tonnelat, S. (2010). The sociology of urban public spaces. ;P 5
[43] H.Whyte (1980). *The Social Life of Small Urban Spaces.* New York: Edwards Brothers, Michigan; P 10

2.5.2 Crowding

The capacity of a public space and relative availability of useable space may affect the occupancy of public space. When more people come together at a certain node with relatively less available space, it results to crowding. Crowding is a phenomenon which makes us think about availability of useable space or number of users in that space. Crowding perhaps is one reason for the capacity of a space consideration.

"Nearer to the center of New York, the imbalance of space use was even more apparent. Most of the crowding could be traced to a series of chokepoints".[44]

2.5.3 Zoning Practice

Occupancy, capacity, and sufficiency of a public space are directly related to zoning practice of that community. Leaving open space on which side of the building and its depth from the front and position also have certain effects. People like more reachable spaces and spaces on their way.

Fig: 10 Tough zoning practice and large spaces H.Whyte (1980)

"Some zoning practices may look attractive in design but not in practical. Huge space alienate users from other fellow beings which they may not like. Therefore, Tough zoning practice unable to attract more people".[45]

According to H.Whyte (1980) "People tend to sit most where there are places to sit, which are on the way easy to reach. Small places attract more people than large spaces".[46]

2.5.4 Self-Congestion

Occupancy of a public space exceeding its capacity may cause congestion. Small urban spaces around commercial and business places are more vulnerable to this kind of congestion on the daily basis, especially at peak hours. People happen to be in places where more people around. Due to small availability of public space around commercial buildings, fewer people are even more. Congestion is one of the major push

Fig: 11 Self Congestion H.Whyte (1980)

[44] H.Whyte (1980). P12
[45] H.Whyte (1980). P 11-15
[46] H.Whyte (1980). P 24-28

factors to consider the sufficiency of small public space. Occupancy of public spaces cannot be measured or predicted from mere asking people, when and where they are expected to be presented at a particular time and space. People say different and do different things.

"What attracts people most, it would appear, the other people. It is because that many urban spaces being designed as though the opposite were true, and that what people liked the best were the places they stay away from. People often do talk along such lines; this is why their response to questionnaires can be so misleading. How many people would say they like to sit in the middle of the crowd? Instead, they speak of getting away from it all, and use terms like "escape" "oasis" "retreat"."[47]

Fig: 12 People watchers; H.Whyte (1980)

2.5.5 Who, When, Where

Occupancy of a public space is further defined by who, when and where. People from different backgrounds come to public space. They may have different education, economic and social classes. One of their class is gender and other could be different age group. They may be technicians or from a white collar job from public or private offices. People from different class may carry different standards of mannerism. They may have a different choice of hanging around, sitting, gathering or solitude. One of the most popular trends in almost every social background is socialization. One of the most favorite use of public space gathering is watching people. People from different backgrounds like to sit at places from where they can watch passer-by. People like watching people. People sitting between a beautiful scene and the passer-by most likely face towards the passer-by rather a beautiful landscape or a beautiful scene.

"…….Of the men upfront, the most conspicuous are girl watchers. Generally, watchers line up quite close together, in groups of three to five".[48]

When people choose a certain part of space due to any reason even if it is for just watching the passerby then this part of space may get more occupants and hence the occupancy of space may increase than the certain another part of same space.

[47] H.Whyte (1980). P 19
[48] H.Whyte (1980). P 18

2.5.6 Choices in a Public Space

Distribution of choices in a public space can also help manage occupancy of a space. If choices are more known to designers. People are well aware of their choices as they keep on adapting according to the available space and distribution of choices. As people sit where there is a place to sit then sitting places distribution can manage occupancy. Better space management can better capacitate a space.

Fig: 13 sitting choice in public space H.Whyte (1980)

H.Whyte (1980) says that "the pedestrians rarely complain. While some will detour around the blockage, most will thread their way through it. Standing patterns are similar. When people stop to talk on the plaza, they usually do so in the middle of the traffic stream. They also show an inclination to station themselves near objects, such as a flagpole or a statue. They like well-defined spaces, such as steps, or border of a pool. What they rarely choose is the middle of a large space"[49].

2.5.7 Cultural Background vs Public Space Behavior

"The strongest similarities are found among the world's largest cities. People in them tend to behave more like their counterparts in the other world cities than like fellow nationals in the smaller cities. Big city people walk faster, for one thing, and they self-congest. After we had completed our New York study, we made a brief comparison study of Tokyo and found the proclivity to stop and talk in the middle of department store doorways, busy corners, and the like, is just as strong in that city as in New York. For all the cultural differences, sitting patterns in parks and plazas are much the same, too. Similarly, schmoozing patterns in Milan's Galleria are remarkably like those in New York's garment center. The modest conclusion: given the basic elements of a city center- such as high pedestrian volumes, and concentration and mixture of activities- people in one place tend to act much like people in another".[50]

Extract:

People in the big cities:

- Walk faster.
- Self-congest
- Stop and talk in the middle of walkways
- Sitting patterns in parks and plazas are much the same

[49] H.Whyte (1980). P 20-23
[50] H.Whyte (1980). P 23

2.5.8 People Distribution in a Public Space

During peak hours the number of people around a plaza will vary considerably according to seasons and weather. The way people distribute themselves over the space, however, will be fairly consistent, with some sectors getting heavy use day in and day out, others much less. In our sighting, we find it easy to map every person, but the patterns are regular enough that you could count the number in only one sector, then multiply by a given factor, and come with the percent or so of the total number of people in the plaza.

"Off-peak use often gives the best clues to people's preferences. When a place is jammed, a person sits where he can. This may or may not be, where he most wants to. After the main crowd has left, the choices can be significant. Some parts of the plaza become quite empty; others continue to be used. At Seagram's, a rear ledge under the tree is moderately, but steadily, occupied when other ledges are empty; it seems the most uncrowded of the places, but on a cumulative basis it is the best-used part of Seagram's".[51]

2.5.9 Space availability vs Sitting Spaces

2.5.9.1 Amount of Space

The amount of space defines the capacity of a space. An Increase in the amount of space increases the capacity of that space and hence the efficiency of the space in case of an increase in occupancy. If occupancy increases within the means of its capacity space remain sufficient.

H.Whyte(1980) With his team studied some 18 small urban spaces for available space vs sitting spaces. Their aim was to find out that availability of space was directly proportional to its use or no.

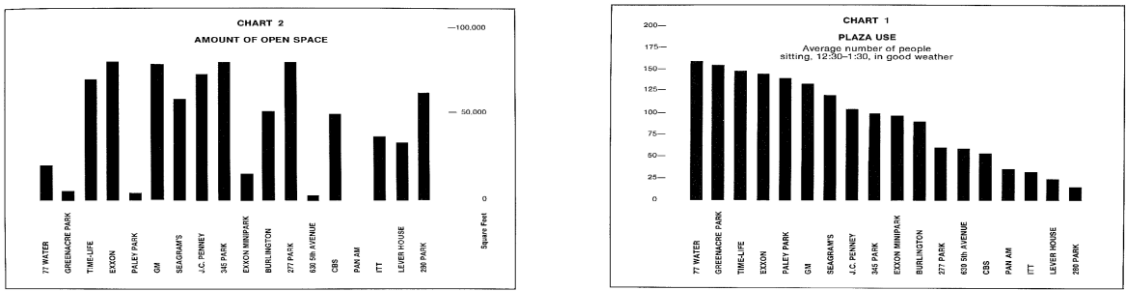


Fig: 14 Chart 1 and Chart 2 showing availability of space and use of space by H.Whyte (1980)

When both above charts Fig: 14 Chart 1 and Chart 2 showing availability of space and use of space by[52] were overlapped into one Fig: 15 Combination of charts 1 and 2 to show availability of space vs use of space makes it clearer to analyze that availability of space is thought looks obviously very important but not the people preference of use. In 77 Water, Green Acre Park, Paley Park, and 630 5th Avenue people presence

[51] H.Whyte (1980)
[52] H.Whyte (1980). P 26-27

are much larger than the availability of space. Whereas in rest of places people are less than available space.

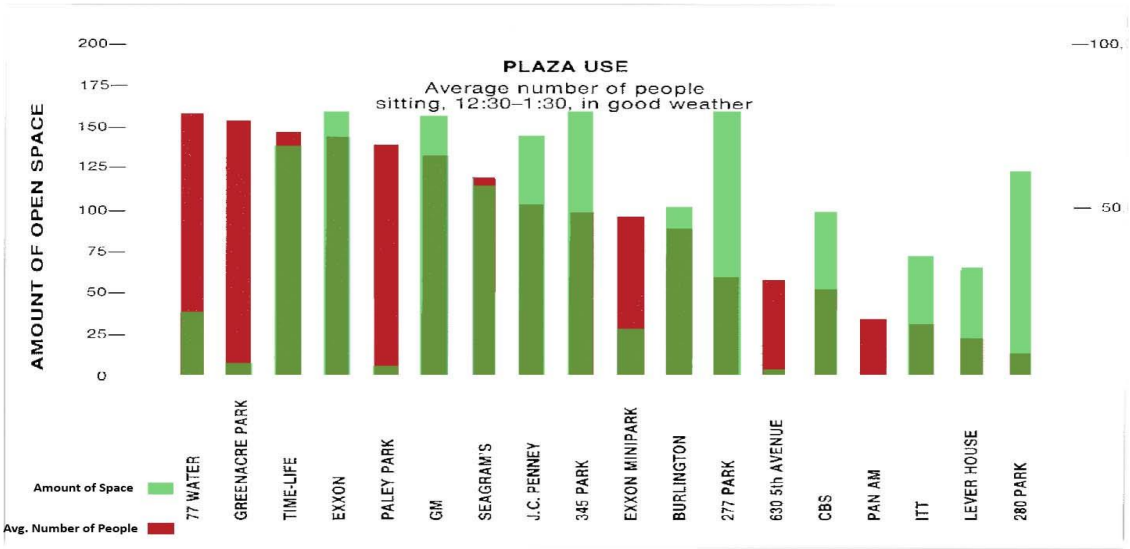


Fig: 15 Combination of charts 1 and 2 to show availability of space vs use of space

2.5.9.2 Sit-able space

It is obvious fact that people sit where there is any possible type of sit-able space available. "People tend to sit most where there are places to sit".[53]

But at the same time people cannot be forced to sit anywhere we want. People don't like more cohesive designs of exteriors of semi-public places. These spaces are offered as a public but people shy away from considering these as restricted places. "Forced choice is rarely chosen."[54]

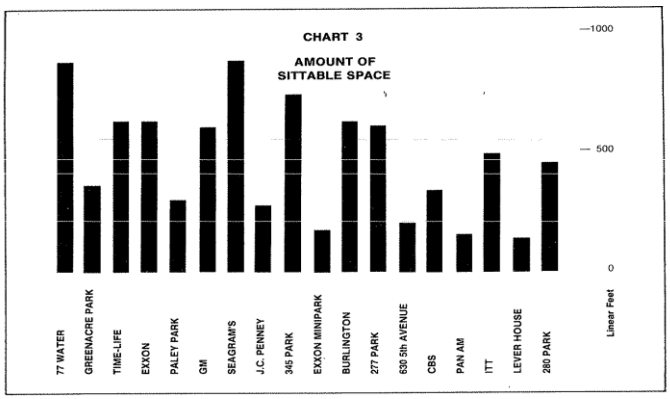


Fig: 17 sit able space availability chat; H.Whyte (1980)

Fig: 16 forcing a choice; H.Whyte (1980)

[53] H.Whyte (1980). P 28
[54] H.Whyte (1980). P 36

2.5.10 Integral sitting

"Ideally, sitting should be physical comfortable- benches with backrests, well-contoured chairs. It's more important, however, that it be *socially* comfortable. This means choice: sitting up front, in the back, to the side, in the sun, in the shade, in groups, off alone".[55]

But in reality, people are very adaptive and they can make better use of the available situation.

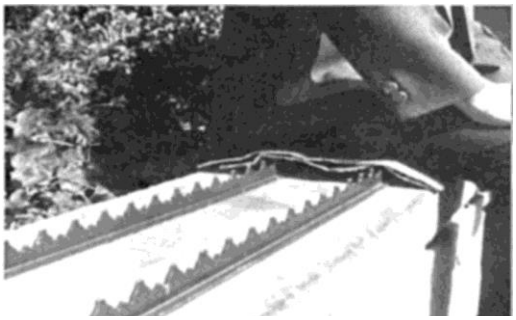


Fig: 18 People are very adaptive
H.Whyte (1980)

2.5.11 Sitting Heights

"One guideline we expected to establish easily was the matter of sitting heights. It seemed obvious enough that somewhere around 1'7" inches would probably be near the optimum. But how much higher or lower could a surface be and still be stable? Thanks to the slope of sites, several of the most sat-upon ledges provided a range of continuously variable heights".[56]

Fig: 19 Good and bad heights; H.Whyte (1980)

"Some places, like Liberty Plaza in Washington, D.C., combine good sitting heights and bad sitting heights".[57]

People choose to sit at a certain height beyond that height place is considered not only uncomfortable but also restricted. Sometimes it is also used as an instrument by the owner to avoid occupancy or miscalculation of a designer can also make it unusable.

"We had to conclude that people will sit almost anywhere between a height of one foot and three, and this is the range specified in the new zoning. People will sit on places higher or lower, to be sure, but there are apt to be special conditions".[58]

[55] H.Whyte (1980). P 28
[56] H.Whyte (1980). P 30
[57] H.Whyte (1980). P 31
[58] H.Whyte (1980). P 31

2.5.12 Sitting Space on the Back

The capacity of a sitting space can be changed by tuning its design. For instance, two-way sitting space offers more occupancy than one-way benches or ledges. Sitting spaces mostly designed one way.

"Rarely will you find a ledge or bench deep enough to be stable on both sides; some aren't deep enough to be stable on one".[59]

"For few extra centimeters of the depth, builders can double the amount of sitting space".[60]

"Most frustrating are the ledges just deep enough to tempt people to sit on both sides, but too shallow to let them do so comfortably. Observe such places and you will see people making awkward adjustments".[61]

H.Whyte (1980) found that a little extra space can make space more comfortable according to his findings*: ledges and spaces two backsides deep seat more people comfortably than those that are not as deep. While 30 inches will do it, 36 is better yet.*

Fig: 20 Deep bench provide opportunity on both sides H.Whyte (1980)

Fig: 21 Deep ledge provide opportunity to sit on both sides; H.Whyte (1980)

2.5.13 Amount of sitting Space

"A key question we had to confront was how much sitting space should be required. We spent a lot of time on this-- much too much, I now realize and I'm tempted to recount our various calculations to demonstrate how conscientious we were. The truth is that almost any reasonable yardstick would work as well as ours. It's the fact of one that is important. This said, let me tell how conscientious we were. We measured and re-measured the sitting space on most of the plazas and small parks in midtown and downtown New York. As for sitting space, we included all the spaces meant for people to sit on".[62]

[59] H.Whyte (1980). P 31
[60] H.Whyte, (1980)
[61] H.Whyte, (1980). P 31
[62] H.Whyte (1980)

2.5.14 Extra Space

Extra space also adds more comfort to public space, but the question arises how much extra space is for the comfort and how much is a further waste of space. In context to public space there have been no hard and fast rules yet been defined, but on the other way around it is not easy to announce or denounce any criteria. In the case of public space, it is not possible to define any specific number of visitors or its occupancy but it is possible to define its capacity. Provision of an extra space in public space for various functions for instance sitting, standing, socializing etc.; comes under the *social comfort* as studied by H.Whyte (1980).

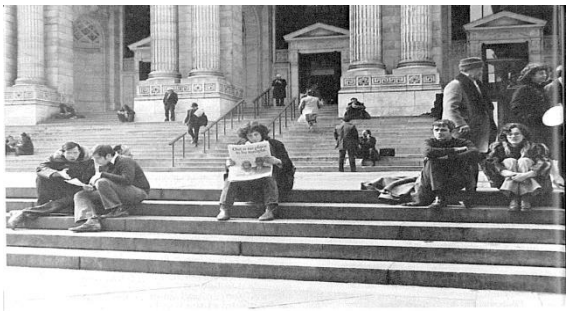


Fig: 22 Provision of extra space; H.Whyte (1980)

The capacity of a public space in conjunction with its occupancy can define the level of social comfort offered by public space in context to its optimal use. Extra space increases the level of choices which is also a form of a social comfort. The benefit of the extra space is social comfort more room for groups and individuals to sort themselves out, more choices and more perception of choices.[63]

2.5.15 Capacity as an Effective instrument:

It is another public space sitting places idea that can be used in public spaces. There were few reservations by the providers on account that this idea may have certain setbacks of being stolen but when this was applied at some places it worked out really well and people used it and the idea was very successful.

People prefer to sit where there is the place to sit, occupancy of a public space can even be controlled by using capacity as an instrument.

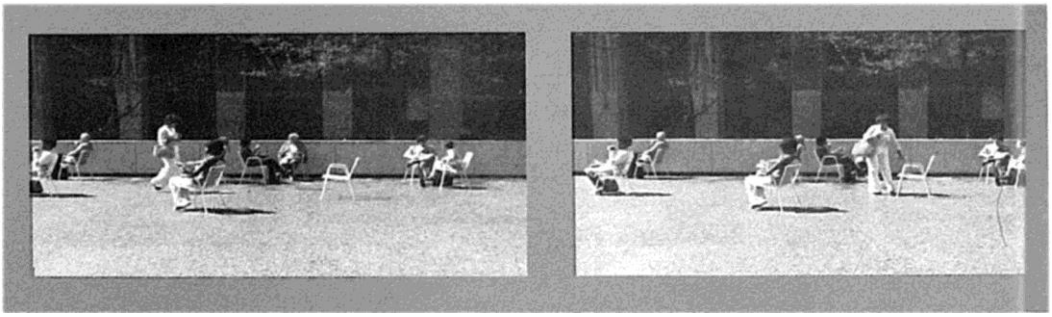


Fig: 23 Moveable sitting places; H.Whyte (1980)

[63] H.Whyte (1980)

2.5.16 Sun, Wind, Trees and Water

Sun, wind, trees and water are also very attractive elements in a public space which impact the occupancy of a public space. People like to sit the sun in winter but not in extreme summer. The Wind is not preferred choice in extreme winter but in summer. People like to hang around water in summer. Shady places if available are preferred choice in summer. "Access to the sun should be protected."[64]

Fig: 24 People sitting near water and under trees H.Whyte (1980)

"One of the best things about water is the look and feel of it".[65]

Fig: 25 People enjoying Sun; H.Whyte (1980)

2.5.17 Effective capacity

Space in its public use context comes with the availability of useable space. The capacity of space is also an alternate to the amount of useable space. Effective capacity is a phenomenon of an efficient use of space or an optimal use of space. H.Whyte (1980), in his work also discussed the effective capacity of a public space. He raised some very fundamental questions about the amount of available space.

According to H.Whyte (1980), was there a way of gauging the carrying capacity of city spaces? Or regulating it? How many people is too many? In order to get an answer to these questions, they undertook to close up studies of five of the most intensively used sitting places in New York.[66]

First, they recorded the average number of people sitting at each spot at peak and off-peak hours. It was quickly apparent that the number who could sit and the number who did were quite different. At the highest used places, they found, the range was between 33 and 38 people per hundred feet of sitting space. In later observations, they noted a slight increase in usage, though the range was about the same as it was in other comparable places they studied. There is thus enough consistency on which to base the following rough rule of thumb*:*

[64] H.Whyte (1980)
[65] H.Whyte (1980)
[66] H.Whyte (1980)

"If you wish to estimate the average number of people who will be using a prime sitting space at peak periods, divide the number of feet in it by three and you won't be far off from a good figure"[67].

2.6 **Myth of a Public Space**

Book: **"Image of the City** by Lynch,K. (1960)

2.6.1 Temporal Character of Public Spaces and Occupancy

"The city is a construction in space" [68]and a Public Space is an obvious element of a city. A city evolves over a period of time and "City design is, therefore, a temporal art"[69] , so are the public spaces. Occupancy of Public spaces in a city is also undergoing a continuous evolutionary process, therefore we can say that occupancy is also a temporal phenomenon. Population in a city may rise or decline with a change in the public interest. More inhabitants in a city mean, more occupancy in public spaces and vice versa.

Occupancy of a public space is not an irrelevant experience. It can't be judged in an instant and in an absolute. It always has a spatiotemporal relevance. Furthermore, it may also have demographic, cultural, age and economic class relevance. One aspect of its judgment is interspaced reference, i.e. comparing occupancy level of different public spaces in the same city. Second could be interspaced reference, i.e. comparing occupancy of public spaces of different cities. "Nothing is experienced by itself, but always in relation to its surroundings, the sequences of events leading up to it, the memory of past experiences."[70]

[67] H.Whyte (1980)
[68] Lynch, K. (1960). *Image of the city.* Massachusetts: The M.I.T. Press. P 1
[69] Lynch, K. (1960). P 1
[70] Lynch, K. (1960)Lynch 1960. P 1

The following Fig. shows the expansion of Zurich city over the period of time. Therefore the growth of a city is a temporal phenomenon.

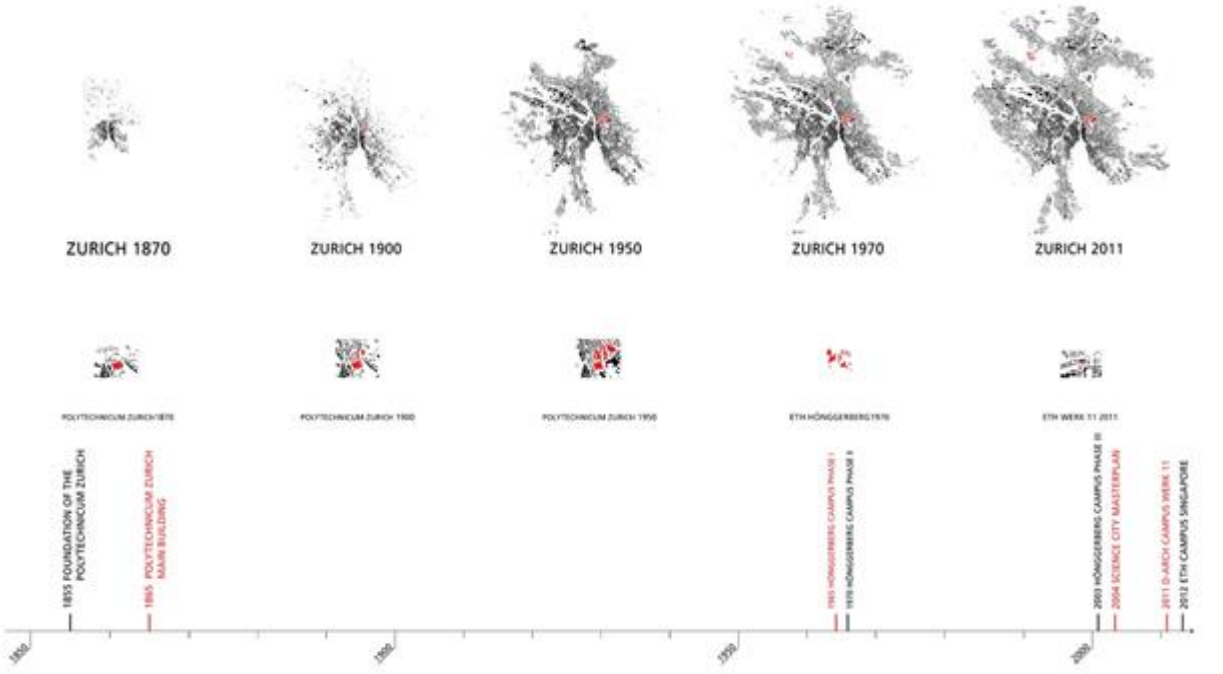


Fig: 26 Timeline of Zurich City
http://projectivecities.aaschool.ac.uk/portfolio/marcin-ganczarski-campus-and-the-city-in-zurich/6-eth-timeline/

2.6.2 Public Space as a mean to Satisfy Emotional Desire:

Urbanization is an ongoing process from demographics to physical developments. Physical development in a city could be a consequence of demand and supply but "Only partial control can be exercised over its growth and form."[71]

In a lenient process of a physical development, the most profound impact could be a loss of the strong image of the city.

"A beautiful and delightful city environment is an oddity, some would say an impossibility".[72]

Physical development on account of urbanization may impact:

- Legibility
  - Wayfinding
  - Emotional Security
  - Depth and intensity of experience
- Structure and Identity
  - Individuality
  - Spatial Relation
- Building the image
  - Distinctions
  - Relations
  - Adaptability of Observer
- Imageability

[71] Lynch, K. (1960). P 2
[72] Lynch, K. (1960). P 2

As by Lynch,K. (1960) City is construction in space. Public space is mean to *satisfy our emotional desire* by recreating a space within built environment for what could not be achieved in that very environment. Public space has almost all the features of a city, smaller in size but with extra ingredients which could not be attained in the city. In the following table elements of a city and a public space are compared between failures and achievements to show that what could not be achieved in the city is tried to achieve in public space. Information in the following table has been deduced from various paragraphs of the book image of the city Lynch,K. (1960) and arranged in tabular for understanding.

City	Failures	Public Space	Achievements
Paths		Paths	
Edges		Edges	
Districts		Districts	
Nodes		Nodes	
Landmarks		Landmarks	
	Chaos		Tranquility
	Overcrowd		Emptiness
	Pollution		Cleanliness
	Noise		Silence
	Congestion		Liquidity
	Rush		Stay

Table 1 : City, Public Space; Failures and Achievements comparison

Earlier public spaces were created in the form of gardens and parks in aloof from a city environment, later when cities started performing better by effusing some of the features from the public spaces, cohesion increased between the city and public space. Public spaces inched to the city center with some makeover from garden and parks to urban squares.

Urban Square is, in fact, such a form of inspired public space, which stepped in to rescue inhabitants of the city from the hard urban life.

2.6.3 Reconnaissance and Interviews

The Urban study is not mere an independent work, rather, its objectives can be materialized with much better, if performed combined with the public participation. New techniques can be devised to interact with local people or some standard existing pretested techniques could be benefited from. Much important of the task is to devise or use these techniques so systematically, to achieve best of the results.

"It is possible, however, to study both interviews and field studies more systematically, and to learn much more about the character and structure of the urban image". [73]

The best field study initiatives are reconnaissance surveys.

[73] Lynch, K. (1960). P 45

"A systematic field reconnaissance of the area was made on foot by a trained observer".[74]

Questionnaire and interviews on a sample set of people can also help to understand public bent of mind.

"A lengthy interview was held with a small sample of city residents to evoke their own images of their physical environment."[75]

2.7 **Social Identity of Public Spaces**

Book: "Public Space and Social Identity" (Dr. Sevigi Valera 1998)

According to *Dr. Sevigi Valera* people of a neighborhood can be defined on the basis of following six characteristics can which also help to develop a fundamental understanding of how to take public space study project initiated. All six following dimension in some form and manifestation have been included in this project were learned from the social identity of public spaces. "

a) Territorial Dimension

A communally identified geographical area

b) Social Dimension

A working class social composition

c) Temporal Dimension

The perception of sharing a common past which identified them

d) Behavioral dimension

In addition to some practical social characteristics, behavior is

e) Ideological Dimension

A radical and liberal ideological tradition

f) Psychosocial dimension

The most marked, a particular way-of-life similar to that found in a village or reduced community"[76]

2.8 **Personal Posture Standards**

"TIME-SAVER Standards for Landscape Architecture" Charles, W., & Nicolas, T. (1998)

2.8.1 Introduction:

People in a public space are in variety postures and as it is presumed that each posture occupies different space. Some primary postures (standing, sitting, and walking) are already reported in TSS for Landscape Architecture(Charles, W., & Nicolas, T. (1998)). Space impact for primary posture can directly be picked

[74] Lynch, K. (1960). P 15
[75] Lynch, K. (1960). P 15
[76] Sevigi Valera (1997) Public Space and social identity; P 8

from TSS and their spatial impact can be calculated. But secondary or combined posture and their corresponding impact needed to be calculated.

2.8.2 Personal Postures

Personal postures have been divided into two categories. Where primary posture are based on the natural human situation, postures are those which developed after adopting some man made a gadget for movement for example bicycle, walking trolley, baby stroller etc.

2.8.2.1 Primary Postures

According to TSS for LA, “Human spatial standards are derived from ergonomic and cultural data and vary widely across cultures and land-use settings.

Standards are often established to provide:

a. Minimal safety clearances (ergonomic/ legal)
b. Perceived user comfort (psychological/ Perceptual)
c. Ceremonial Protocol (cultural/ ritual)
d. Aesthetic choice (personal/cultural)

Most "normative" standards require cultural adjustment before being applied to a particular design setting. Cultural standards are often referred to as the "hidden dimension," and at times may contradict strictly”. [77]

2.8.2.1.1 Standing Posture

Minimum space required by a person can be extracted from TSS-LA

Table 2 standing posture [78]

Actual Measure	
Orientation	Measure
Front	(535)21”
Side	(470)18”
Average	
Front	(708)27.8”

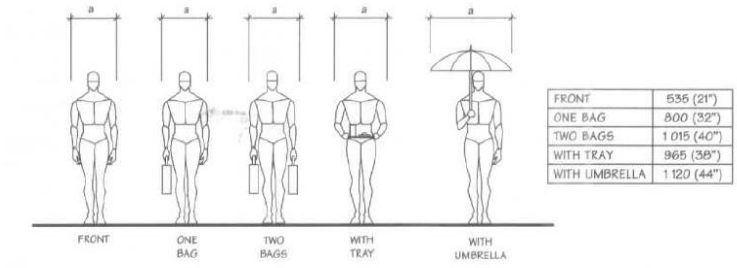
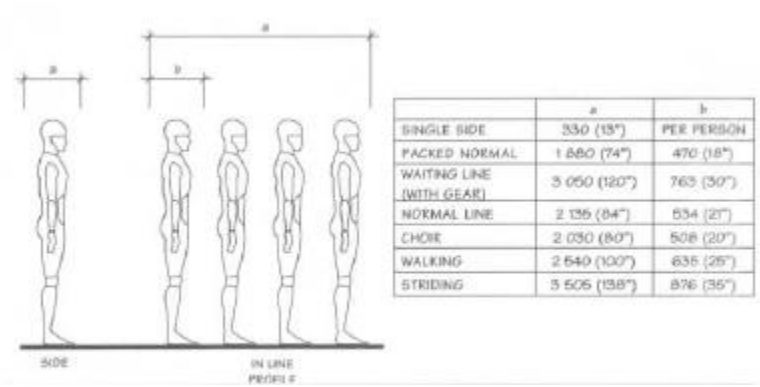


Figure 210-7. Width requirements for selected pedestrian activities.

Fig: 27 width requirements for selected pedestrian activities; page 210-4; Charles, W., & Nicolas, T. (1998)

[77] Charles, W., & Nicolas, T. (1998). TIME-SAVER STANDARDS; P 210-2
[78] Charles, W., & Nicolas, T. (1998).; P 210-4

In engineering, impact measurements are always done with contingency plans. It is also a way of considering the whole range of possibilities to avoid failures. Therefore an average value of a standing person with and without gears is calculated to consider a possible contingency plan.



	a	b
SINGLE SIDE	330 (13")	PER PERSON
PACKED NORMAL	1 880 (74")	470 (18")
WAITING LINE (WITH GEAR)	3 050 (120")	765 (30")
NORMAL LINE	2 135 (84")	534 (21")
CHOIR	2 030 (80")	508 (20")
WALKING	2 540 (100")	635 (25")
STRIDING	3 505 (138")	876 (35")

Fig: 28 space requirement from side Figure 210-6 ;
Charles, W., & Nicolas, T. (1998)

Note:

Units are in Millimeters and Inches

2.8.2.1.2 Sitting Posture[79]

Sitting is another common posture, and a minimum space required by a person as extracted from TSS-LA as follow.

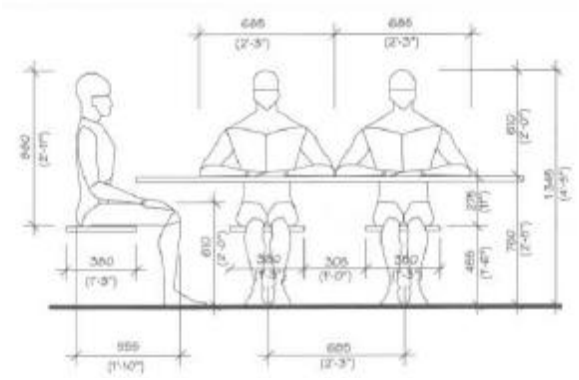


Fig: 29 sitting space dimensions front & side
Ref.from. Figure 210-9 seated figures;
Charles, W., & Nicolas, T. (1998)

Orientation	Measure
Front	(685)2'3"
Side	(555)1'10"

Table 3 sitting posture

2.8.2.1.3 Extended Sitting Posture[80]

In the case of possible extended legs, some extra space is required.

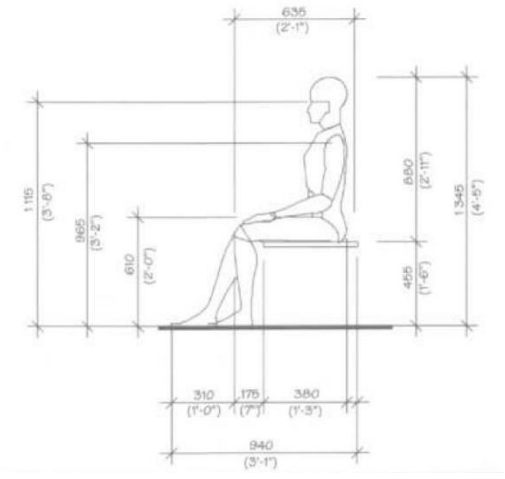


Fig: 30 with extended legs Figure 210-9;
Charles, W., & Nicolas, T. (1998)

Orientation	Measure
Front	(685)2'3"
Side	(940)3'1"

Table 4 Sitting with extended legs

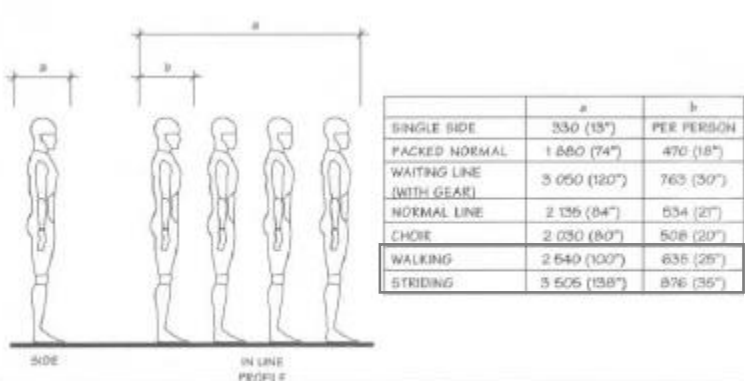
[79] Charles, W., & Nicolas, T. (1998).; P 210-5
[80] Charles, W., & Nicolas, T. (1998).; P 210-5

2.8.2.1.4 Walking Posture[81]

Walking is the third type of personal posture which comes in two form:

a. General walking

b. Striding



	a	b
SINGLE SIDE	330 (13")	PER PERSON
PACKED NORMAL	1 880 (74")	470 (18")
WAITING LINE (WITH GEAR)	3 050 (120")	765 (30")
NORMAL LINE	2 135 (84")	534 (21")
CHOIR	2 030 (80")	508 (20")
WALKING	2 540 (100")	635 (25")
STRIDING	3 505 (138")	876 (35")

Fig: 31 walking and striding distances Figure 210-6; Charles, W., & Nicolas, T. (1998)

In the case of walking 100" (2540mm) is given per person which is also including clearance distance for a person to take next step while is occupying the existing pace.

While in the case of striding the forward distance yet increases in order to make space available to take next step. The minimum distance required for a person while striding is measured 138" (3505mm).

"Spatial bubbles are necessary for circulating accommodations for an expected number of people in various situations, with the intent of maintaining psychological Comfort"[82]

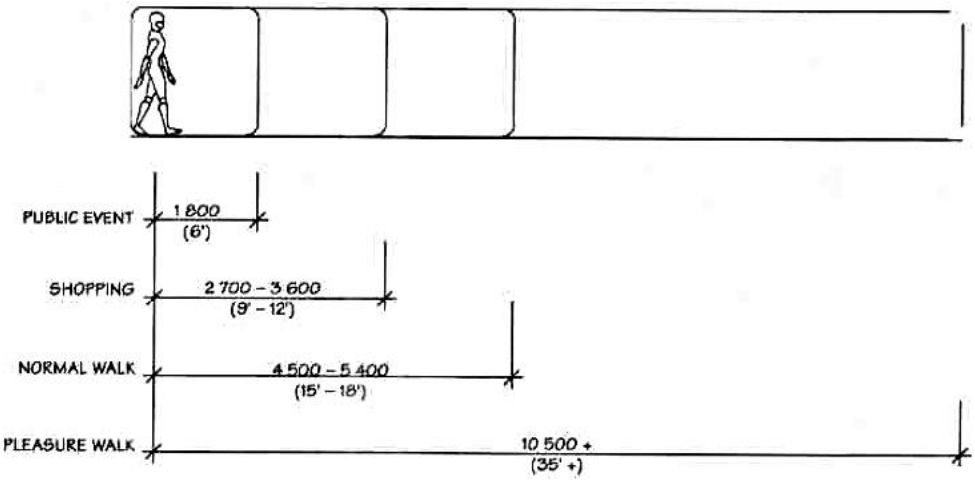


Fig: 32 Forward spatial bubbles: Figure 340-3 ; Charles, W., & Nicolas, T. (1998)

2.8.2.2 Secondary Postures

- Bicycle
- Walking trolley
- Mobility scooter

[81] Charles, W., & Nicolas, T. (1998).; P 210-4
[82] Charles, W., & Nicolas, T. (1998).; P 210-4

- Baby stroller

2.8.2.2.1 Bicycle Riding and Bicycle Walking

Riding a bicycle and Walking a bicycle has been categorized separately by assuming that both categories may occupy different space.

According to TSS-LA:

"Bicyclists fall into two major categories:

1. The recreational bicyclist, who uses the bicycle for pleasure or exercise.

2. The functional bicyclist, who uses the bicycle as an alternative form of transportation to school, to work, or to shop

Most bicyclists use a bicycle for both functional and recreational reasons.

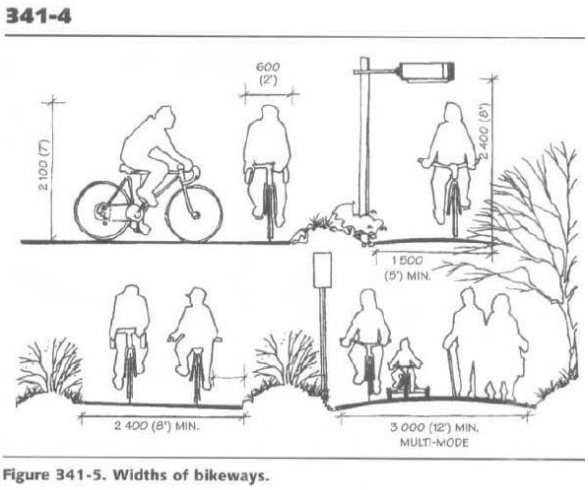


Fig: 33 Bicycle width from width of bikeways; Charles, W., & Nicolas, T. (1998)

Bikeways must be designed to accord with a corridor's existing characteristics rather than with narrowly defined user traits or purposes.

Minimum standards must be emphasized to accommodate a full range of user types while optimizing safety for all".[83]

Width of Bikeways

"Factors to consider when determining widths for bikeways must include:

1. The spatial dimensions of bicyclist and bicycle
2. Maneuvering space required for balancing
3. Additional clearances required to avoid obstacles (Figure 341-5)" [84]

Length= 1800mm_ 70.88"

Width= 610mm _ 24"

[83] Charles, W., & Nicolas, T. (1998).; P 241-2

[84] Charles, W., & Nicolas, T. (1998).; P 241-2

Note: Designers should assume that in many cases two-way travel will occur on separated bicycle paths, regardless of design intentions. Appropriate widths should be provided.

2.8.2.2.2 Walking Trolley[85]

Technical specifications:

- Total width 660mm_26”
- Total length 750mm_30”

- Total height 85 - 95 cm
- Seat width 45 cm
- Seat depth 23 cm
- Seat height 60 cm
- Weight 8.2 kg

Fig: 34 Elderly walking trolley
https://www.amazon.de/DIETZ-TAiMA-Rollator-mit

2.8.2.2.3 Mobility Scooter[86]

With German manufacturer specifications:

- Overall length 1500 mm
- Overall width 665 mm

- Ground clearance 134 mm
- Front wheel individually sprung 323x105 mm
- Rear wheel 323x105 mm
- Range 40 km
- Speed 15 km/h

Fig: 35 Mobility scooter for elderly people
Source: (United Spinal Association, 2017)

[85] https://www.amazon.de/DIETZ-TAiMA-Rollator-mit Luftbereifung/dp/B00D2V57RU/ref=sr_1_12?ie=UTF8&qid=1485347694&sr=8-12&keywords=walking+trolle

[86] http://www.usatechguide.org/itemreview.php?itemid=1485

2.8.2.2.4 Baby Stroller[87]

Specifications:

- Overall length: 110 cm
- Overall Width: 56.5 cm

Fig: 36 Baby stroller
https://www.amazon.de

2.9 **GIS best Practice by Esri**

2.9.1 Common GIS Applications:

As of a landscape architecture viewpoint, Ian McHarg was the first to set the stage for modern Geographic Information Science in his 1969 book, Design with Nature. McHarg defined the Overlay Method. (Fig:37[88]) The overlay method assigns values to thematic data (land cover, property lines, road network etc.) that correspond to every land use in the project area. Multiple layers are overlapped and their overlapping values can be added subtracted and further manipulated for desired results. In this way, very complicated questions can be answered with respect to value and location which otherwise could be a somewhat intricate job.

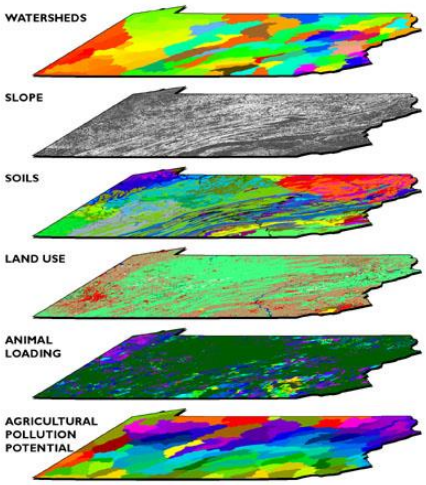


Fig: 37 Diagram illustrating the map overlay process used to evaluate potential agricultural pollution by watershed in Pennsylvania.

[87] https://www.amazon.de

[88] https://www.e-education.psu.edu/natureofgeoinfo/c9_p6.html

As shown in Fig: 38 Stake of Land use layers[89], can be used estimate the combined effects of multiple properties; pollution potential in this case.

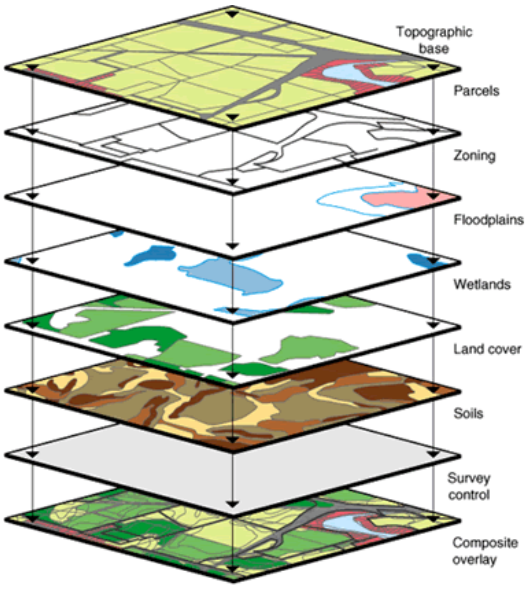


Fig: 38 Stake of Land use layers

The Overlay method has become a standard practice in site suitability analysis and is extremely effective for incorporating natural resource information into planning and design processes. Just like other techniques, it does have some limitations, especially its absolute rationalism. Several GIS operator with the same datasets and the same methods may always reach results. Urban Design and Urban planning is a dynamic and ever-evolving process, it includes human behavior which is always very complicated and cumbersome to deal with flawlessly. Reliable decisions only on the basis of datasets and overlay methods are severely lacking this dimension.

Despite all pros and cons, GIS technique is one of the most powerful tools, to deal with planning decision making, available today. Just because of only available and most powerful tool it is being relied on in this project

2.9.2 GIS Criticisms:

The methodologies described above are powerful decision-making tools, but this power is not without criticism. Perhaps foremost in the minds of landscape architects is its severe analytical rigor and inflexibility. The design is a synthetic process concerned with human qualities of intent, purpose, and emotion. Landscape architects are concerned with questions like, Does the function of this place changed recently?

[89] https://graphicdesign.stackexchange.com/questions/54140/how-do-you-make-perspective-layer-formation

How should this place change now that related activities or functions are changing? How should this place be configured in order to support the anticipated activities?

The ability of GIS to support these kinds of queries is currently very limited. It cannot yet support queries as to why – say – there is a small structure at the bottom of the ski slope and whether another one should be expected to be at the top, or how that entire configuration of open spaces and installations may change if the ski resort closes for good. In other words, in does not incorporate or evaluate human intent. For landscape architects who are critically engaged in synthesizing human experience into designed spaces, this may prove a hindrance to the design process and explain why GIS application remains limited within the industry. For example, a McHargian overlay will reveal which road alignment will avoid wetlands, maximize traffic volume, and minimize construction cost, but it cannot tell you if that road alignment accommodates the dreams and ambitions of the community for whom it will serve. This analytical focus is further reinforced within academia and industry. Martin and Wing evaluated GIS texts, course syllabi, vendor advertising and the like and determined the general discourse of GIS, "facilitates an ongoing devaluation of non-GIS practices and theorizations."(Martin & Wing, 2007) Thus in practice, the reliance on GIS in its common form overemphasizes easily quantifiable attributes like land cover, elevation, and cadastral boundaries, and minimizes qualitative, yet critical attributes related to human experience and interpretation.

GIS techniques have evolved enormously over the years and it can be used to analyses very complicated data sets and reach very logical decisions shortly. It does leave space for human emotions and desires during next phase of design.

Chapter 3. Methods and Procedures

3.1 Process Chart

This project chart is to describe the overall process with steps and major considerations.

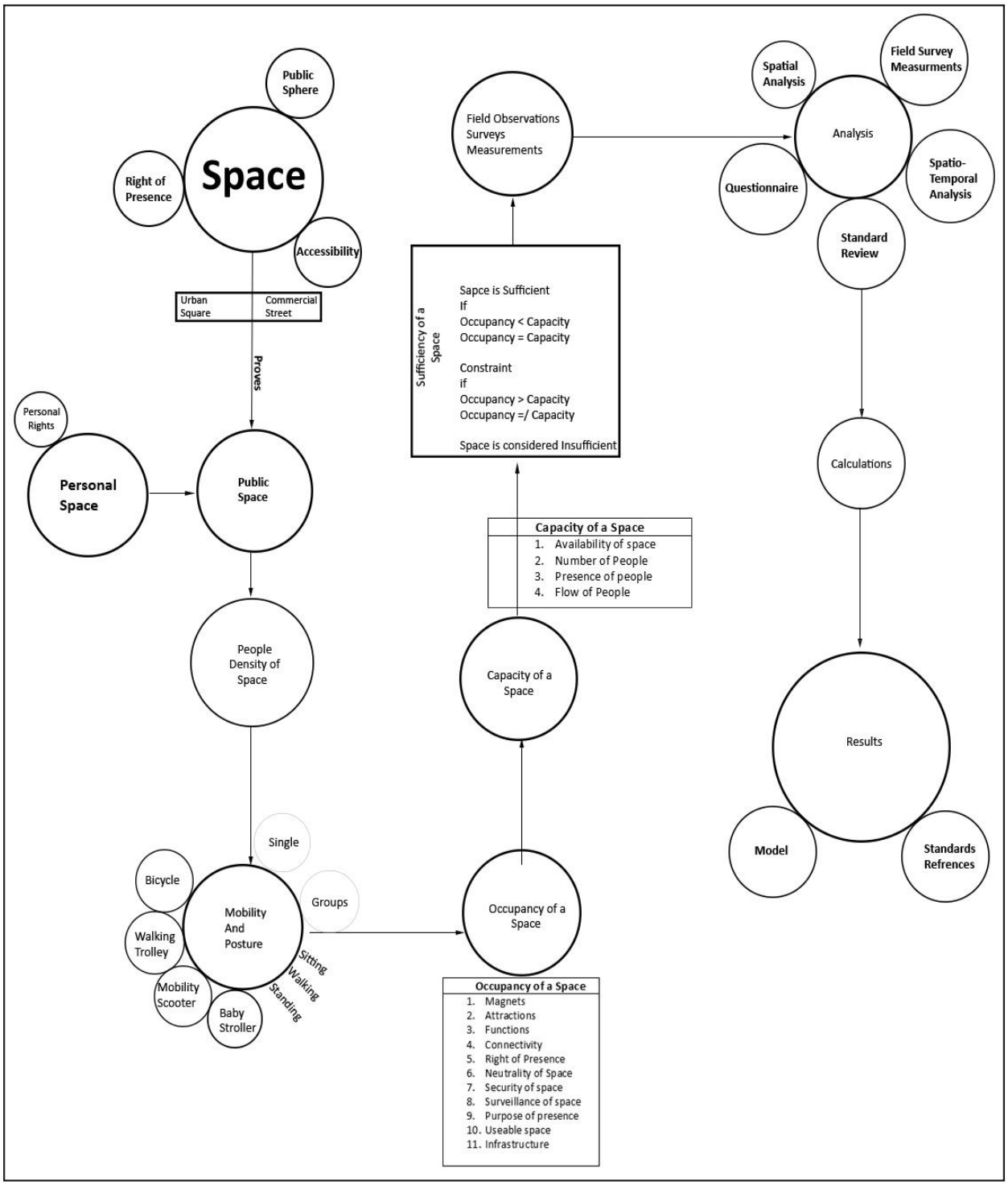


Fig: 39 Flow chart for the Project

3.2 **Personal Posture Analysis**

Study of personal posture is one of the basic tasks in this project. Personal postures have been divided into two categories, primary postures, and secondary postures.

3.2.1 Defining Personal Postures

Defining the personal postures in urban space according to the presence in the project area.

3.2.1.1 Primary postures:

Primary postures are natural human postures. For example, siting, standing and walking.

3.2.1.2 Secondary Postures:

Secondary postures are adapted postures. For example Bicycle riding, an elderly walking trolley, mobility scooter and baby stroller etc.

3.2.2 Field Study of postures

A field reconnaissance survey was conducted to observe the presence of most common personal postures in the project area. Primary postures are natural and universal but the secondary postures may subject to change from place to place, according to local need and norms.

3.2.3 Standards and Information Consultation

The initial source of consultation is TSS for Landscape Architecture by(Charles, W., & Nicolas, T. (1998), space requirements for designing spaces are available in TSS for LA but some information was unavailable especially related to gears being used in the secondary postures. This information is collected from manufacturer specifications. For example walking trolley, mobility scooter etc.

3.2.4 Measurements of Actual Impact

Actual Impact: Actual impact can be defined as an exact average space required for a gear or primary posture. For example, in the case of a standing person 47cmx53.5cm space is required. The actual impact is measured for all primary postures, gears, and their combined impacts by adding primary posture and corresponding gears. (Page 85 Section 5.5.2)

3.2.5 Determining Secondary Posture

Secondary postures are the result of primary postures and relevant gears. All secondary postures were determined by adding areas of primary posture and gear area. For walking trolley, impact area of walking person id added up to the impact area of the elderly walking trolley. (Page 86 Section 5.5.2.2)

Walking trolley= (Walking Impact)+(Elderly Trolley Impact)

= (254.0cmx70.0cm) + (75.0cmx66.0cm)

= 22933.2 cm^2

3.2.6 Transformation of Impact Area

Posture impacts are in square and rectangular form, these posture impact areas are converted into radial form by using area of a circle formula. In this was the radius of the impact circle is calculated, for example, the radius of above area if in a circular for is 85.42 cm.

The Equation of a Circle:

$$Area = \pi r^2$$

$$r = 85.42cm$$

3.2.7 Comparison: Posture Impact Radius vs Personal Space Radius

Personal space radius is mentioned 120cm and posture impact is also available in a radial form and can easily be compared with each other. In this way, it can be verified that posture required space is equal or less or more than personal space. If posture impact is more than personal space impact, then personal space is required to be redefined, otherwise, it can be used directly with the same value of 120cm.

3.2.8 Flow Chart

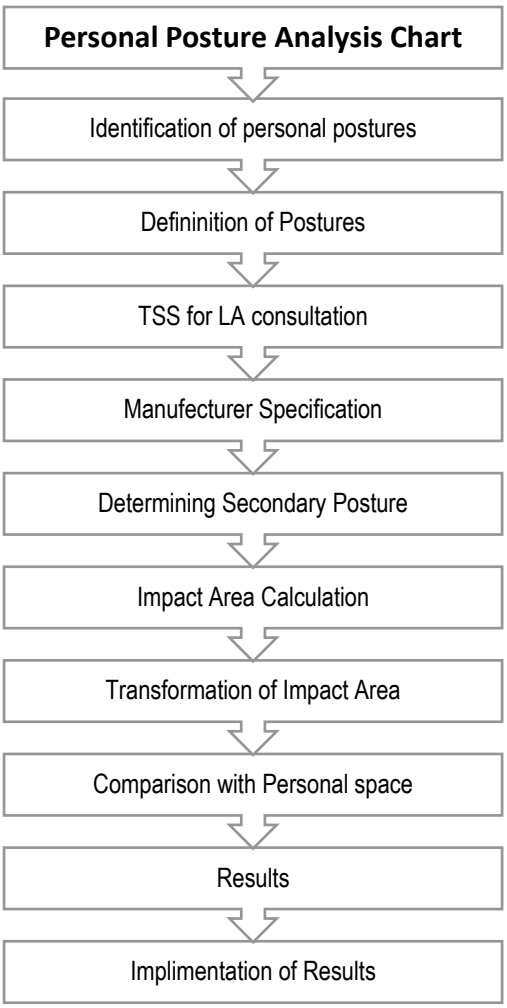


Fig: 40 Process chart to determine and analyze postures

3.3 **Spatial Analysis**

3.3.1 Mapping

In the case of this project mapping of public space is required, but as per recommendation working drawing of the public space design is the best data source to be used to perform spatial analysis. Property mapping by using GPS or total station can be performed to get higher quality detail and precision of data. In this case study mapping is done by satellite image digitization.

3.3.2 Satellite Image Digitization

A detailed mapping of public space is required so that all its spaces can be defined, identified and separated from each other. Initial digitization of Google Earth Pro satellite image is done and saved as a kml format. This kml is then imported to ArcMap as kml to layer.

3.3.3 Geodatabase development

An empty geodatabase was created in ArcMap containing all the required feature classes and attributes. This geodatabase is loaded in ArcMap and data in the layer from kml is copied and pasted in a relevant layer of the newly created geodatabase. In this way, geodatabase is populated with digitalized data from Google Earth Pro.

Table 5 Spatial analysis Geodatabase; features and attributes

FID	Landuse	AREA(sq.m)	CATEGORY
1	Cafe_sitting		Limited
2	Karlplatz		Useable
3	Lindenstraße		Useable
4	Park_Unpaved_Areas		Useable
5	Poststraße		Useable
6	Walkways		Useable

3.3.4 Field Verification and Feature Measurement

A field verification was carried out to tape measure some small features like planting wells, benches and walkway width etc. Sizes of all infrastructure were first adjusted to the size taken from the filed measurements.

3.3.5 Spatial analysis in ArcMap

A spatial analysis is required to find out what are the useable and unusable spaces. In order to perform such spatial analysis a well versed criterion is required. Criteria could be based on planning and environmental

laws. In this spatial analysis, criteria are more or less based on local public behavior observation. It may vary from region to region and even in the study area in different seasons. This project is based on short time study of an area. Grass lawns near urban square were not being used for sitting and relaxing but people may be seen using in public parks. This criterion has been perceived on general observation and reconnaissance survey.

Criteria:

a) Green lawns and water features are unusable spaces.
b) Roads are only for the cars, not usable spaces.
c) Footpaths are spaces to walk not to stay and usable spaces.
d) People like to sit only where there is space to sit-able places.
e) Planting wells are not usable spaces.
f) Café sitting are considered private spaces and limited access but useable spaces.
g) Benches and ledges are neutral spaces (personal space doesn't apply) Sit-able places.

3.3.5.1 Identification of Spaces

Identification of features and spaces from the field is one major task. After identification geodatabase should be corrected. An accurate geodatabase is a prerequisite for a reliable spatial analysis. Any criteria can only be applied, if the use and type of public space features are known.

3.3.5.1 Separation of useable spaces

Geodatabase contains all the land uses (buildings, water features, lawns), sit-able places (Benches and ledges), and infrastructure (walkways). Sit-able places are for sitting and walkways for walking rest of the places are for standing and other personal postures. Useable spaces are separated by using "Symmetrical Difference" command as shown in the model builder routine (Fig: 41).

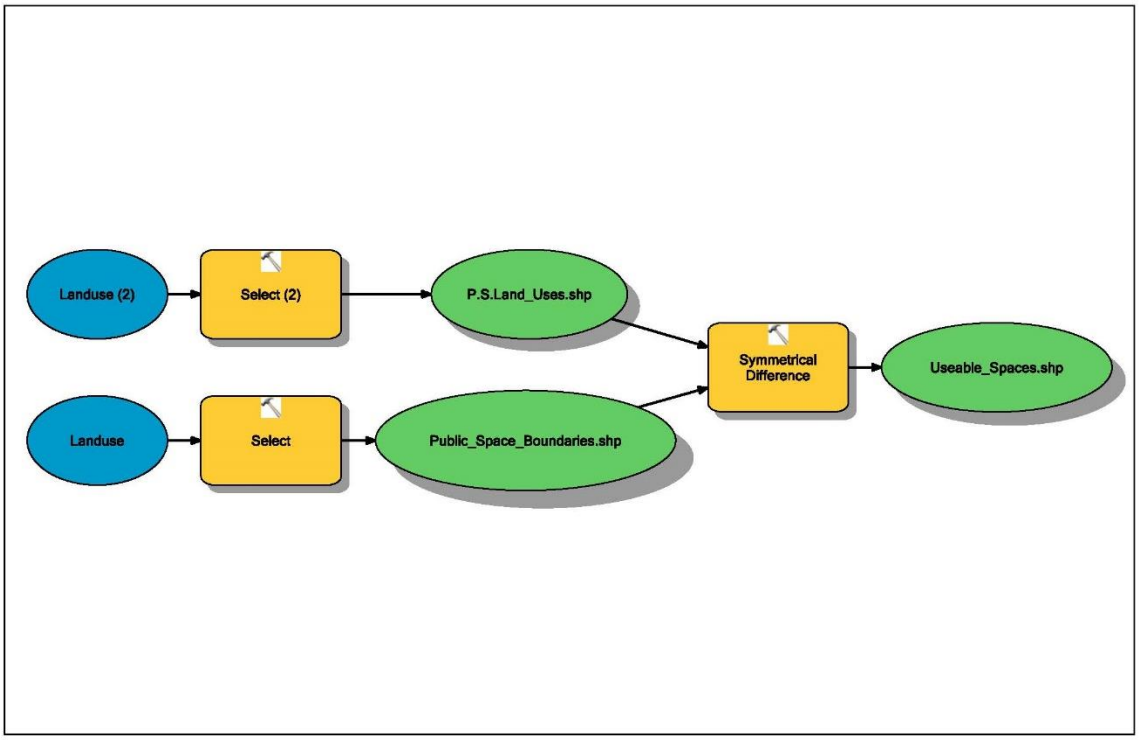


Fig: 41 Model builder routine to show separation of useable spaces.

3.3.6 Analysis Report

3.3.6.1 Quality and Reliability

The quality of the results depends entirely on the accuracy of the mapping and criteria for usable and unusable spaces. Filed verification of all the infrastructure measurements and sizes also an important role.

In the case of this project, only permanent uses were considered but there were a lot of temporary infrastructures and uses which were overlooked to reduce the burden of the task. Some of the temporary uses include advertising banners and boards, on sale items outside shops, coffee tables, chairs, book tables etc.

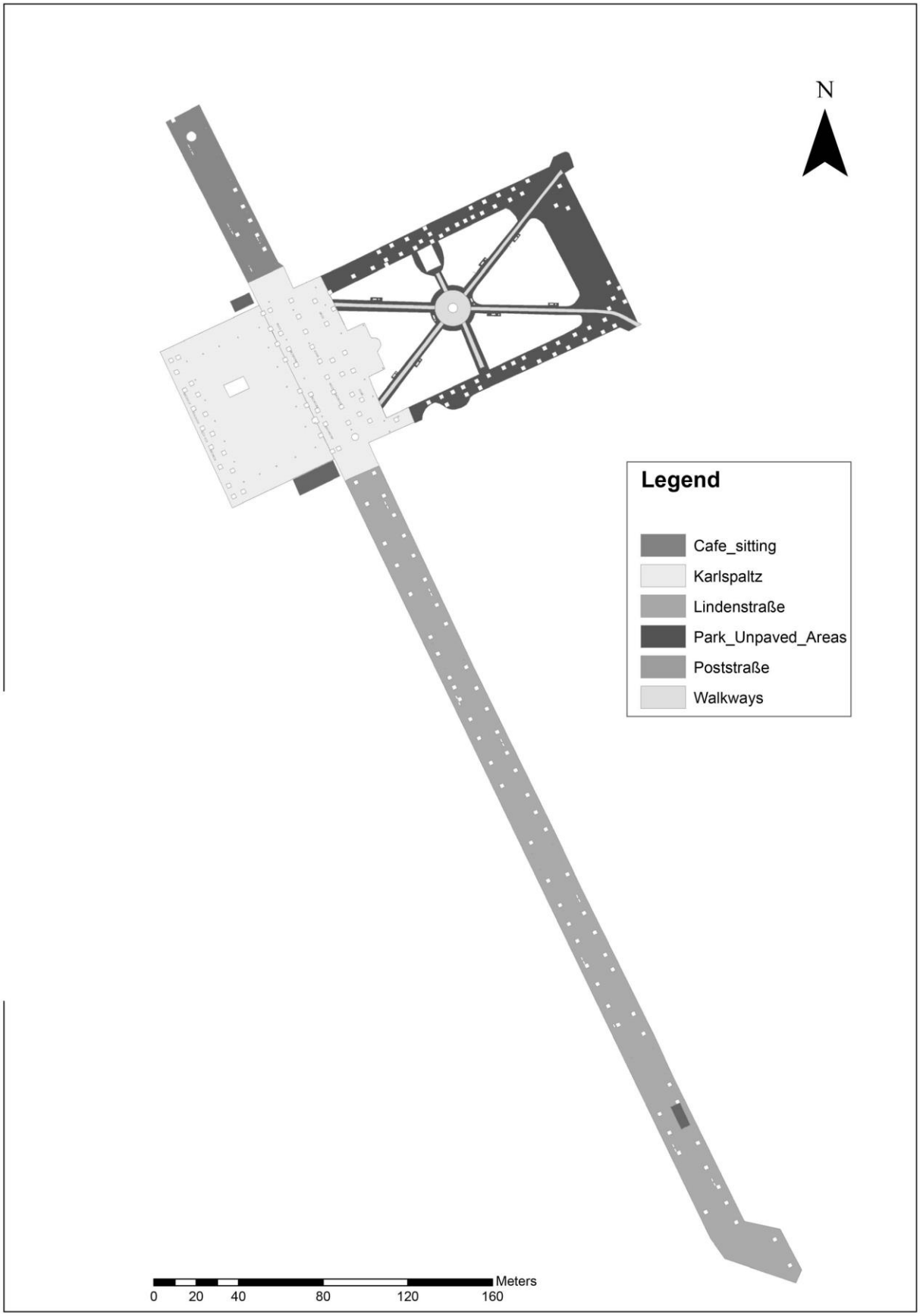


Fig: 42 Resulted spaces from Symmetrical Difference

3.4 **Spatiotemporal Analysis**

This analysis is about space, time and the people presence; it defines a number of people presence in a particular area of public space at a particular time.

3.4.1 Mapping of the People Project

It is an important part of the spatiotemporal analysis because public space determinants are directly related to people presence. OCS[90] of a public space could be determined on the basis of assumed data. But in order to test and compare results with the existing situation man mapping was taken as an important part. Man mapping helped learn people distribution in public space, which later could help to explain highs and lows of occupancy, capacity, and sufficiency in a public space.

3.4.1.1 Field survey

A field survey on a comparatively very high occupancy day was conducted, people were out for Christmas shopping and it was also a lunch time.

3.4.1.2 Data collection

Video stream was a part of a plan to record people presence in public space. It proved to be not working in the field because the camera did not had a shock absorption feature, and video recorded was not of required quality. The plan was immediately changed and still, photographs were taken just to test the quality of results. Still, photographs were taken in such a way and order so that people position on the satellite image could be marked according to the features in reference.

Fig: 43 Photograph for marking location of people

[90] Occupancy, Capacity, Sufficiency

Fig: 44 Photograph for marking the location of people on the map.

3.4.1.3 Reduction of photographs to mapping

A better quality satellite image was required to mark people position in public space. The base map image in ArcMap was not of a satisfactory resolution, but Google Earth Pro image was giving much better quality and updated image. A generalized people position was marked in google earth pro and saved as a *.kml format. People position from kml format was converted into ArcMap layer.

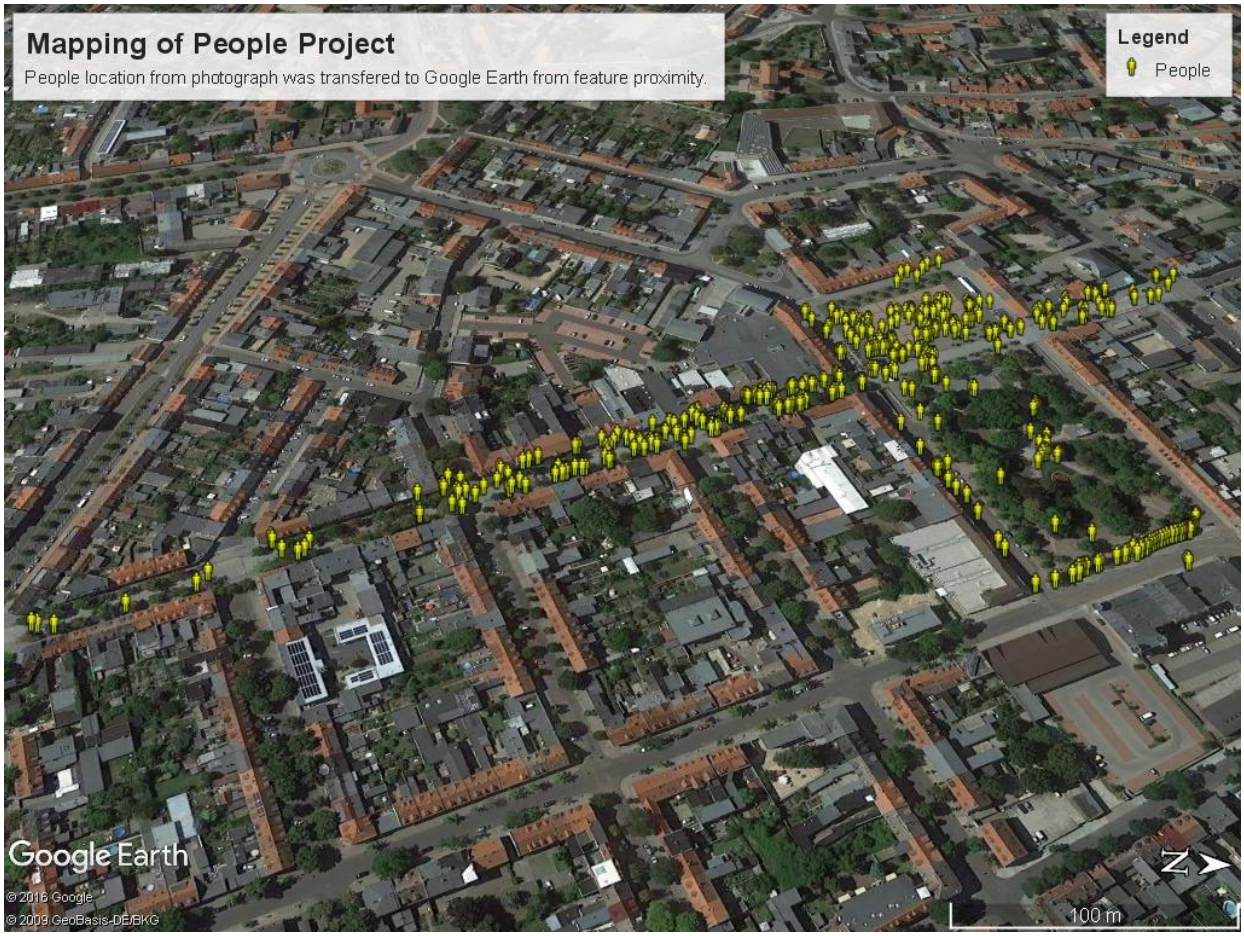


Fig: 45 mapping of the people; reduction of data from Photographs to Google Earth

3.4.1.4 Handicaps and difficulties

There were many handicaps and difficulties in doing such field work some social, some technical but more difficulties are technical rather social.

a) Time limitations
b) Choice of day
c) H&V[91]data translation
d) Feature matching problems
e) Guessing interpersonal distances
f) People stare

The quality of position was not such an issue because the analysis was restricted to four main areas (Karlplatz, Park, Poststraße, and Lindenstraße) and not specific positions on the site.

3.4.2 Geodatabase development

A geodatabase was developed with all possible information that could be derived from the still photographs. There were four possible attributes derived from the still photograph.

i. Gender
ii. Posture
iii. Age group (Generalized)
iv. Direction

Gender, age group, and direction has no effect on Personal space but this information was taken just as a precautionary measure, if it may have some impact at some later stage of this project. Posture was considered important because as a part of hypothesis it was considered that it may have some impact on the personal space and could be used when personal space will be redefined. Personal space was found later totally independent and any of above attributes what so ever impact on the space model defined by (Edward T.Hall 1966).

3.4.3 Analysis in ArcMap

3.4.3.1 Occupancy Analysis

Occupancy analysis has been used to determine location based occupancy of different areas. In location based selection occupants of different areas can be selected and separated to analyze page109 section 5.6.6.1.

[91] Horizontal and Verticle

3.5 **Psycho- Spatial Analysis (Questionnaire)**

Community participation has proved to be an essential tool in studying and analyzing social issues related research. Such tools have also evolved over a period of time and can help profoundly to get first-hand insight into a social issue. In this project, a small questionnaire has been designed to study occupancy of the public space. It has been termed as psycho-spatial as it includes responses of the people while in public space.

There are three research questions;

1. Occupancy of a space
2. Capacity of a space
3. Sufficiency of Space

Occupancy of the space is strongly related to people in space, therefore, a tailored questionnaire can help to have second look into the public space state of affairs.

3.5.1 Questionnaire Development and Testing

A small questionnaire has been designed and conducted with the purpose, a set of data with a firsthand information collected form filed that can be compared with the peoples mapping project data. The questionnaire is a reflection, what people think while being in a public space, whereas people mapping project is what people actually do. Set of information resultant from questionnaire should be comparable with the people mapping project, and some supporting information for the discussion. The questionnaire was designed and a friend was asked to attempt it and according to the understanding of the audience, it was revised to make it comprehendible. The main audience of the questionnaire are the local people, therefore, a Local German friend was requested to translate the questionnaire.

3.5.2 Basis of Questionnaire

3.5.3 The structure of Questionnaire

a. Demographic b. Occupancy Mode c. Preferences	d. Defining peak hour e. Define Occupancy

3.5.4 Questionnaire conducting

The site of research is located in Bernburg, Germany and most of the public space users are therefore local people. The questionnaire is first translated into the German language with the help of a German Landscape

Architecture student, then she also helps to personally coordinate while being in the field to ask people and fill the questionnaire.

3.5.5 Survey Sampling, Size and Time

It was initially planned that the number and choice of the people will be based on the ratio derived from the mapping of the people project. In the mapping of people project almost 508 people were mapped on the site it has been tried to maintain the ratio of gender, age group, and personal posture but while in the field it happened to be quite different. It was very difficult to get time from people, very few people showed interest to record responses. But most of the people who responded were very interested to speak their mind.The survey sample is random and size remained 27 people including all demographic backgrounds. It took three days to complete 27 interviews.

Gender sampling ratio			
Questionnaire		People Mapping	
Male	68.18%	Male	38.99%
Female	31.82%	Female	61.01%
Age group sampling ratio			
Questionnaire		People Mapping	
13-19	18.18%	minor-Teen	12%
20-39	31.82%	Adult	16%
40-59	18.18%	Middle age	29%
60 and Above	31.82%	Old	44%
Personal Posture			
Questionnaire		People Mapping	
Bicycle	18%	Bicycle	6%
Walking	14%	Walking	34%
Sitting	23%	Sitting	9%
Standing	23%	Standing	49%
Walking trolley	9%	Walking trolley	1%
Baby Stroller	9%	Baby Stroller	1%
		Mobility scooter	1%

Table 6 Comparison of sampling ratios

Questionnaire Sample:

Date: ----/------/2017

Questionnaire

1. Demographic
   - Gender

☐ Male	☐ Female

   - Age

Teens	Young Adults	Middle aged	Seniors
☐ 13-19	☐ 20-39	☐ 40-59	☐ 60 and above

2. Occupancy Mode (to define capacity)

☐ Walking	☐ Bicycle	☐ Baby Stroller
☐ Standing	☐ Walking Trolley	☐
☐ Sitting	☐ Mechanised Chairs	

3. Defining Peak hour
   a. How often you visit this place? (Range)

☐ daily	☐ Twice a week	☐ Thrice a week

   b. Why? (Public space interest)

☐ Shopping	☐ Socializing	☐ other	……

   c. What time you visit this place? (Peak hour)

☐ 8:00-10:00	☐ 10:00-12:00	☐ 12:00-14:00	☐ 15:00 and later

4. Define Occupancy
   a. How much time you generally spend at place?(Duration)

☐ Less than an hour	☐ 1 hr.	☐ 2 hrs.	☐ 3 hrs.	☐ more

   b. Where you happened to be more?(Location)

☐ Lindenstraße	☐ Karlplatz	☐ Poststraße

5. Preferences
   a. Do you feel need to sit.

☐ Yes	☐ No	☐ Sometimes

   b. Where do you prefer to sit?

☐ Front	☐ Back	☐ No preference

   c. Do you like people in space?

☐ More people	☐ Less people	☐ N/A

6. Personal Space (Interference)
   What would you prefer: (A). Share a Bench____ (B): Keep Standing____
   Reason: Do you give Space? _____ Do you want Space? _____

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Fig: 46 Questionnaire sample (English)

Questionnaire translation for the German public participation:

Datum: ----/------/2017

Fragebogen

1. Demographie
   - Geschlecht

☐ Männlich	☐ Weiblich

   - Alter

☐ 13-19	☐ 20-39	☐ 40-59	☐60 und darüber

2. Nutzung

☐ Laufen	☐ Fahrrad fahren	☐ Kinderwagen
☐ Stehen	☐ Trolley/Rollator	
☐ Sitzen	☐ Rollstuhl	

3. Benutzungs zeit
   a. Wie oft benutzen Sie diesen Platz?

☐ Täglich	☐ Einmal die Woche	☐ Zweimal die Woche	☐ Häufiger

   b. Warum kommen Sie hier her ?

☐ Einkaufen	☐ Sich treffen	☐ andere	……

   c. Zu welcher Uhrzeit kommen Sie hier her?

☐ 8:00-10:00	☐ 10:00-12:00	☐ 12:00-14:00	☐ 15:00 and later

4. Belegung
   a. Wie viel zeit verbringen Sie normaler weise hier?

☐ Weniger als eine stunde	☐1 stunde	☐ 2 stunden.	☐ 3 stunden.	☐ Mehr

   b. Wo genau?

☐ Lindenstraße	☐ Karlplatz	☐ Poststraße

5. Präferenzen
   a. Sitzen Sie gerne hier?

☐ Ja	☐ nein	☐ manchmal

   b. Wo sitzen Sie lieber?

☐ Im Vordergrund	☐ Im Hintergrund	☐ Egal(Keine Präferenz)

   c. Mögen Sie Personen auf Plätzen?

☐ Viele Leute	☐ Weniger Leute	☐ Egal(Keine Präferenz)

6. Persönlicher Freiraum

Was würden Sie bevorzugen?: (A). Bank teilen____ (B): Stehen bleiben____

Grund: Möchten Sie platz lassen? _____ Möchten Sie silber platz haben?_____

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Fig: 47 Questionnaire sample (German Translation)

Chapter 4. Case study

4.1 Project Site

The site selected for the thesis project is in Bernburg, Germany. It consists of functionally different Public spaces

4.1.1 Karlsplatz (an Urban Square)

Multipurpose public space with transformable space functions, like festivals on special occasions, food and vegetable market, flea market. It has two outdoor café sitting. Some benches along connecting street are available. A part of Karlsplatz is a small park of 1ha.One side of the park is a bus bhanhof. It is most favorite public space around and mostly people are found in this space.

Fig: 48 Karlplatz multipurpose area Oct 28, 2016, between 11:30 - 13:00

Fig: 49 some views of Karlsplatz Park and bus stand Oct 28, 2016, between 11:30 - 13:00

4.1.1.1 Functions of Karlsplatz:

Functions of Karlsplatz are more in addition to above-mentioned functions of Lindenstraße and Poststraße. It is more used because of more functions and connectivity. Because of its connectivity, people make it a meeting point. It's connectivity increases because it also has the main bus stand which carries people to and from different places from within and out of the town.

Functions of Karlsplatz		
• Flea Market • Festivity • Socialization	• Street Café • Sitting places • Dispersion point	• Meeting Point • Food • Main Bus Stand

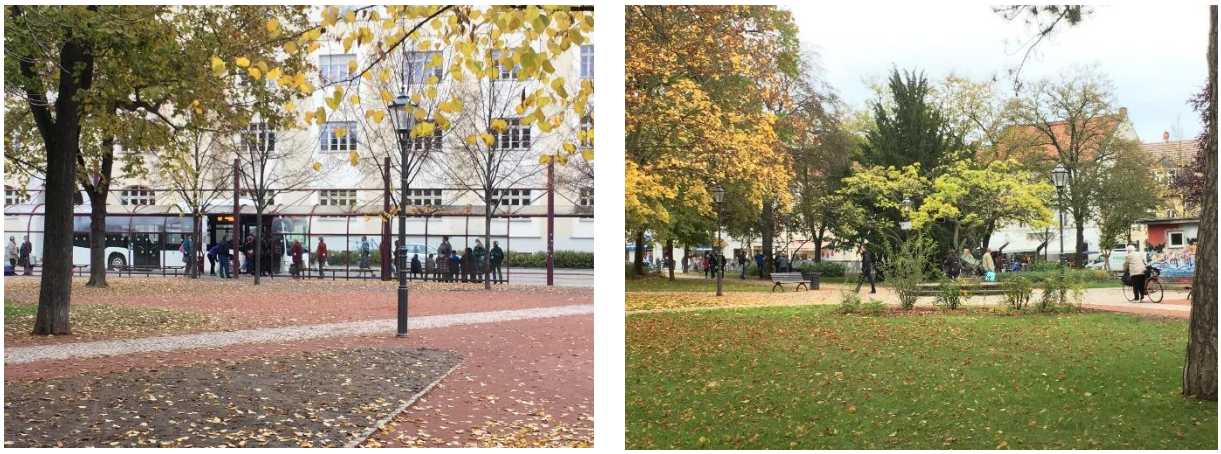

Fig: 50 Karlplatz functions connectivity and activity, Bus stand and crossing through to reach market area

Fig: 51 Karl Platz functions connectivity and activity walking, bicycling, business, sitting, socializing, food

4.1.2 Poststraße (Public Street)

It's a commercial street with a barrier to control through access. It has access to public bus and service vans and truck but private car access is restricted. It has estimated the length of 80m. It has a small water feature with nice metallic statues, some benches are also available for sitting.

Fig: 52 Poststraße Oct 28, 2016 at 11:00am

4.1.3 Lindenstraße (a commercial street)

It is predominantly a commercial street of almost 680m length, with a variety of functions listed below.

Fig: 53 Lindenstraße Oct 28, 2016 at 11:00am

4.1.3.1 Functions of Lindenstraße and Poststraße

Functions of Lindenstraße and Poststraße are more or less the same.

Fig: 54 Linden Straße left and Post Straße right

Functions of Lindenstraße and Poststraße	
• Shopping • Socialization • Street café • Connectivity • Pedestrian • Bicycle Route and parking	• Service van • Public Bus Route • Sitting (Benches) • Advertising • Street Performance (Music etc.) • Food

4.2 **Project Site**

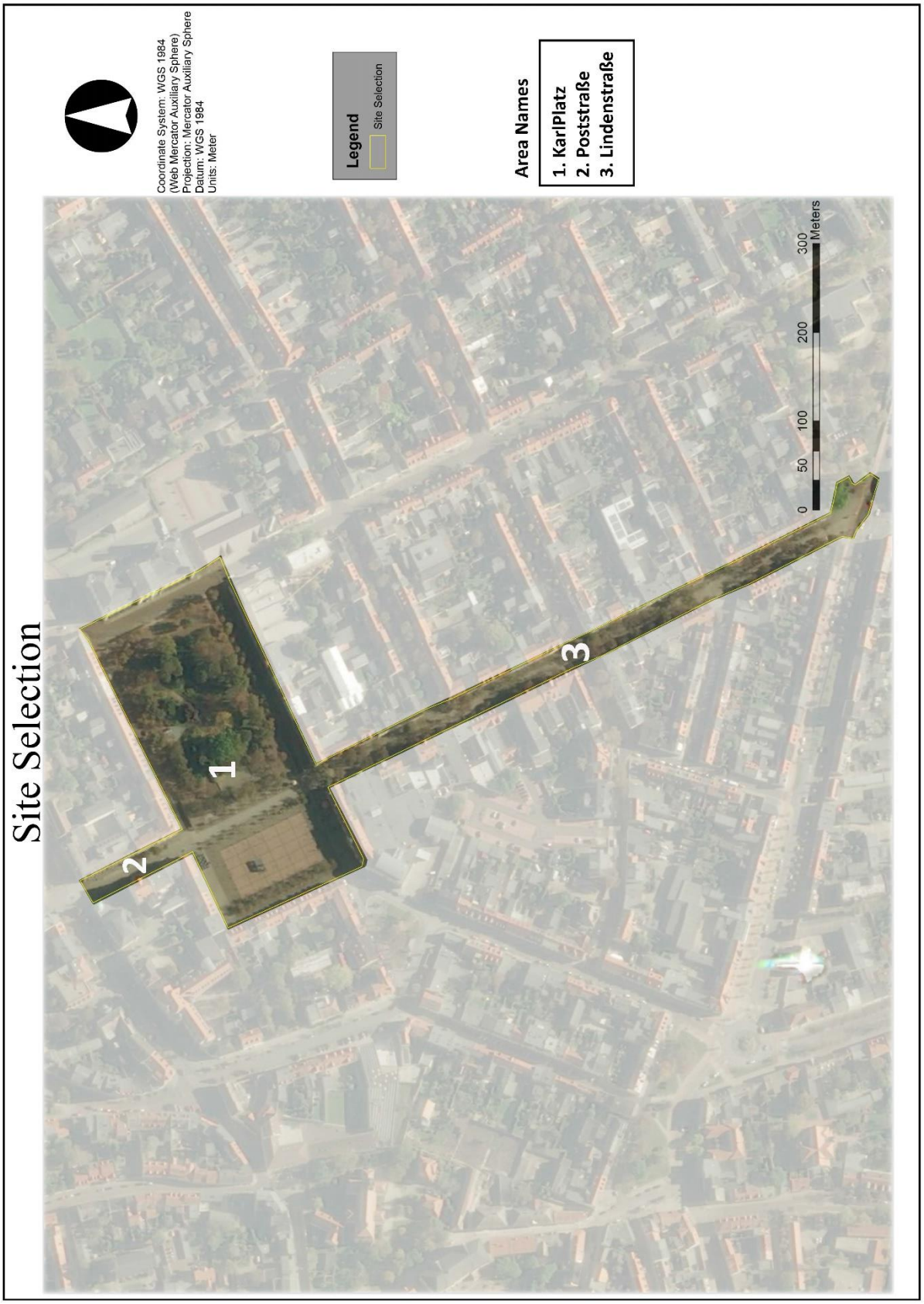

Fig: 55 Satellite image showing site selection

Chapter 5. Data Processing, Calculations, Assessment and Results

5.1 Psychology of Space

Research starts with the reconnaissance of the case study area to observe the people behavior particularly with reference to local culture and norms. In this section, some results are being presented from mere observations and in the light of Edward T.Hall's (1966) model of interpersonal distance. Psychology of space discussed and presented here is solely based on general observations. This initial study defined basis for the design of the questionnaire, selection of personal postures, categorization of personal postures in to primary and secondary postures. It also helped further to work out a criteria for spatial analysis by observing; how people use different areas in a public space.

5.1.1 Introduction to Fundamentals of Space

Edward T.Hall's Model of Interpersonal Distances **(**Edward T.Hall 1966)

As shown in the Fig: 56 a model developed by Edward T.Hall (1966), he mainly depended on the work of Grosser, who recorded a number of observations but he did not use the terms for interpersonal spaces and later these terms were defined by Edward T.Hall (1966). He claims responsibility for the elaboration of interpersonal space terms, as follows. "The interesting point about Grosser's observations is that they are consistent with proxemics data on personal space. Although he does not use the terms, Grosser distinguishes between what I have called intimate, personal, social, and public distances."[92]

5.1.2 Intimate space

It is a space in which relatives and people of very close acquaintance are allowed to enter, like a wife, children, parents etc. In Edward T.Hall (1966) model a standard intimate space is a 1.5ft or 0.45m radius around a person.(Edward T.Hall 1966)

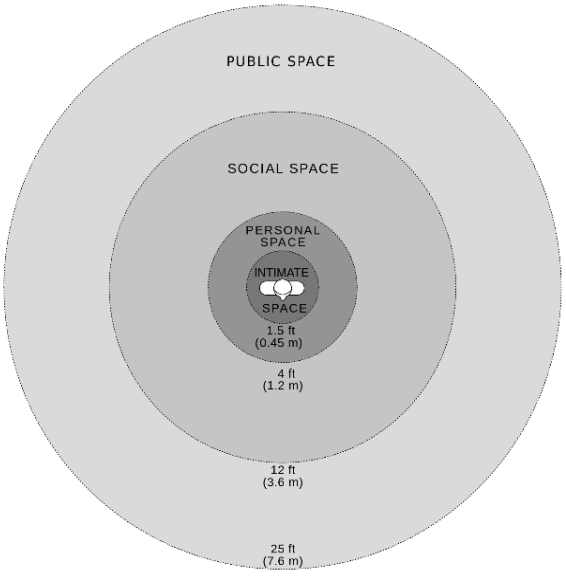

Fig: 56 A Chart showing Edward T.Hall 1966 interpersonal distances of man

5.1.3 Personal space

According to the Oxford dictionary, personal space can be defined as "The physical space immediately surrounding someone, into which encroachment can feel threatening or uncomfortable."[93] Personal space

[92] Edward T.Hall (1966). The Hidden Dimension. ISBN 0-385-08476-5; P 78

[93] Oxford, D. (2010). *Oxford Dictionary of English* (3rd ed.). (A. Stevenson, Ed.) Oxford University Press

can be defined by personal distance as described by Hediger (1955). “Personal distance is the term applied by Hediger (1955) to the normal spacing that non-contact animals maintain between themselves and their fellows. This distance acts as an invisible bubble that surrounds the organism. Outside the bubble, two organisms are not as intimately involved with each other as when the bubbles overlap. Social organization is a factor in personal distance.”[94]

In Edward T.Hall’s (1966) model a standard personal space is 4ft or 1.5 m radius around a person.

5.1.4 Social space

“Social animals need to stay in touch with each other. Loss of contact with the group can be fatal for a variety of reasons including exposure to predators. Social distance is not simply the distance at which an animal will lose contact with his group—that is, the distance at which it can no longer see, hear, or smell the group—it is rather a psychological distance, one at which the animal apparently begins to feel anxious when he exceeds its limits. We can think of it as a hidden band that contains the group.”[95] In Edward T.Hall’s (1966) model a standard social space is a 12ft or 3.6m radius around a person.

5.1.5 Public space

A public space is a social space that is generally open and accessible to people with right of presence.

In Edward T.Hall’s (1966) model a standard social space is a 25ft or 7.6m radius around a person.

5.2 **Psychology of personal space**

Personal space in human being come with somewhat different meanings than personal territory in the animals. It should not be confused with each other. Personal space in public spaces comes with mutual rights, not with the integral rights whereas personal territory has somewhat integral rights on space.

When personal space is discussed in context to public space, it is known that public space is a “Neutral Space” in its provision, design, law and use.

5.2.1 In Pursuit of Personal Space

Personal space has both physical and psychological dimensions. In order to look into, what is deep inside the phenomena of personal space? Let us analyze it. Personal privacy is one such phenomenon, people remain in search of their personal space. Home is a private and street is a public space, and people move between and live everyday life in these two spaces. Living space changes over and over again, in use from

[94] Edward T.Hall (1966). The Hidden Dimension. ISBN 0-385-08476-5; P 13-14
[95] Edward T.Hall (1966). The Hidden Dimension. ISBN 0-385-08476-5; P 14

private to the public throughout a human lifetime. Private and public space are different in nature and in possession regulations. Most people learn this regulation and pretend accordingly, while very few ignore or pretend to ignore. Those, who exhibit that they have learned how to behave in public spaces are considered more mature and understanding people. These are the people who can handle perceptively or unintentionally both physical and psychological forms of personal space phenomena.

Impact:

An urge to search for one's own personal space may have consequences, for instance, need more space. It also has certain positive effects on occupancy of a public space. It has dispersal propensities and can result in equal distribution of people over the entire public space.

5.2.2 Possessiveness of one's personal space

People are sometimes very possessive about their personal space and sometimes it depends on the situation and mood. It varies with gender, age groups, education, acquaintance, language and ethnic background. People from less educated societies are more interactive than in the highly educated societies despite acquaintance level.

For instance, immigrants are usually found in groups, they find each other and come together and talk, discuss their problems. One of the most obvious reason is that they take common background and language as their reason of acquaintance and a strong justification to intermingle, which is taken for granted by the host nation. Local people need stronger reasons to come together, in their case interaction may happen when they are familiar or they have to share a space, a festivity or any other common reason.

Fig: 57 Personal space experiment in a public space

The above (Fig: 57)[96] show an experiment about personal space in a commercial street. Possessiveness is intense while sitting than standing and walking. Sitting walking and standing are three consecutive postures with a definite psychological signal in possessiveness of space.

[96] http://westsidetoastmasters.com/resources/book_of_body_language/chap9.html

Sitting is the strongest claims of possessives, standing is a second and walking offer the weakest claim of ownership. People hardly intrude personal space of sitting people, their claim is taken strongly but if someone standing even close to a sitting space people may come and occupy that space. Possessiveness is a two-way psychological phenomenon, for example, people may not come together feeling personally intruding into others personal space and another way around expression may come from the occupier.

Fig: 58 People sitting on two distant benches and communicating while three immigrants grouped together

Impact:

When people are more possessive about their own personal space, they may move away from each other. As soon as distance increases, space required for people will also increase which will result in such a way that, even in lower density exhibit of public space occupancy will be very high.

5.2.3 Keep Distance Feeling

Personal space being physical or psychological phenomena is a measure of distance. Keep distance is again two-way phenomena, people may keep distance for not to disturb and not to be disturbed. This may impact personal footprint and minimum need for personal space. A deep study of this phenomena may help to explore what is the least space required for every occupant in a public space.

The least Space requirements of people in a public space vary with the change of posture. For instance, people in standing mode occupy less space than sitting but while walking personal space bubble expands in a surge of clearance and person may need extra space to walk safely without collision into others.

A person on a bicycle, a walking trolley, or a baby stroller needs extra space than solitary movement or stay.

Speed is also another factor which claims more space in public spaces. People walking hurry or paddling bicycle may create more chances to collide therefore need extra space for clearance and safety.

Senior or handicap people sometimes appear with mechanized chairs which are especially big in size occupy more space.

People out in public spaces with any of the aid or gadget becomes part of the body and therefore need extra space. Personal space for all these special people is more than normal people.

Impact:

This phenomenon can also help to understand the need for required space, though it varies from person to person, based on the type of gadget, they are within a public space. As a person with a bicycle needs more space than a pedestrian. Therefore if we calculate required space based on actual demand, relevant to each gadget, it may impact the capacity of public space. It can also help to measure, know and understand that how much sufficient is that space for a certain number of people with different kind of gadgets.

5.2.4 Respect for Personal Space

There is also a great element of social respect and acceptance of others claim to their personal space. This is more common in educated societies and formal people. People sitting behavior was studied on a regular day in Karlsplatz. People used to sit one on each bench instead of sharing benches. In a study which prolonged over a period of 45 minutes people were sitting and leaving the benches but every next coming user was sitting on an empty bench. What is the reason people are not sharing a bench, designed for three people? Everybody was sitting on a separate bench but on the edge, leaving space for others. But as there was empty bench available, they chose empty bench.

This behavior leads to two questions;

Are people concerned about their personal space? Or do people respect other people's personal space? Or do they concerned about both of above reasons?

Fig: 59 People sitting behavior study in Karlplatz

Sitting on a separate bench is more about care for their own personal space but sitting on the edge of the bench means, they still have in mind to respect for other people's personal space, therefore, they leave their space.

Impact:

People behavior, whether they are concerned about their own personal space or they respect other's personal space, do affect demand for useable space in public spaces. In both cases, people have repelled away and as a result capacity of public space decreases and the notion of sufficient space is changed.

5.2.5 Security Issues

Security is also another issue in public spaces which may have a basis in alien roots and gender. People from same cultural background may feel safe with each other but local may feel security issues around immigrants and vice versa as there are very fewer chances of communication because of language barriers. Gender could also pose barriers to in coming closer in public space. Female may avoid sharing space with men in some cases. People feel more secure while more people around then in empty corners of public spaces. Therefore in the front side of the public space concerned people may behave differently than in the back side of public space. Where people feel secure may share space and less apprehensive about their personal space. People turn to possessive about their personal space as soon as they feel threatened. In high occupancy area of public spaces, people feel more secured, than in low occupancy areas.

Impact:

Whatever form (Alien roots, gender, age) of insecurity prevails in a public space, it triggers territorial occupancy of public spaces. If there is any such sense, people distribution of space is affected, especially female move to the front of the public space where there is already high occupancy. In such cases, some parts of public space are over utilized and rest may remain underutilized.

5.2.6 Personal Space Intrusion

Personal space intrusion is another perceptual fear, which prompts mutual estrangement. Personal space intrusion is a repercussion of coming so close in proximity to intimidate others. In order to avoid intrusion people dissociate each other. It depends on the cultural warmth of societies, that how much adhesion they offer.

Impact:

The sensitivity of personal space intrusion in a society may have certain spatial consequences. A society more conscious about their personal space may cause personal repulsion. A society in a state of personal repulsion, need more public space for a fewer

number of inhabitants to avoid an encounter. Therefore as a consequence capacity of a public space may affect in a way that fewer people could be accommodated in more space. As a result, space cannot be used efficiently.

5.2.7 People Attract people

Public spaces are social centers and magnets for the masses. People are attracted towards public spaces. Societies are need and leisure driven. People do things in need for example shopping, work, food etc. or for pleasure and entertainment. Whatever the push and pull factors are, people, happen to be there, where there more people. It depends on social background how people socialize, but as far as phenomena "people attract people" is concerned it is universal in nature.

Impact:

When in a public place "people attract people" concentration in a certain area rise than rest of places. The rate of occupancy rises and therefore the capacity of space is affected. Public space is a constant in the provision, whereas people are variable.

5.3 **Personal Postures in a Public Space**

People in an urban space may come from different age groups and backgrounds. German diaspora has also contained a variety of age groups. Some people are also in their old age and may use special walking aids like walking trolleys, motorized chairs, etc.

As a pilot project field survey on a peak time was conducted in which some 540 people were observed and a number of data attributes were derived from creating a database to process their posture with their geographical locations.

Some observations about use has also been enlisted;

1) In most of the cases people sitting alone in a Bench even on a very high occupancy day Fig: 60.
2) People standing in groups almost everywhere, even in the middle of the streets and talking Fig: 61.
3) People were eating, taking coffee, and enjoying ice cream in public place.

5.3.1 Primary Postures (Sitting, Standing, Walking)

Sitting, standing and walking are three most common human posture from everyday life usually practiced in public places.

Fig: 60 People sitting in a public space

Fig: 61 People standing in a public space

Fig: 62 People walking in a public space

5.3.2 Secondary Posture

5.3.2.1 Bicycle, Walking Trolley, Mobility Scooter, Baby stroller

The bicycle is also part of everyday life in Germany and it is very popular in almost all ages and both genders. In German public spaces, bicycles are very common. Therefore it is considered and important posture to be included in the study and calculated. It is also important to note that presumably, it may take more space than primary postures, like standing, sitting and walking.

Modern societies are also aging societies and German society is one of them. In china, Japan and also in Germany the number of old people are on the rise.

Fig: 63 People in public space with secondary posture

Population of Germany (2017 and historical)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Germany Global Rank
2017	**80,636,124**	-0.06 %	-46,227	150,000	46.4	1.4	231	77.3 %	62,341,809	1.07 %	7,515,284,153	18
2016	**80,682,351**	-0.01 %	-6,194	150,000	46.4	1.4	232	77.2 %	62,260,626	1.09 %	7,432,663,275	16
2015	**80,688,545**	0.06 %	50,648	250,000	46	1.39	232	77 %	62,170,091	1.10 %	7,349,472,099	16
2010	**80,435,307**	-0.2 %	-162,299	6,300	44	1.36	231	76.7 %	61,674,606	1.16 %	6,929,725,043	16
2005	**81,246,801**	-0.16 %	-129,825	200	42	1.35	233	75.7 %	61,497,844	1.25 %	6,519,635,850	14
2000	**81,895,925**	0.07 %	56,605	148,900	40	1.35	235	74.5 %	61,020,429	1.34 %	6,126,622,121	12
1995	**81,612,900**	0.66 %	530,933	646,500	38	1.3	234	74.7 %	60,935,648	1.42 %	5,735,123,084	12
1990	**78,958,237**	0.36 %	277,646	342,100	38	1.43	227	74.5 %	58,850,740	1.49 %	5,309,667,699	12
1985	**77,570,009**	-0.15 %	-117,904	0	37	1.46	223	74 %	57,366,703	1.6 %	4,852,540,569	11
1980	**78,159,527**	-0.13 %	-101,560	57,700	36	1.51	224	73.8 %	57,669,546	1.76 %	4,439,632,465	9
1975	**78,667,327**	0.08 %	60,144	142,800	35	1.71	226	73.5 %	57,843,826	1.94 %	4,061,399,228	8
1970	**78,366,605**	0.62 %	475,174	183,500	34	2.36	225	73.1 %	57,304,431	2.13 %	3,682,487,691	8
1965	**75,990,737**	0.76 %	562,214	-8,400	35	2.13	205	72.6 %	55,156,781	2.29 %	3,322,495,121	7
1960	**73,179,665**	0.52 %	373,185	8,000	35	2.29	210	71.5 %	52,350,242	2.42 %	3,018,343,828	7
1955	**71,313,740**	0.43 %	305,499	-8,400	35	2.13	205	70 %	49,937,036	2.59 %	2,758,314,525	7

Source: **Worldometers** (www.Worldometers.info)
Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2015 Revision. (Medium-fertility variant).

Table 7 Population of Germany from UN statics

Population growth rate in negative is also an indicator of aging population and in case of Germany population growth rate in 2017 remained -0.06%.

Old people are one of the significant public space users and their presence comes with the variety of walking aid. Some most common walking aids observed in German open spaces are shown in the following figure. It is also considered most likely to occupy more space than primary posture.

5.4 **Psycho-spatial analysis**

It is an analysis of the behavior of the people present in public space to get an insight by the way of asking a small questionnaire. It will further help to design a criteria to perform spatial analysis.

5.4.1 Demographic (Question No.1)

In the demographic data as shown in the following table and the chart, different age groups has been compared with the gender. It is to demonstrate that what is a gender share of public space occupancy and what are their relevant age groups.

Age Group		Gender	
Ages	%age	Male	Female
13-19 Yrs.	18.2%	25.00%	75.00%
20-39 Yrs.	31.8%	42.86%	57.14%
40-59 Yrs.	18.2%	25.00%	75.00%
60 Yrs. and Above	31.8%	28.57%	71.43%

Table 8 Gender and age group table

Bar chart shows that public space users of the age group 13-19 Yrs. comprise 18.2% of the total users with 25.0% male and 75.0% females. Similarly, users from age groups 20-39 Yrs., 60 Yrs. and above comprise the major part i.e. 31.8% each with gender share of 42.85% male and 57.14% female in former group and 28.57% male 71.43% females in the latter group.

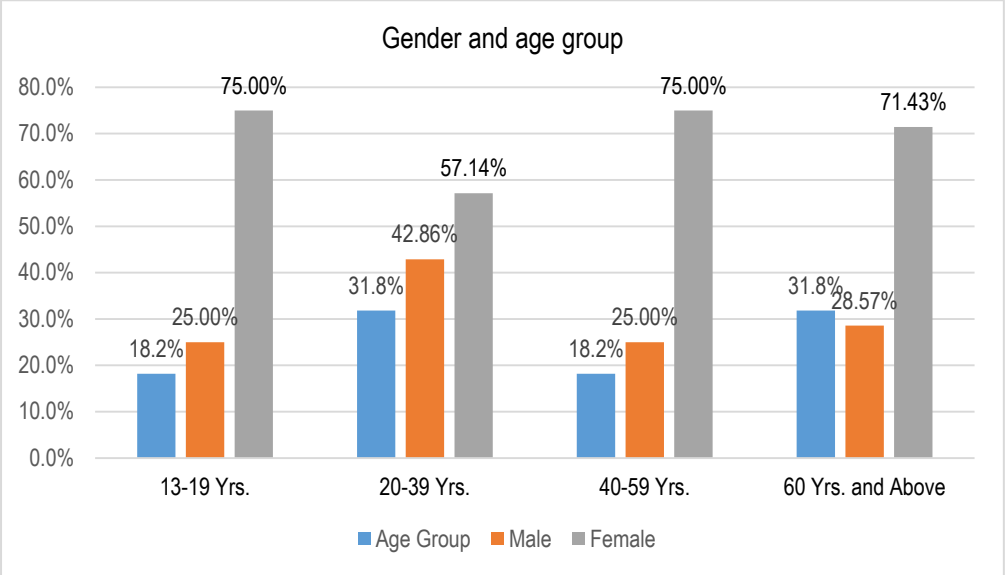

Fig: 64 Gender and age group bar chart.

Impact:

Demographics define the composition of the occupancy of the public space. It is the composition which defines personal postures, presence and necessary gears like bicycle, walking trolley, mobility scooter or strollers.

5.4.2 Personal posture as a mode of Occupancy (Question No.2)

Personal posture are considered of modes of occupancy therefore, they were recorded as per variety available in the Public space under study. Most common posture found in the public space were standing and sitting.

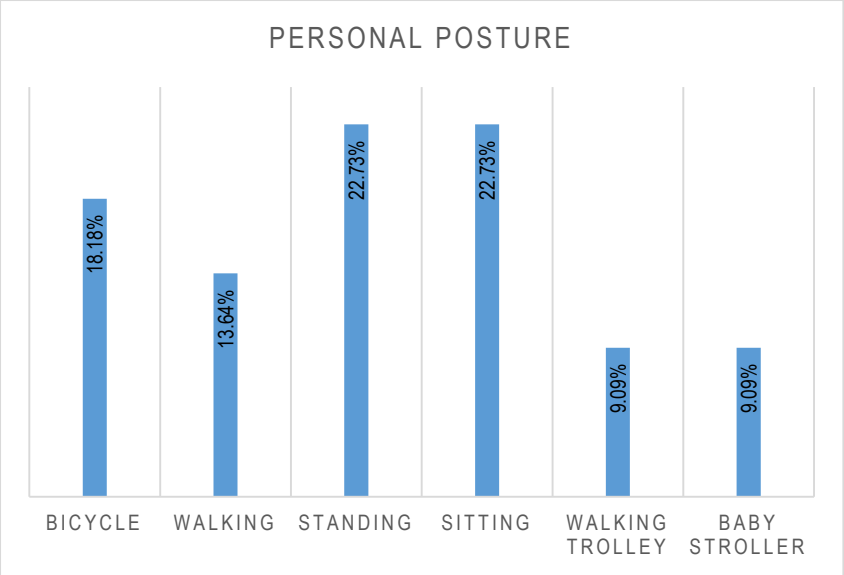

Fig: 65 Personal posture as mode of occupancy

Impact:

Personal postures define mode of occupancy of the public spaces and their corresponding need for space if personal space changes with the change of personal posture.

5.4.3 Frequency, Purpose of Public space visit and Peak hour of Occupancy (Question No.3)

5.4.3.1 Frequency of Public space Visit (Question No.3a)

Occupancy of a public space is also defined by frequency of the visit paid users. Most of the people around 45.45% responded that they visit daily. Second highest response was 31.82% as once a week.

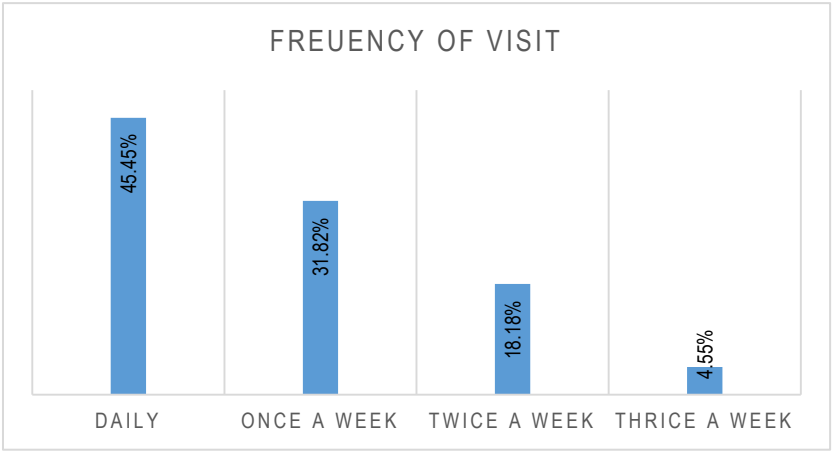

Fig: 66 Frequency of Public space visit chart

Impact:

Frequency of the public space visit defines the day of the higher occupancy of the public space. The daily visitor are maximum which add to every other category to define the occupancy of public space on that day. More the frequency of the visit more effect on the capacity and sufficiency of the public space.

5.4.3.2 Purpose of Public Space Visit (Question No.3b)

Purpose of the visit has an active element of public space occupancy that is socialization. Whereas shopping is also a passive element of public space occupancy. Most of the public space occupancy comes from passive occupancy that is 56.25% occupancy of study area is because of the shopping and 25.00% people come to this public space for socializing.

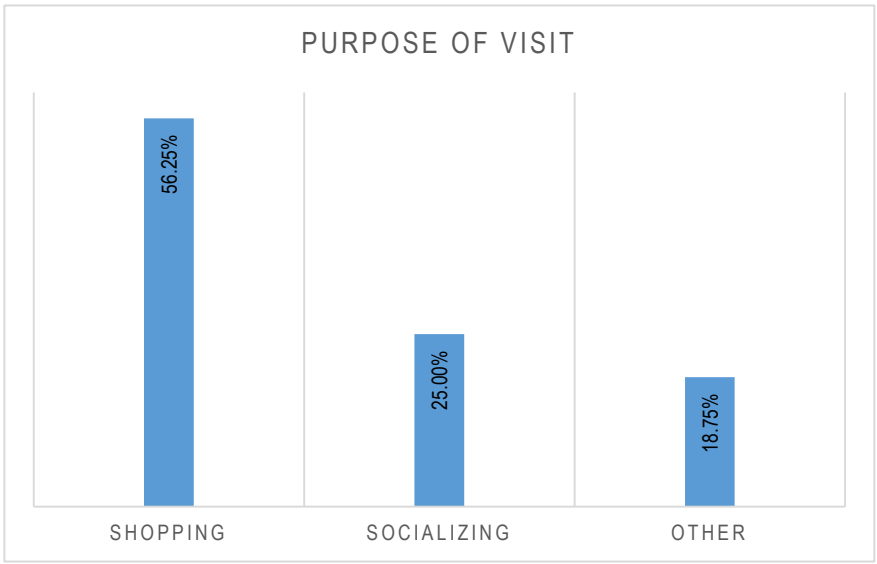

Fig: 67 Purpose of public space visit

Impact:
Purpose of visit is also related to occupancy of public space, people visiting just for a sole purpose of socializing are actual feed to occupancy of a public space and impact directly, rest of the visitors have passive impact on the occupancy of the public space.

5.4.3.3 Duration defining Peak Hour (Question No.3c)

Peak hour is yet another factor defining public space occupancy during which specific time hour slot. Most of the people recorded their slot of presence during 10:00-12:00 and 15:00 and Later 30.30% each. Second highest number of people presence slot is between 8:00-10:00 i.e. 24.24%.

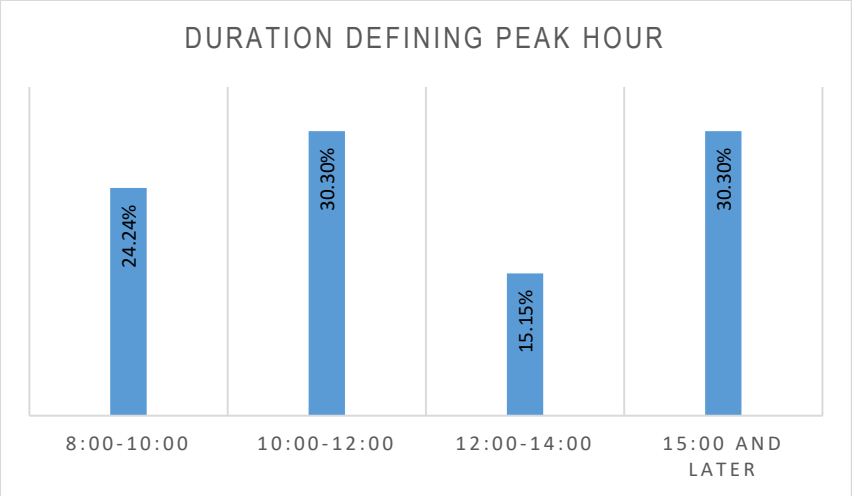

Fig: 68 visiting hours of a public space

Impact:
Peak hour is actually the time of presence and hence the time of pressure on capacity and sufficiency of the public space. In this study it is from 10:00-12:00 and from 15:00 and later

5.4.4 Duration defining Time length, Location of Presence (Question No.4)

5.4.4.1 Time length in Public Space (Question No.4a)

Duration of stay in a public space an occupancy defining factor and most of responses 50.00% were those who stay less than an hour. It means while a high level of occupancy is maintained by people coming and going out of public space. Second highest response is 31.82% who stay at least an hour, around 18.18% stay around two hours.

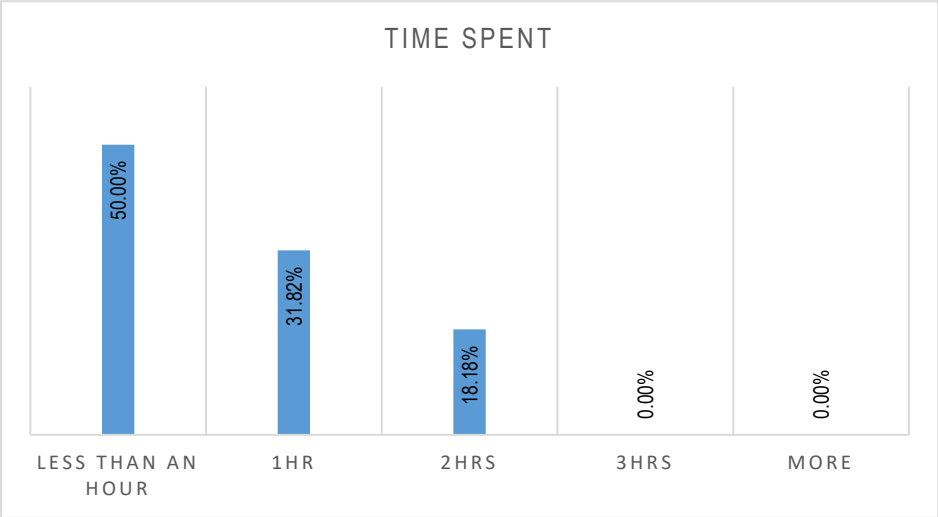

Fig: 69 Time spent in public space

Impact:

Time spent by people is another pressure factor. Longer the time spent span may impact occupancy more but shorter the span like in the case of this study, impact is counterbalanced by the shorter time span of presence in the public space.

5.4.4.2 Location of Presence (Question No.4b)

Location of presence preference is a factor defining occupancy of a particular area of the public space. Karlplatz being a public square which attract more people than linden Straße and Poststraße. Occupancy of Karlplatz is 43.18% as per people preference and least 27.27% of the Poststraße. Around 29.55% people showed interest of presence in Lindenstraße.

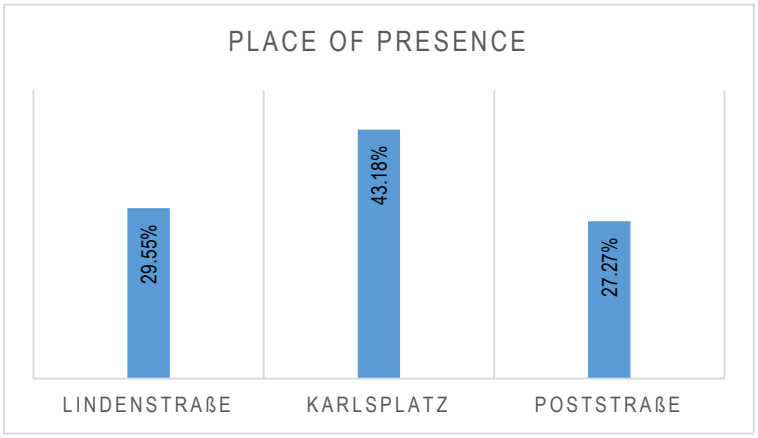

Fig: 70 Place of presence

Impact:

Place of presence in a public place defines the areas of likely pressure zone of the public space in context to occupancy and capacity.

5.4.5 Personal Preferences about Space and People (Question No.5)

5.4.5.1 Feel Need to Sit (Question No.5a)

In some cultures people may like or dislike sitting at public places, in this study 31.82% people recorded their response that they don't feel need to sit in the public space. Around 36.36% people recorded that sometimes they feel need to sit around in the public space, under study. Some people mentioned their reservations about sitting in public space with the argument that if they ever feel they will go to nearby café to sit there rather sitting outside.

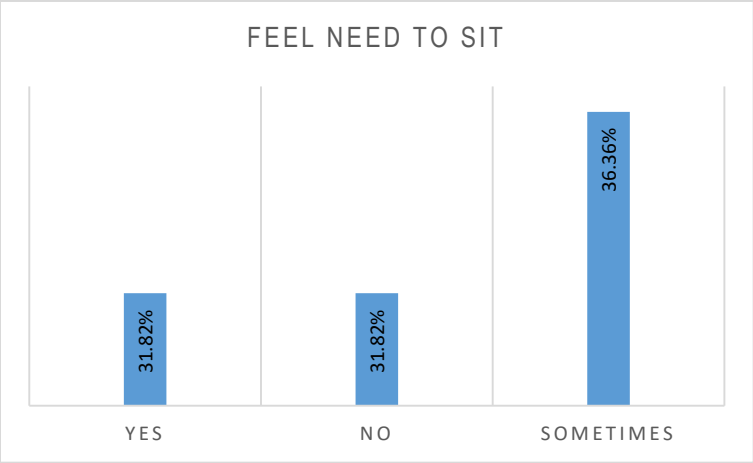

Fig: 71 Feel need to sit in public space

Impact:

This response can help to know the demand for sit able places.

5.4.5.2 Sitting Location Preferences (Question No.5b)

Preferred sitting location has an inquiry clue that people like to sit in front where there are most of the people gather or pass from or at the back with less people. Most of the people showed no concern about any particular preference.

Impact:

Sitting location preference may define the demand for sit able places in front or on the back in the public space.

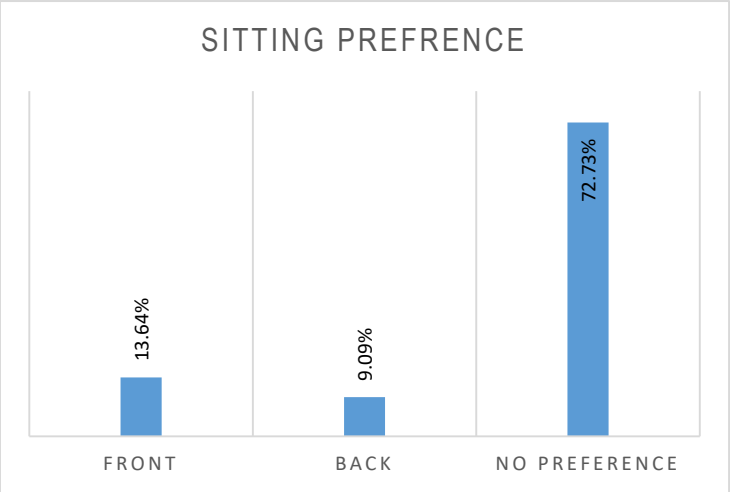

Fig: 72 sitting preference in public space

5.4.5.3 Number of the people in Public Space (Question No.5c)

Number of people in a public space is an occupancy defining factor on one hand but in some casing it could also be an occupancy defying factor. It is generally believed that people attract people but in some culture it is an opposite factor. In this case study only 10% people responded in the favor that they like many people in a public place and around 29% responded in the favor that there should be less people in a public space.

But there is an encouraging factor that almost 61.29% people recorded their response in favor of that they have no problem with more or less people presence in public space. As a matter of fact they could be included in the category of many people presence in public space.

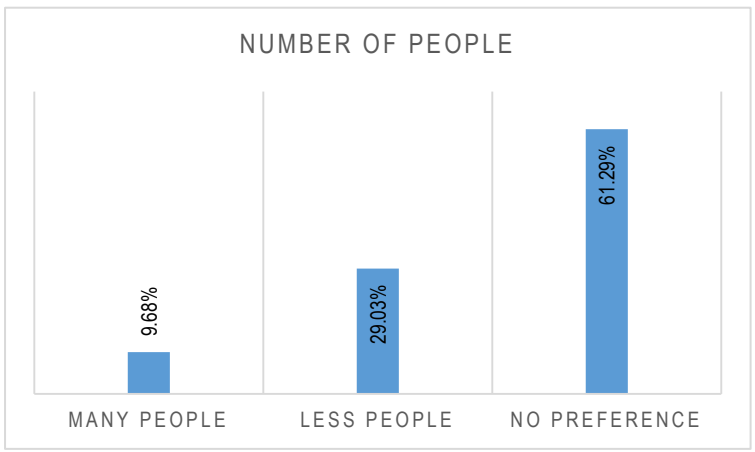

Fig: 73 Quantity of people in a public space

Impact:

Response defines number of people who may avoid places with more people and as a result may less likely to be the part of higher occupancy. The impact would be reduction of pressure on the public space occupancy.

5.4.6 Personal Space (Question No.6)

5.4.6.1 Sharing of sitting place (Question No.6a)

Sitting Places are an important element of public spaces but have some limitations in provision. Sharing of sitting places is a nice gesture and a great tendency in best utilizing limited public resources in an efficient manner.

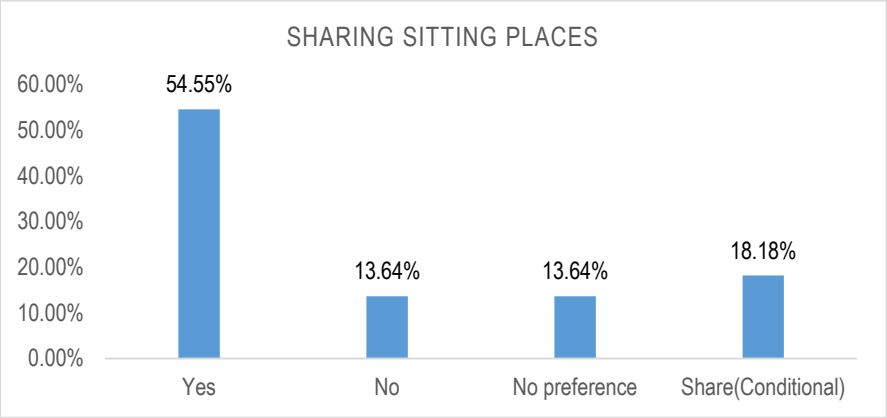

Fig: 74 sharing of siting place in a public space

Some people may have certain reservations in sharing sitting places. Most of the people around 54.55% responded positive in favor of sharing of sitting places, around 13.64% responded in negative, It means don't want to share. There are 13.64% people who have no concerns in both cases. There were around 18.18% unusual responses in which people mentioned some conditions in which they may share siting places. Some of the conditions shared by the people are mentioned in "Conditional Responses and Notes.

Impact:

Sharing of sit able places tendency reduces pressure from demand of more places and efficient use of existing sitting places. It is also a supporting sing for sufficiency of available infrastructure.

5.4.6.2 Reason for sharing and not sharing a sitting place in Public space (Question No.6b)

Public spaces are shared spaces and everybody have it in the back of their mind. Some people share sitting places and some don't share. There must be some reason behind this response. In this question people were asked when they don't share what could be reason behind in context to their want for personal space. Around 27.27% people don't want to share a siting place because they think they may disturb the person already sitting on a bench.

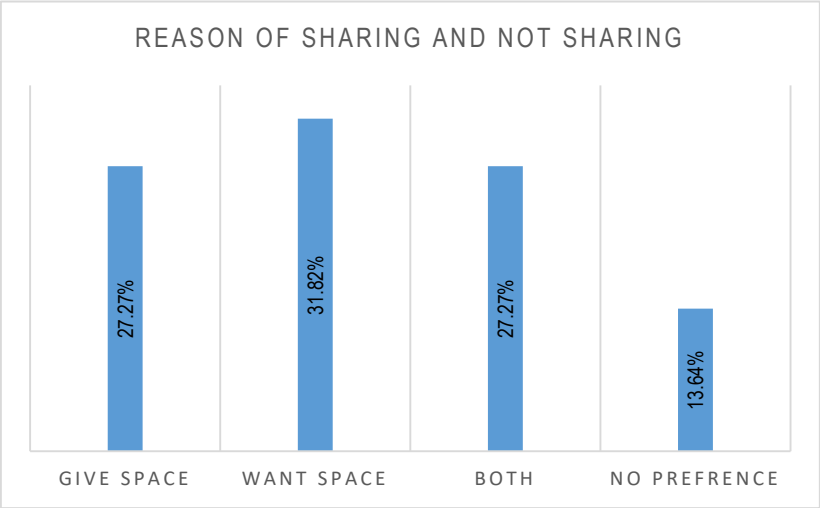

Fig: 75 Reason for sharing and not sharing sitting place

Around 31.82% people don't want to share because they want to be alone and sharing with others may offend them in want for their own personal space. Around 27.27% shared both feelings that they feel disturbed and at the same time they feel disturbing others, while sharing a bench and only 13.64% people showed no preference.

Impact:
This response refers to personal space consciousness of the mases. The response is fifty-fifty both ways, people give space and want space at the same time. Some more expressive people choose both option. Overall result is almost equal on both sides.

5.4.7 Conditional Responses and Notes

It includes what people speak additionally but somehow lies within the scope of study.

a) At least three women said they will share a bench only if they know the person, otherwise no.
b) He said before sitting beside a person on a bench, he will ask the person, "may I sit here sir?"
c) She doesn't like to sit outside if she feels a need to sit she goes to a café, have some coffee and rest there.

d) She doesn't feel need to sit on the bench because she can use walking trolley as a chair.

e) Her dog doesn't like people around, so she also doesn't like more people around.

f) An old decent lady said, sitting places are too dirty to site on.

5.5 **Hypothesis Statement 1**

According to first Hypothesis statement:

a. Personal space changes with the change of given personal posture.

"It is assumed that people in different posture occupy different space, therefore each distinctive posture should be measured and compared with standard personal Space."

5.5.1 Personal Space

Term "Personal space" originated from the psychology of social sciences. It has its roots of perceptions in psychology. In this project, it has been taken from there and transformed in a physical space to use as a unit of measurement for the calculation of public space occupancy. The capacity of a public space requires a measure of useable space and a unit to measure it. In this way, personal space may also act as a measuring a unit to calculate the capacity of a given public space.

Personal space phenomena is used as a personal space bubble with a measure of radius 1.2m or 4 feet. Let us assume that this is taken as while a person is in a standing position, and it should be different for other primary or at least secondary postures discussed in chapter 2, Section 2.8.

In order to calculate personal space, common personal postures have been divided into main two types: Primary and Secondary Postures, as discussed in section 2.8.2 of chapter 2. All three primary postures (standing, walking and sitting) are discussed in times saver standards for landscape architecture[97]. One of secondary posture bicycle has also been discussed partially as this project requires, in TSS for LA[98]. In order to use all postures as measuring units, they must be defined first.

[97] Charles, W., & Nicolas, T. (1998)
[98] Charles, W., & Nicolas, T. (1998)

5.5.2 Measurement of Postures

5.5.2.1 Primary Postures

There are three primary postures, their measurements has been derived from TSS for LA[99], as discussed in Chapter 2 Section2.8.2.1

- Standing and Sitting Postures

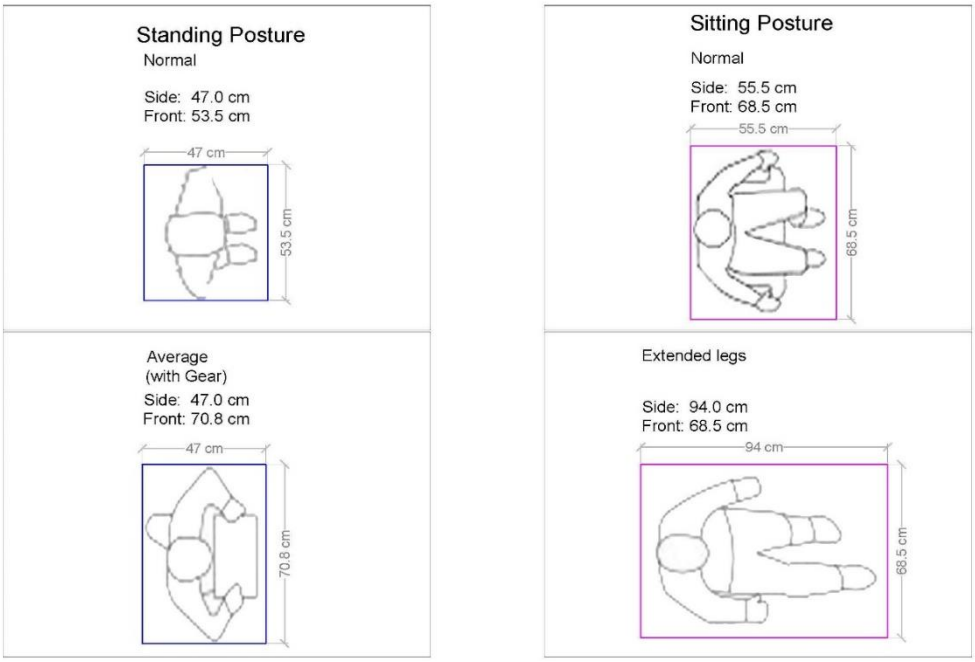

Fig: 76 Standing and Sitting Posture as per (Charles, W., & Nicolas, T. (1998)

- Walking and Striding

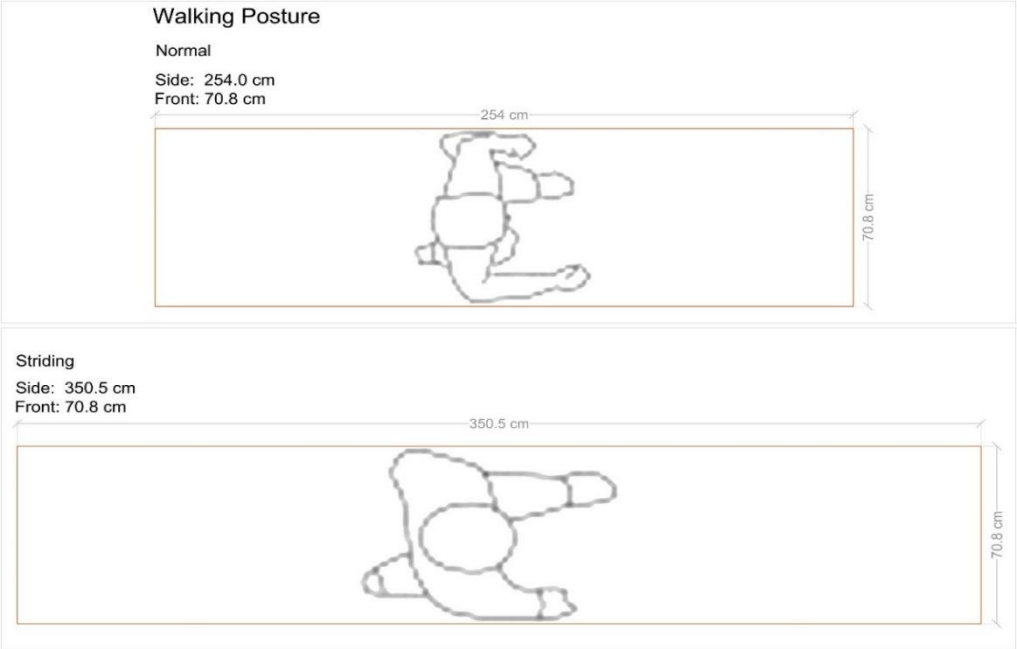

Fig: 77 Walking and Striding posture as per (Charles, W., & Nicolas, T. (1998)

[99] Charles, W., & Nicolas, T. (1998)

5.5.2.2 Secondary Postures

- Bicycle

Fig: 78 Bicycle posture as per (Charles, W., & Nicolas, T. (1998)

- Walking Trolley

Fig: 79 walking trolley posture as per manufacturer specifications

- Mobility Scooter

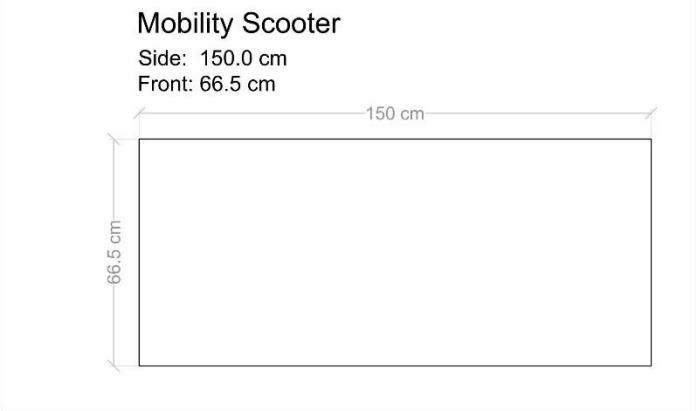

Fig: 80 Mobility scooter posture as per manufacturer specifications

- Baby Stroller

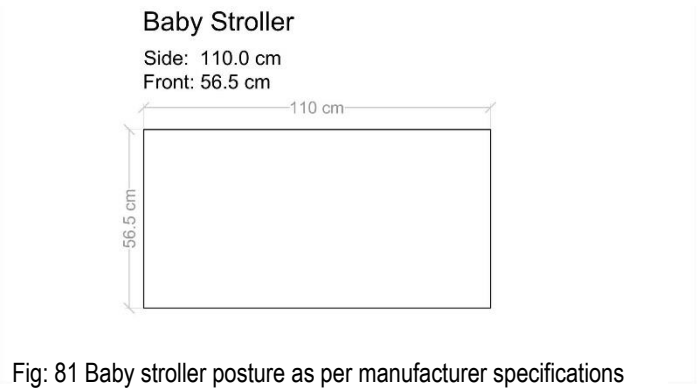

Fig: 81 Baby stroller posture as per manufacturer specifications

5.5.3 Calculation of Impact area

Impacts of some primary postures are measured and mentioned in TSS for Landscape Architecture[100] in rectangular form. In order to compare personal posture impacts with standard personal space, postures are needed to be transformed into radial form and then their corresponding radii could be compared with the standard personal space which is already described in radial form. Impact areas for all postures are calculated in the following table;

5.5.3.1 Impact area for Primary Posture

Impact Area for Primary Postures				
Posture	**Condition**	**Side(cm)**	**Front(cm)**	**Impact Area(cm²)**
Standing	Normal	47.0	53.5	2514.5
	With gear	47.0	70.8	3327.6
Sitting	Normal	55.5	68.5	3801.75
	Extended legs	94.0	68.5	6439
Walking	Normal	254.0	70.8	17983.2
	Striding	350.5	70.8	24815.4

Table 9 impact area of primary postures as per (Charles, W., & Nicolas, T. (1998))

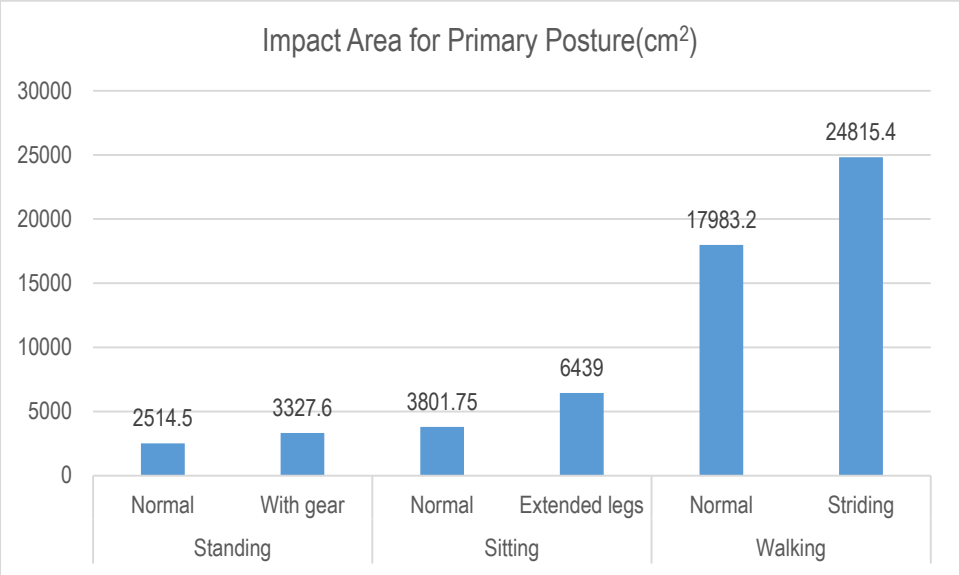

Fig: 82 Comparing postures to show which cover more area

5.5.3.2 Impact area for Secondary postures

In contrary to primary postures secondary postures are with some gear and so are named after the gears. In order to measure secondary posture impact area of the primary posture is added to the impact area of

[100] Charles, W., & Nicolas, T. (1998)

corresponding gear. For example impact area of walking is 17983.2 cm^2 and impact area of walking trolley 4950.0 cm^2 the resultant impact area of walking trolley will be 22933.2 cm^2.

As actual impacts of postures are not in radial form, therefore, the corresponding area is converted into radial form by using area equation. It can help to know the corresponding covered area of each personal posture, their radii and then it could be compared with the personal space radius.

Equation 1 Equation adopted to convert Rectangle areas into Radial form

$$A = \pi r^2$$

$$22933.2 = \pi r^2$$

$$\frac{22933.2}{\pi} = r^2$$

r= 85.42 cm

Impact Area for Secondary Postures						
Posture	Side (cm)	Front (cm)	Gear Impact (cm^2)	Corresponding Primary posture (cm^2)	Posture Impact (cm^2)	Secondary Posture Radii (cm)
Bicycle	180	60	10800	17983.2	28783.2	95.70
Walking Trolley	75	66	4950	17983.2	22933.2	85.42
Mobility Scooter	150	65.5	9825	6439.0	16264	71.94
Baby Stroller	110	56.5	6215	17983.2	24198.2	87.75

Table 10 impact area of secondary postures as per (Charles, W., & Nicolas, T. (1998))

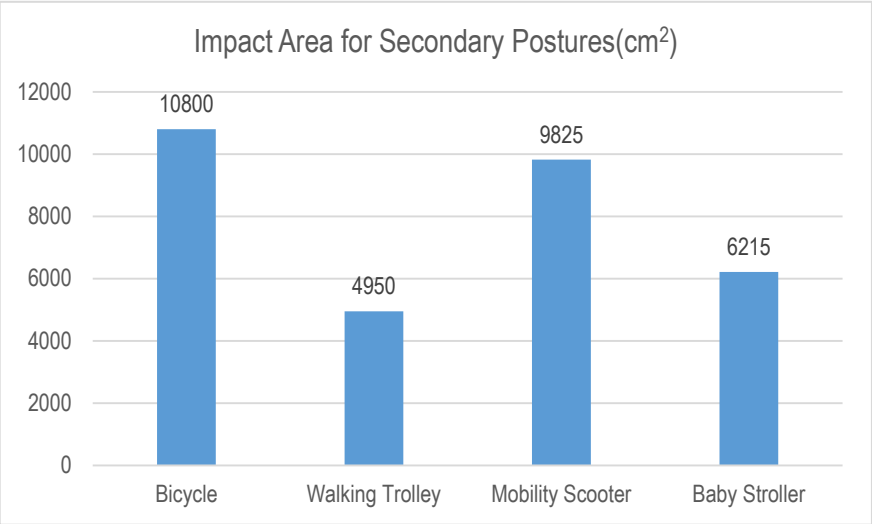

Fig: 83 Comparing postures to show which cover more area

5.5.4 Comparison with existing Personal Space Radius

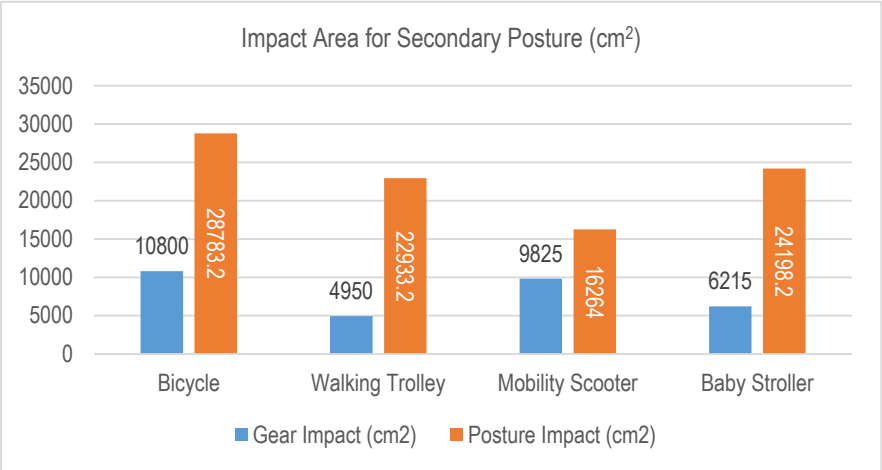

Fig: 84 Gear impact vs posture Impact

Primary Postures Impact Area Radius Comparison with Personal Space Radius							
Posture	Condition	Side (cm)	Front (cm)	Impact Area(cm^2)	Impact Circle Radius(cm)	Intimate Radius(cm)	Personal Space Radius(cm)
Standing	Normal	47	53.5	2514.5	28.3	45.0	120.0
	With gear	47	70.8	3327.6	32.5	45.0	120.0
Sitting	Normal	55.5	68.5	3801.75	34.8	45.0	120.0
	Extended legs	94	68.5	6439	45.3	45.0	120.0
Walking	Normal	254	70.8	17983.2	75.6	45.0	120.0
	Striding	350.5	70.8	24815.4	88.9	45.0	120.0

Table 11 Comparison Impact Circle Radius with Personal Space Radius

5.5.4.1 Graphical Presentation Comparison of Postures

In the following presentations all postures has been compared with personal space from Edward T.Hall's (1960) model.

5.5.4.1.1 Primary Posture Comparison to Personal Space

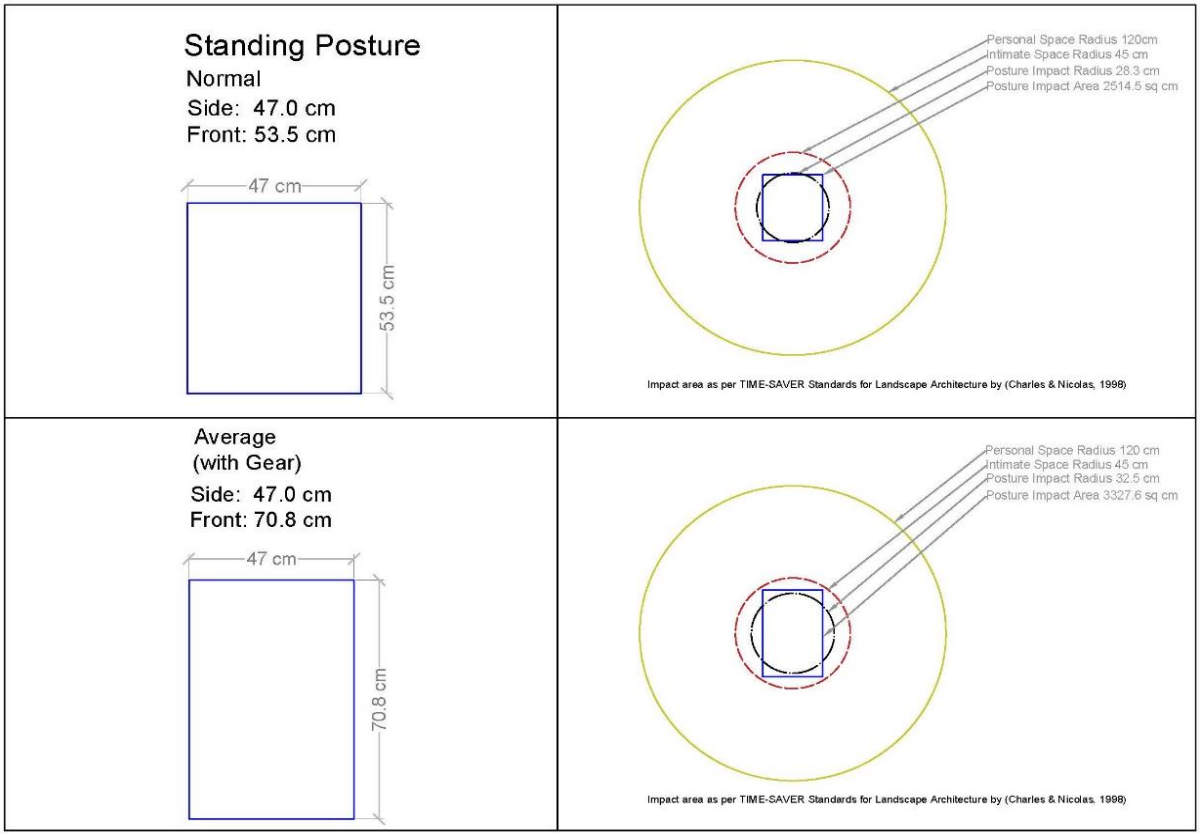

Fig: 85 standing posture comparison to Personal Space Radius

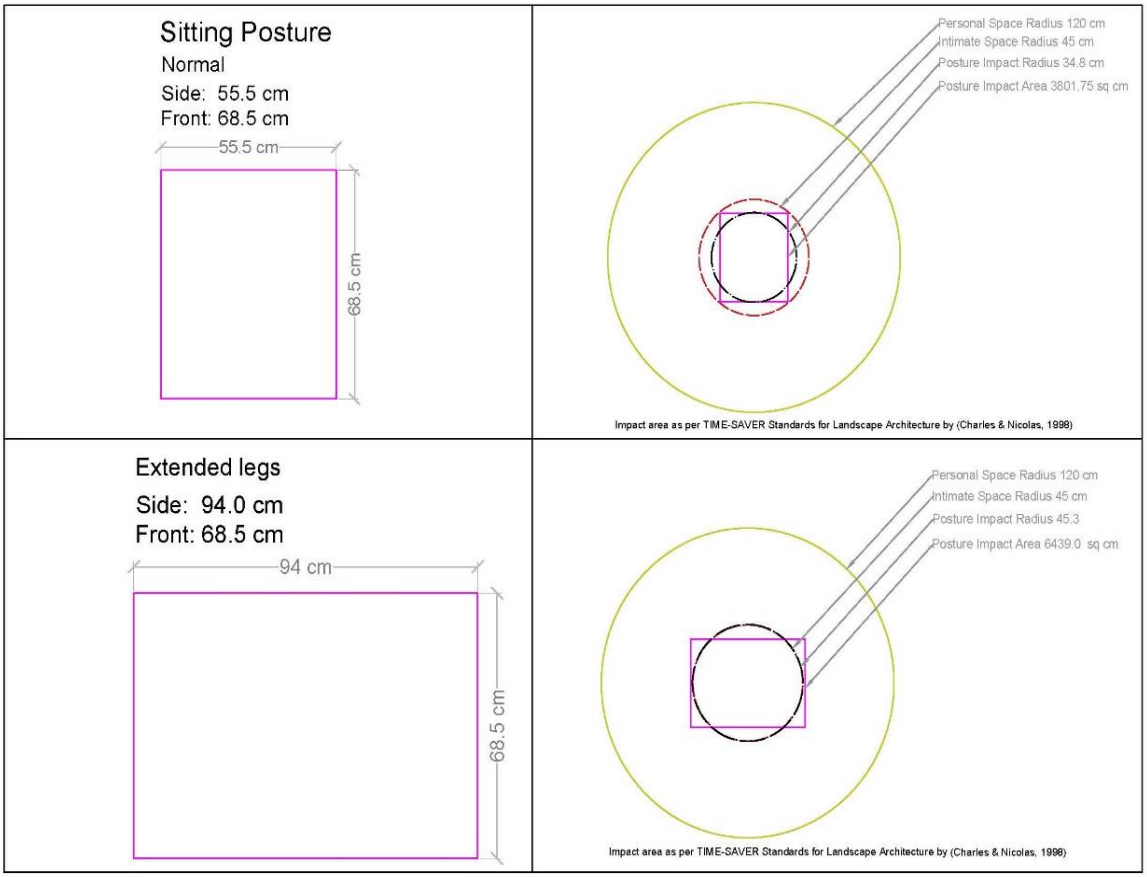

Fig: 86 sitting posture comparison to Personal Space Radius

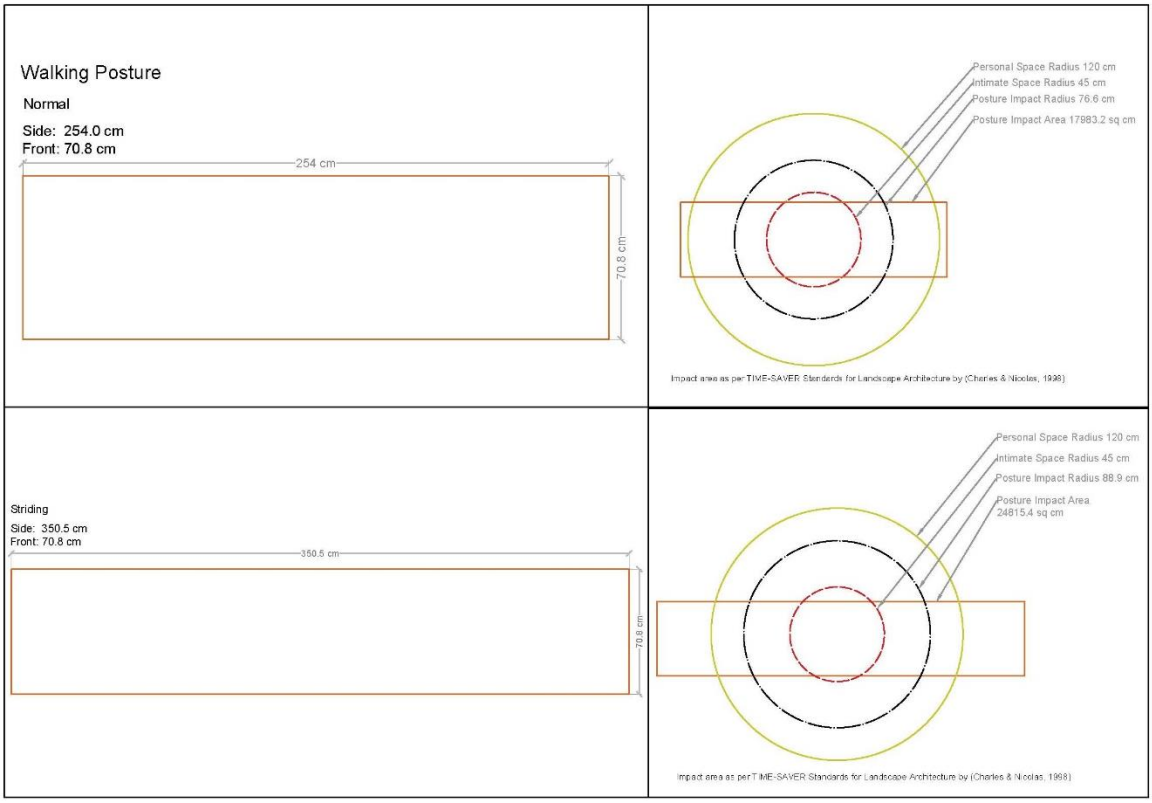

Fig: 87 Walking and striding posture comparison to Personal Space Radius

5.5.4.1.2 Secondary Posture Comparison to Personal Space

Secondary Postures Impact Radius Comparison with Personal Space Radius							
Posture	Side (cm)	Front (cm)	Impact Area(cm^2)	Impact Radius(cm)	Secondary Posture Impact	Intimate Radius (cm)	Personal Space Radius (cm)
Bicycle	180	60	10800.0	58.6	95.70	45.0	120.0
Walking Trolley	75	66	4950.0	39.7	85.42	45.0	120.0
Mobility Scooter	150	65.5	9825.0	55.9	71.94	45.0	120.0
Baby Stroller	110	56.5	6215.0	44.5	87.75	45.0	120.0

Table 12 Comparison Impact Circle Radius with Personal Space Radius

5.5.5 Defining Personal Space as Measuring Tool

Measurement of personal postures and their comparison with personal space shows that all personal

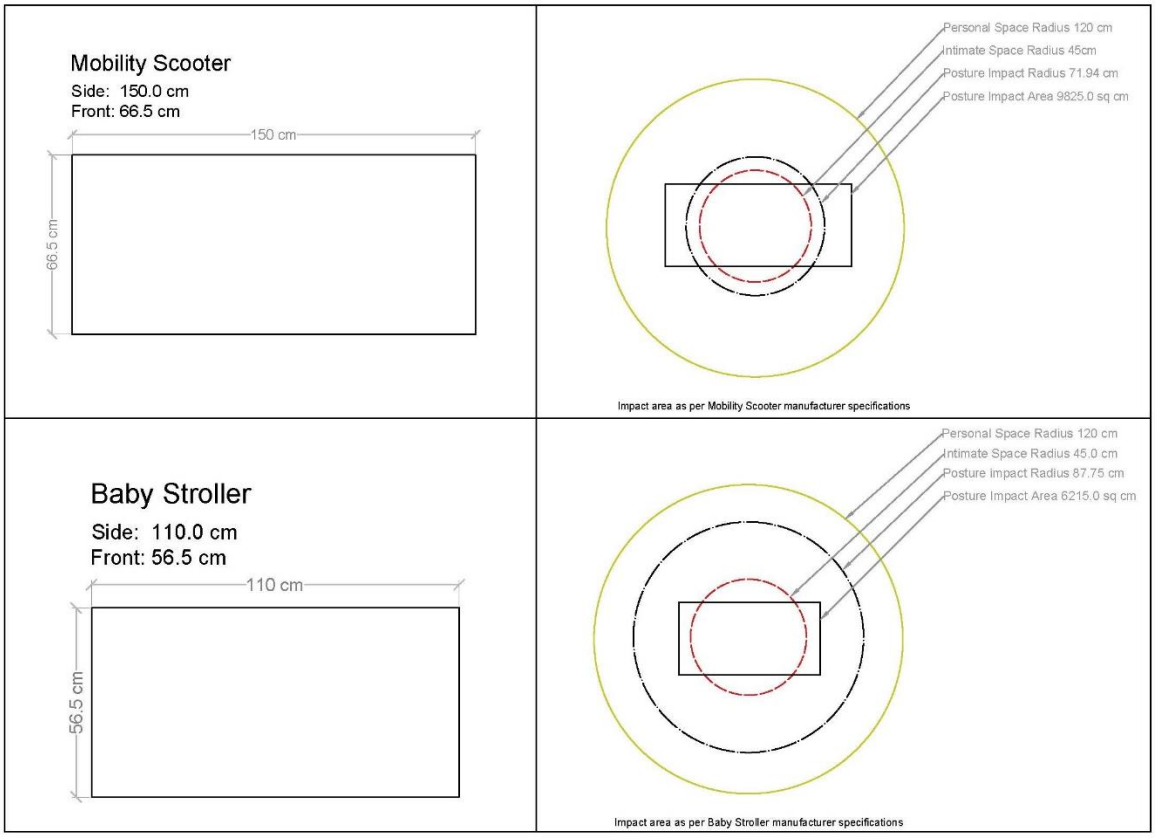

Fig: 88 Mobility scooter and baby stroller posture, comparison to Personal Space Radius

postures fit into personal space. Personal space can be taken as a measuring yardstick only if it can represent all personal postures. In the above process, it fulfills are required parameters to be taken as measuring yard stick. Now Personal space can be taken as a measurement tool to measure occupancy of the public spaces.

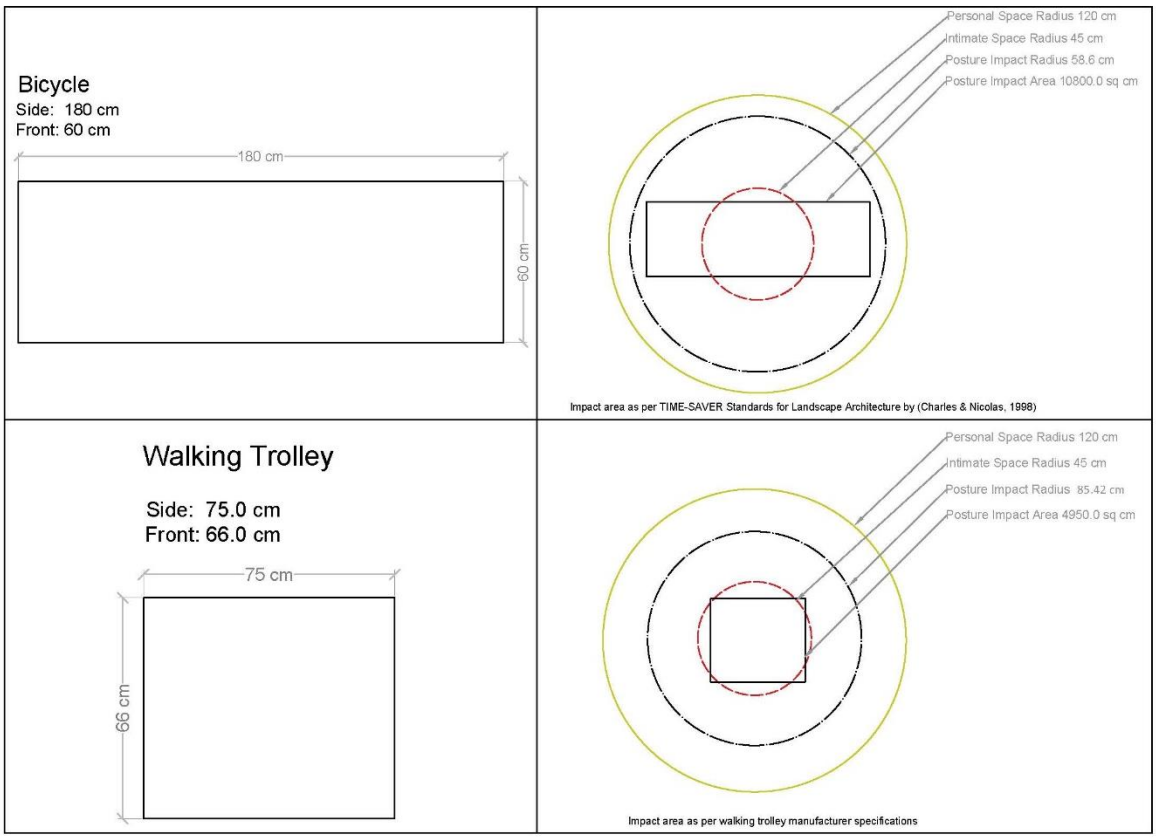

Fig: 89 Bicycle and walking trolley posture comparison to Personal Space Radius

5.5.5.1 Contingency Planning

In order to design a safe engineering project, a contingency plan is an important tool to manage visualization and future impediments.

a) Definition 1:

Actions were taken to prepare for an impending emergency.[101]

b) Definition 2:

A forward planning process in a state of uncertainty, in which scenarios and objectives are agreed, managerial and technical actions defined, and potential response systems put in place, in order to prevent or better respond to an emergency.[102]

In this project, contingency plan is that all postures should sufficiently fit into personal space, which they do.

[101] Cuny,(1998)
[102] UNHCR, 1996

5.5.6 First Hypothesis Statement Poof

According to first Hypothesis statement:

Statement 1:

b. Personal space changes with the change of given personal posture.

It is assumed that people in different posture occupy different space, therefore each distinctive posture should be measured and compared with standard personal Space.

Statement 1 is proved to be wrong and is restated as following:

Restatement 1:

a): Personal Space doesn't change with the change of given personal postures.

In most of the cases personal postures do occupy different spaces but personal space bubble, defined space is sufficient to accommodate all personal postures taken in this project, secondary personal postures may be different according to cultural background and local behavior. Personal postures other than tested in this project should be verified before they could be applied.

5.5.7 Conclusion

1) Primary personal postures are taken from TSS for Landscape Architecture.[103]
2) Secondary postures appear with a variety of gears like a bicycle, walking trolley, mobility scooter, and baby stroller.
3) Different personal postures occupy different spaces.
4) All primary posture impact radius is less than personal space radius.
5) Secondary postures are combined impact of corresponding primary posture and impact of the gear. For example walking trolley is the impact of the trolley and walking person.
6) All secondary personal postures fit into personal space bubble.
7) Public space occupancy is a measure of personal space.

[103] TSS for Landscape Architecture by (Charles, W., & Nicolas, T. (1998))

5.6 **Hypothesis Statement 2**

b. Occupancy of a public space can accurately be determined only by considering corresponding personal space posture.

If personal space changes with a change in personal posture, then occupancy based on personal posture should be different from standard personal space.

5.6.1 Mapping of Public Space

In order to know the occupancy two main things; personal postures and useable spaces are required. Generally, mapping is done from the satellite image but some of the infrastructures are directly measured from the site. Mapped spaces are categorized into useable and unusable spaces. Some infrastructure is also include into useable spaces and some will be deducted as unusable spaces.

Local public space behavior is taken as criteria basis for declaring some of the spaces as unusable.

- People don't step on grass lawns, planting beds and is considered as unusable space
- Low in height thick tree canopy as unusable space
- Planting wells as unusable space
- Water features as unusable space
- Road are meant to be used only for cars
- Benches and ledges are only sit able spaces

Fig: 90 Green lawn and planting beds

Useable Spaces	Unusable Spaces	Infrastructure
▪ Walkways ▪ Stone Paved area ▪ Concrete paved area ▪ Unpaved areas ▪ Roads ▪ Footpaths	▪ Planting beds ▪ Green Lawns ▪ Lift to parking ▪ Parking exhaust ▪ Café sitting	▪ Benches ▪ Ledges ▪ Bicycle stands ▪ Fountains ▪ Lampposts ▪ Trash bins

5.6.2 Identification of Useable spaces

5.6.2.1 Unusable Spaces

1) Planting beds
2) Green lawns
3) Planting wells
4) Café sitting areas as private
5) Buildings covered spaces Lift cabins etc.

Fig: 91 planting wells

5.6.2.2 Infrastructure and unusable spaces

1) Benches

There are two types of benches as shown in the Figures.

Fig: 93 Bench type-1

Fig: 92 Bench type-2

2) Ledges
3) Trash bins
4) Water features

Fig: 94 Trash bins

Fig: 95 Water feature

5.6.2.3 Measurement of Spaces and Infrastructure covered areas

Benches:

There are two types of benches:

- Type1
- Type 2

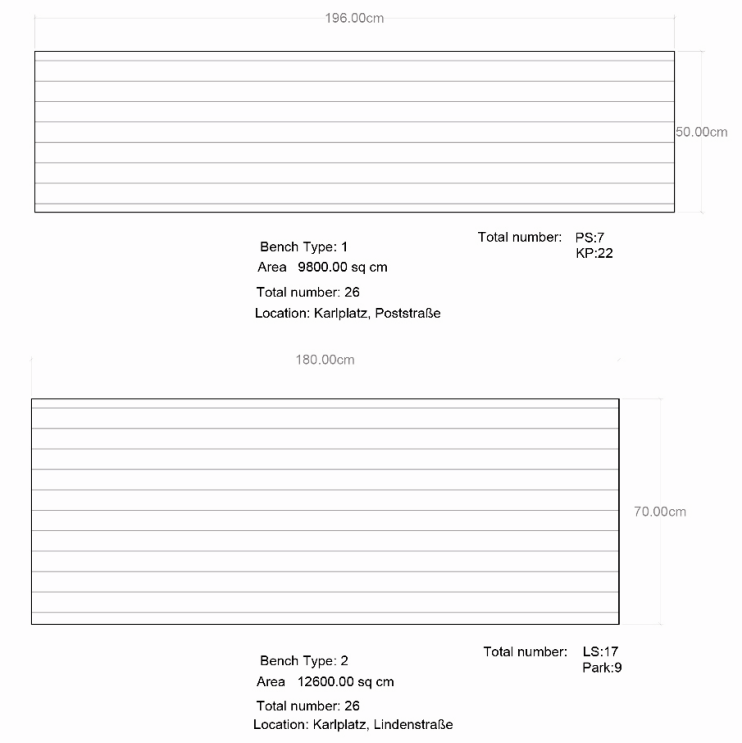

Fig: 96 types of benches on site.

Ledges:

There are two concrete ledges for sitting of the same shape and seating capacity.

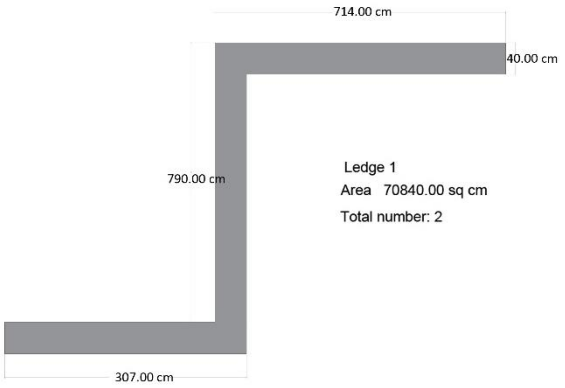

Fig: 97 Ledges on site.

Trash bins:

There is one design of trash bins shown in the figure with area cover.

Fig: 98 Trash bins on site

Lampposts:

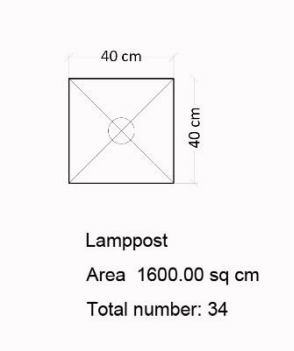

Fig: 99 Lampposts on site

Planting wells:

These are unpaved soil around tree in urban areas on paved areas and footpaths.

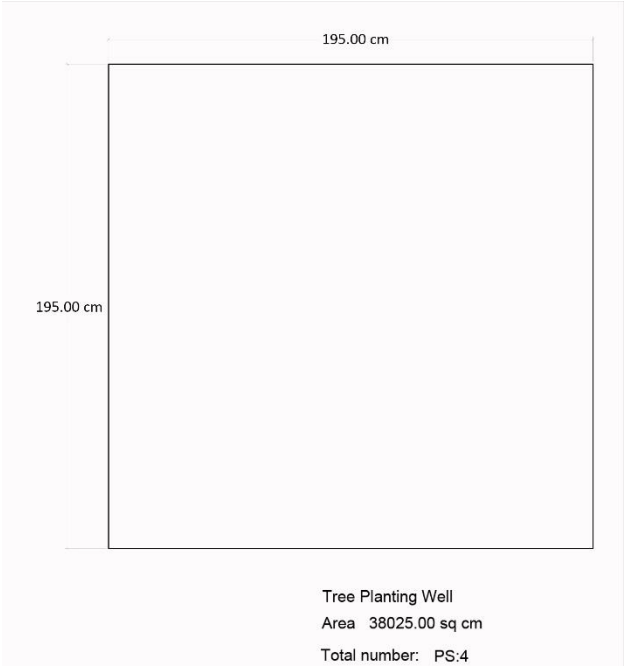

Fig: 100 planting wells with area cover

5.6.3 Land Consumption

Land allocation for public space is done according to planning law as per the need and requirement of the population. Public spaces are designed by infrastructure, planting and other elements. All infrastructure and elements consume certain space. Some spaces and infrastructure are to impart aesthetics some are for use. Some infrastructures and elements which may have aesthetics but are otherwise consume a space and don't allow use are labelled under unusable spaces, for example water elements like pond, lake etc. are unusable spaces. In order to

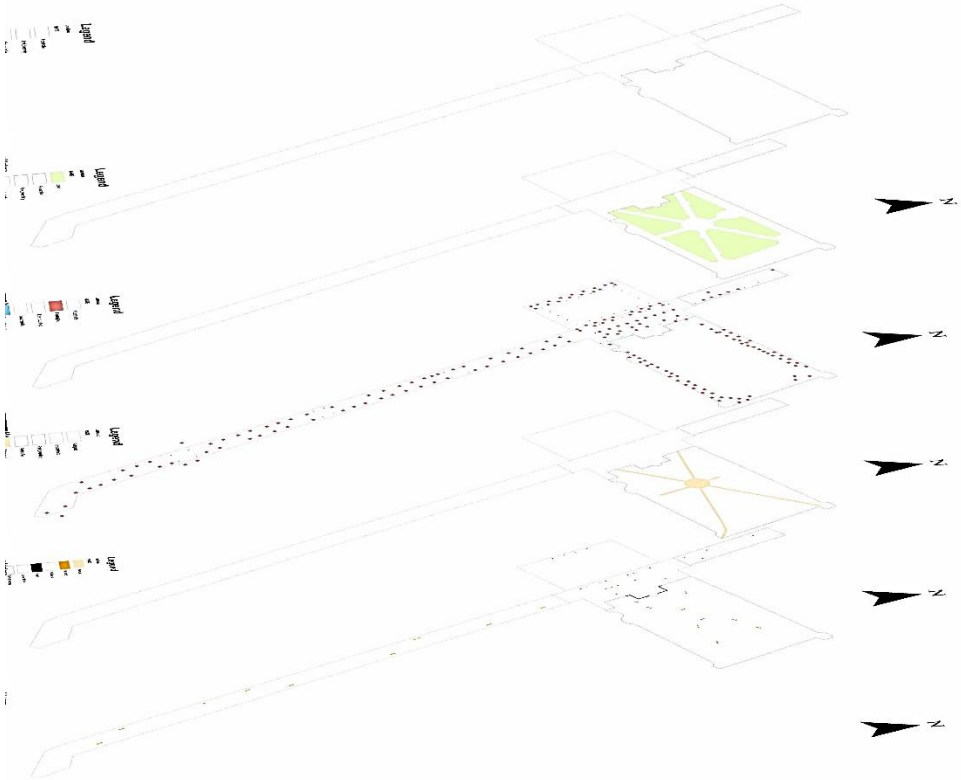

Fig: 101 layer stake map for infrastructure and elements

know the actual land consumption a very accurate mapping is required. In case of this project mapping is based on satellite image for the boundaries and infrastructure location. Actual dimensions of infrastructure is acquired by tape measurement from the site. It is recommended that for more accuracy actual working drawing should be used for better accuracy to find useable land and other land consumption.

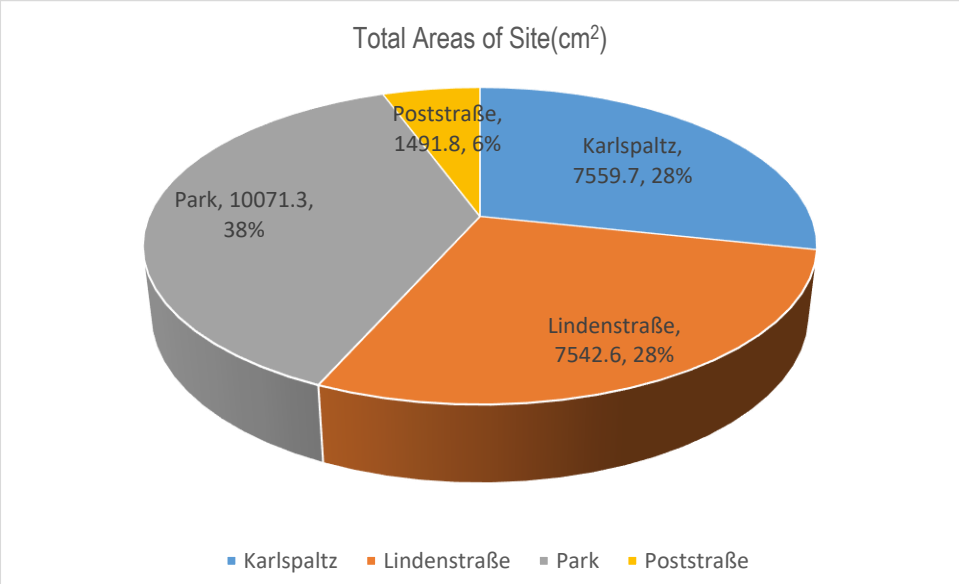

Fig: 102 Total area of site components

5.6.4 Mapping and Presentation

Fig: 103 Land consumption map of Project site

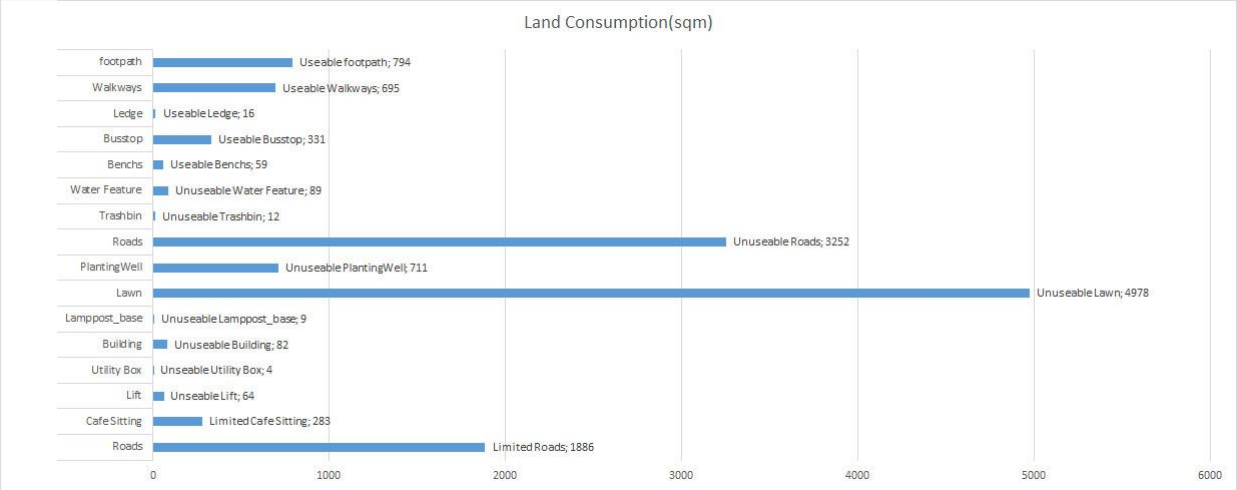

Table 13 chart showing land consumption for different elements

5.6.5 Useable Space

Useable space is a space available for use in a public space. Once land consumption in calculated and deducted from the overall space the result will be useable space. It is really cumbersome task to identify and consider each and every element for the land consumption, but maximum possible effort has been put in place to work out this level. Some land consumption is permanent for example concrete block at the bottom of lamppost but some are temporary. For example in Lindenstraße store keeper put their advertising banners on the street, similarly, bicycle stands, solid waste containers, coffee tables, garment hangers, chairs, construction machinery, book tables, product racks, service vans, route bus etc. All such elements consume huge amount of land but as these are temporary arrangements, have not been considered in order to make things simple and do able. In the map (on page 104) spaces has been segregated in to white, black and gray, where black spaces are unusable spaces, gray are semi-useable and white are all use able space.

Table 14 Spatial analysis results for useable spaces

FID	NAME	AREA(sq.m)	CATEGORY
1	Cafe_sitting	282.86	Limited
2	Karlplatz	7238.01	Useable
3	Lindenstraße	7231.76	Useable
4	Park_Unpaved_Areas	4075.88	Useable
5	Poststraße	1439.44	Useable
6	Walkways	678.70	Useable

5.6.5.1 Sit able Places

Sit able places identified and their corresponding sit able spaces counted and calculated as per standard, design and provision. For example Bench1 and Bench2 types taken as three sit able spaces each bench. Ledges are taken as 60cm width per person. Calculated number of spaces found to be sufficient for 252 people.In people mapping project total 508 people were observed in public space but surprisingly only 37 people were found sitting only 14% sitting spaces were being utilized or sitting spaces are 86% underutilized.

Table 15 Sit able places and number of Spaces

Sitting Place	Sitting Spaces
Bench 1	81
Bench 2	78
Ledge	60
Clock Ledge	13
Water Feature Ledge	20
Total	252

5.6.5.2 Walkable Space

Most of the places in a public space are walkable, including Walkways, foot paths and main area of a square. Roads are also conditional walkable areas, if needed.

5.6.5.3 Multipurpose space

Public spaces has a major component of space which is multipurpose in nature, this space can be used for walking, standing, striding, bicycle, walking trolley, mobility scooter etc. Sit able spaces cannot be used for any other purpose except sitting. Walk able spaces are for waking but restricted for bicycle riding. In walkable spaces one can walk a bicycle but riding a bicycle is restricted. A multipurpose space is free for almost all types of public space postures.

In the following Fig: 104 a map of use able and restricted spaces shown in black and white. All white spaces are use able spaces whereas all black are restricted spaces. All gray areas are semi- useable as these spaces may owned by street café or a limited access roads.

Map of Useable spaces

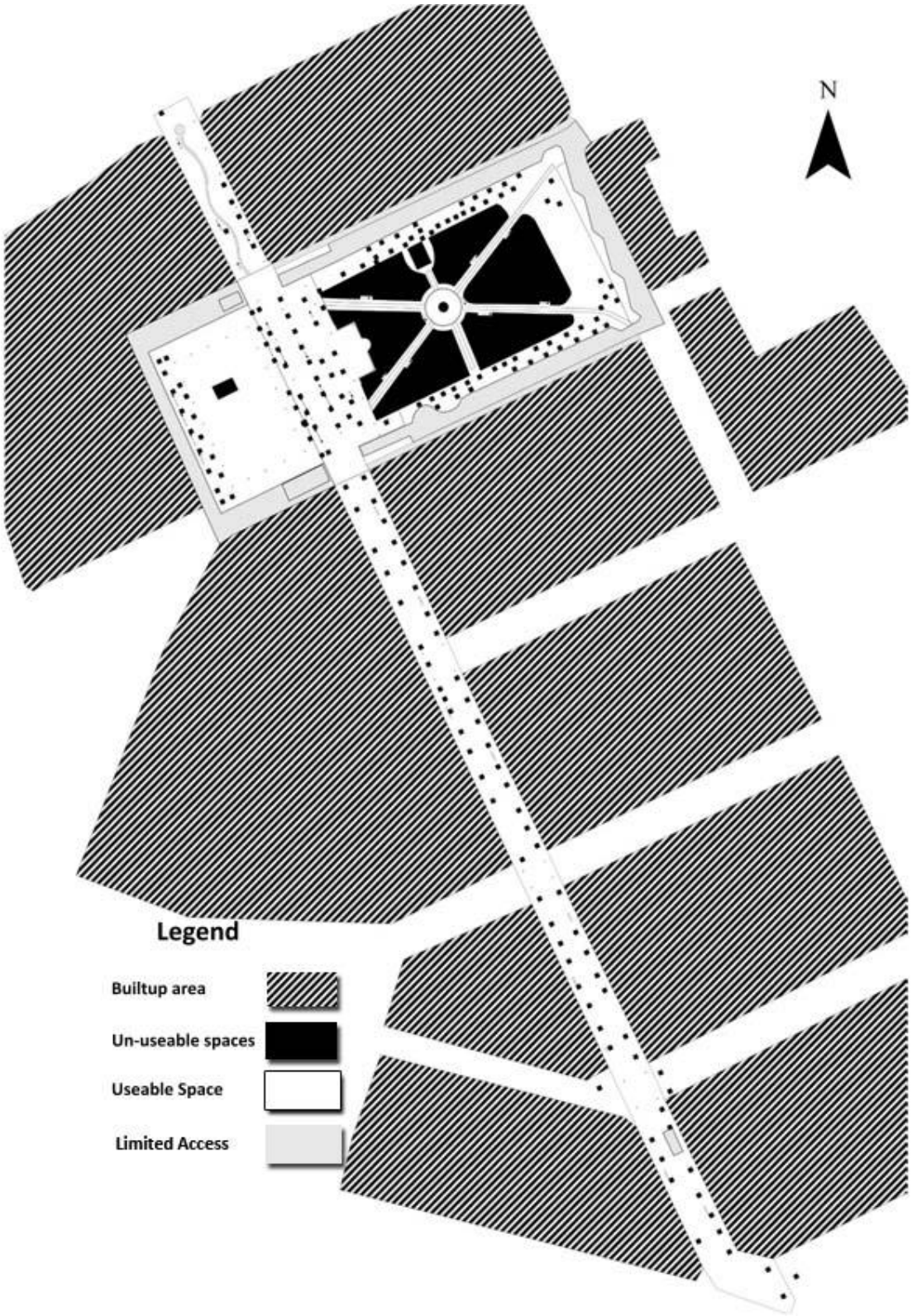

Fig: 104 Map of Use able spaces in Karlplatz, Lindenstraße and Poststraße

5.6.6 Public Space Occupancy

Public space occupancy can be defined in two way;

a) In terms of units
b) In terms of space

5.6.6.1 Public Space Occupancy (In terms of units)

Occupancy of a public space can be defined as number of persons in a public space at a particular instance of time.

For example there were 180 persons in Karl's Platz at the time of observation.

Occupancy in terms of units is a nice way to express the concept of occupancy of a public space but it cannot directly be applied to measure use of public space.

5.6.6.2 Public Space Occupancy (In terms of space)

Occupancy of a public space can be defined as an amount of useable space occupied by people in a public space at a particular instance of time.

Occupancy of a public space is a relative phenomenon and it remains a dynamic process. Time is the most close relative to the phenomena of public space occupancy because occupancy may change with respect to time. Occupancy of public space could be different in the morning, at noon, in the evening and at night. Furthermore occupancy is such a time-dependent phenomena that it keeps on changes every next moment as people move in and out of a public space.

$$Occupancy = \frac{Occupied\ Space}{Useable\ Space} x100$$

Public space occupancy study has a number of applications, therefore considered very important in this project. With the rise in world population and huge drive of urbanization, occupancy of public spaces is expected to rise in future. In the case of Germany the phenomena of population rise remained recessive but with a huge influx of immigration, it may come back on track in future. But countries like China, India, Indonesia, Bangladesh, and Pakistan are already experiencing occupancy related problem.

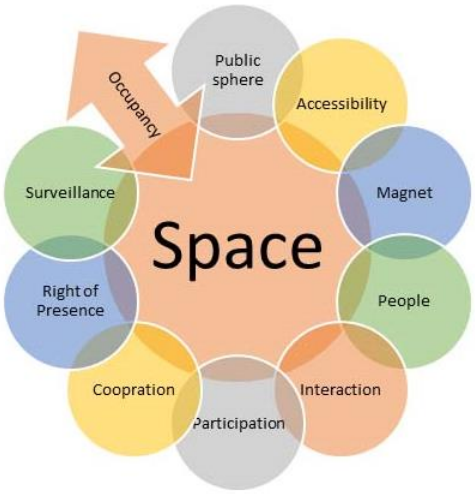

Fig: 105 Characteristics of a public space

5.6.6.3 Characteristics of Public Space Occupancy

A public space has a list of characteristics as shown in the following list. These characteristics define potency of a public space. A public space short of any characteristic may lose it strength. For example a space could be only in two spheres public or private, if a space is not in public sphere than it must be in a private ownership. Cooperation is another characteristic, most of the sitting places designed for group of three and more. If it loses the character of sharing sitting place, a public space resources may remain unutilized or underutilized.

- Public sphere
- Accessibility
- Magnets
- People
- Interaction
- Participation
- Cooperation
- Right of presence
- Surveillance

5.6.6.4 Effects of Occupancy on Public Space:

- Defines available space
- Defines mob behaviour
- Environmental Hazards
- Occupancy management
- Safety and security
- Space management
- Resource management
- Solid waste production
- Public health issues

5.6.6.5 Applying Derived standards on a model

Personal space postures are applied on identified useable spaces to determine occupancy of the public space in the project area.

5.6.6.6 Occupancy Analysis; Results

In *proof 1* all personal postures under consideration fit well inside personal space of radius 1.2m therefore personal posture have no impact on personal space. In order to calculate public space occupancy personal space can be taken as a yardstick. Occupancy of a space is a relative phenomenon and is measured in percentages. Project site have four divisions let us have a calculation of occupancy of each division. The following data processed is of a high occupancy day (Friday) during a peak hour.

Table 16 Occupancy of Karlplatz on a Friday Oct 28, 2016, at 11:30 - 13:00

Karlplatz Occupancy:

Number of people in Karlplatz = 180

Space occupied per person (Personal space area) = 4.5 m^2

(*Personal space area = impact area of Radius1.2m*)

Total use able space available (Table 14page.102) = 7238.01m^2

Karlplatz Area of Occupancy = 180x4.5=810 m^2

Occupancy of Karlplatz =(810/7238.01)*100= 11.19%

Table 17 Occupancy of Park Area on a Friday Oct 28, 2016, Between 11:30 - 13:00

Park Area Occupancy:

Number of people in Park Area = 30

Space occupied per person (Personal space area) = 4.5 m^2

(*Personal space area = impact area of Radius1.2m*)

Total use able space available = 4754.58 m^2

(Park_Unpaved_Areas=4075.88 m^2)

(Walkways=678.70 m^2)

Park Area of Occupancy = 135 m^2

Occupancy of Park = 2.8%

Table 18 Occupancy of Poststraße on a Friday Oct 28, 2016, Between 11:30 - 13:00

Poststraße Occupancy:

Number of people in Poststraße = 42

Space occupied per person (Personal space area) = 4.5 m^2

(*Personal space area = impact area of Radius1.2m*)

Total use able space available = 1439.44

Poststraße Area of Occupancy = 42x4.5= 189 m^2

Occupancy of Poststraße = 13.13%

Table 19 Occupancy of Lindenstraße on a Friday Oct 28, 2016, Between 11:30 - 13:00

Lindenstraße Occupancy:

Number of people in Lindenstraße = 170

Space occupied per person (Personal space area) = 4.5 m^2

(*Personal space area = impact area of Radius1.2m*)

Total use able space available =7231.76 m^2

Lindenstraße Area of Occupancy = 170x4.5 = 765 m^2

Occupancy of Lindenstraße = 10.58%

5.6.6.7 Sitting Spaces and Places

Sitting places are neutral and personal space with is core radius of 1.2m doesn't apply on sitting places. Sitting places and their corresponding capacity can be calculated separately. There are five types of sit able places with total 252 sit able spaces available. In people mapping project total 508 people were observed in public space but surprisingly only 37 people were found sitting i.e. only 14% of the sitting spaces were being utilized or sitting spaces are 86% underutilized. Occupancy is a relative phenomenon, therefore resulted occupancy of sit able places can be defined as 14%.

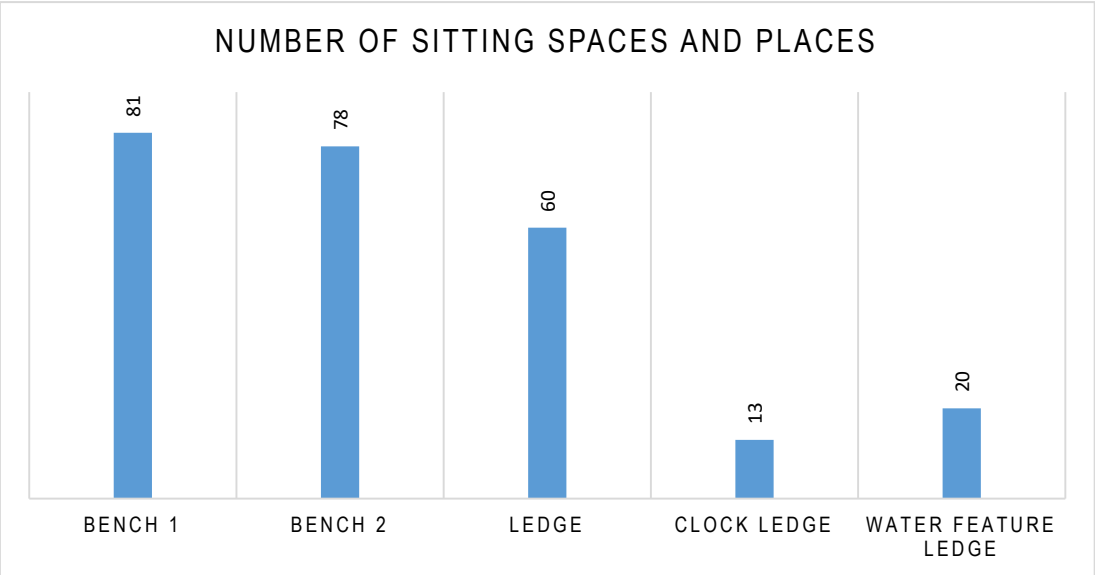

Fig: 106 sitting spaces in all five sitting places

5.6.6.1 Occupancy Analysis; Graphical Presentation

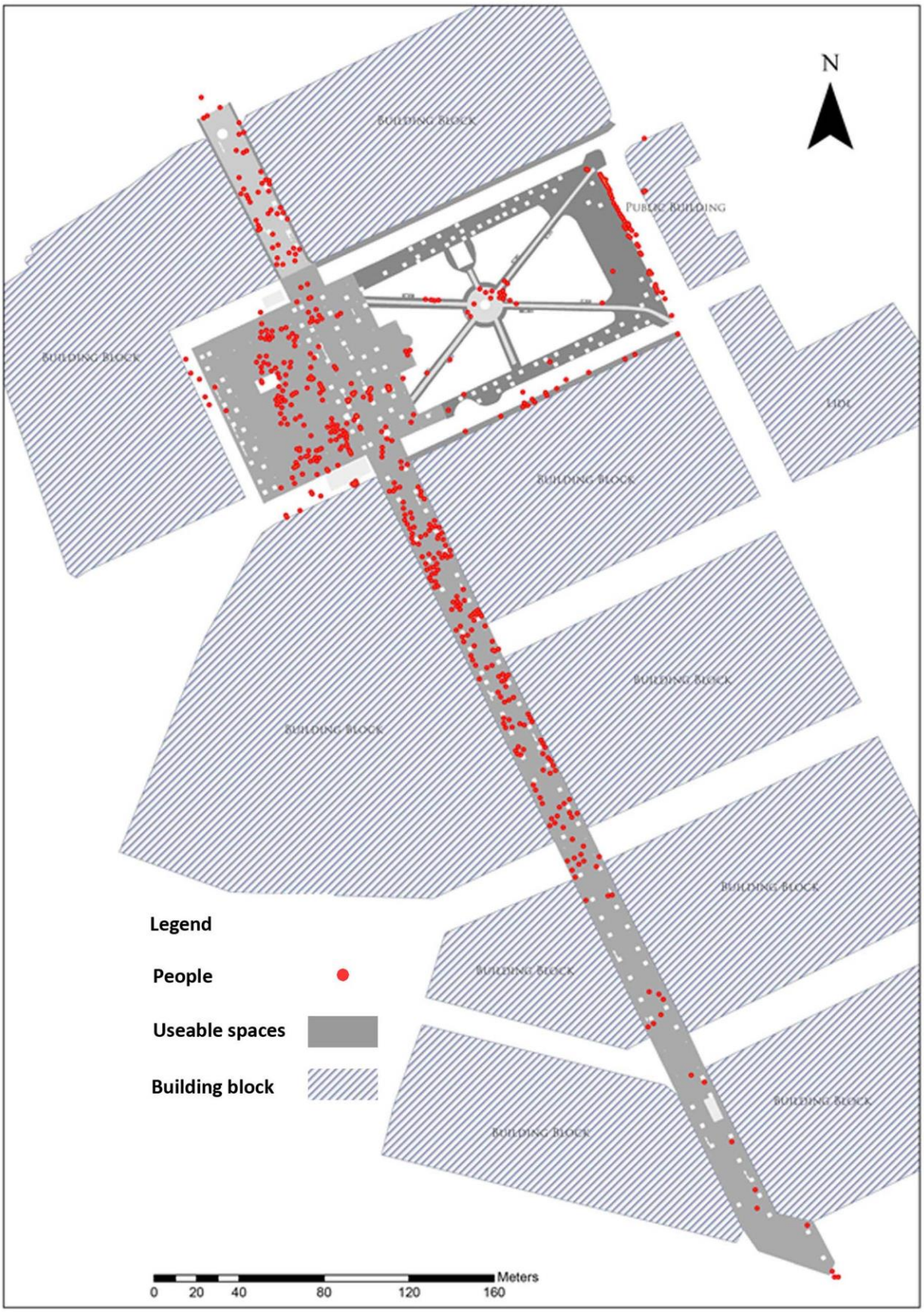

Fig: 107 Occupancy of public space

5.6.7 Second Hypothesis Statement Proof

Personal space doesn't depend upon personal postures therefore occupancy is not dependent of personal postures, rather it depends upon personal space.

Statement 2:

c. Occupancy of a public space can accurately be determined only by considering corresponding personal space posture.

If personal space changes with a change in personal posture, then occupancy based on personal posture should be different from standard personal space.

5.7 **Hypothesis Statement 3**

According to given statement as follows;

c. The actual capacity of a public space can be determined on the basis of personal space.

If personal space applied to a public space, actual capacity can be determined.

5.7.1 Public Space Capacity

Public Space Capacity can be defined as a number of people who can occupy a space, in terms of both physical space and limitations set by law.

This definition has been derived from the following definition of seating capacity definition.

Seating capacity is the number of people who can be seated in a specific space, in terms of both the physical space available and limitations set by law. Seating capacity can be used in the description of anything ranging from an automobile that seats two to a stadium that seats hundreds of thousands of people. The largest sporting venue in the world, the Indianapolis Motor Speedway, has a permanent seating capacity for more than 235,000 people and infield seating that raises capacity to an approximate 400,000.[104]

5.7.2 Public Space Capacity on the basis of Personal Space

Personal space is a minimum essential space required per person in a public space, and it is 1.2m in radius and 4.5m^2 in area.

[104] Indianapolis Motor Speedway; World of Stadiums, 2016

Table 20 Karlplatz public capacity

Karlplatz Capacity @ of personal Space	References:
Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available (Table 14page.102) = 7238.01m^2 Capacity of Karlplatz @ Personal Space= 7238.01/4.5= 1608 Persons Capacity of Karlplatz @ Social Space =7238.01/40.69= 177 Persons Capacity of Karlplatz @ Public Space =7238.01/57.76= 125 Persons	Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

In the Table 20 Karlplatz public **capacity**, it is clear that the capacity of Karlplatz @ of personal space is 1608 persons but the number of people found at the time of people mapping were 180 persons. If we match people presence and the capacity, it matches capacity of Karlplatz @ of social space i.e. 177 Persons. It means that the people in Karlplatz enjoying availability of space @ social space.

Table 21 Park Area public space Capacity

Park Area Capacity @ of personal Space	References:
Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available = 4754.58 m^2 (Park_Unpaved_Areas=4075.88 m^2) (Walkways=678.70 m^2) Capacity of Park Area @ Personal Space= 4754.58/4.5= 1056 Persons Capacity of Park Area @ Social Space =4754.58/40.69= 116 Persons Capacity of Park Area @ Public Space =4754.58/57.76= 82 Persons	Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

In the Table 21 Park Area public space Capacity, the available capacity of the space is 1056persons but people found in park were 30. It doesn't match any of the available standards. It can be said that people in park area are enjoying space availability beyond capacity @ public space.

Table 22 Poststraße Public space capacity

Poststraße Capacity @ of personal Space	References:
Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available = 1439.44 Capacity of Poststraße @ Personal Space= 1439.44/4.5= 320 Persons Capacity of Poststraße @ Social Space =1439.44/40.69= 35 Persons Capacity of Poststraße @ Public Space =1439.44/57.76= 25 Persons	Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

In the Table 22 Poststraße Public space capacity, the capacity on the basis of available useable space is 320Persons but the people found in Poststraße were 42. If we compare it with the capacity table of Poststraße people are enjoin space just below capacity @ social space.

Table 23 Lindenstraße Public space capacity

Lindenstraße Capacity @ of personal Space	References:
Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available =7231.76 m^2 Capacity of Lindenstraße @ Personal Space= 7231.76/4.5= 1607 Persons Capacity of Lindenstraße @ Social Space =7231.76/40.69= 178 Persons Capacity of Lindenstraße @ Public Space =7231.76/57.76= 125 Persons	Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

In the Table 23 Lindenstraße Public space capacity, the capacity on the basis of available useable space is 1607 Persons but the people found in Lindenstraße were 170. If we compare it with the capacity table of Lindenstraße people are enjoin space just more than capacity @ social space.

5.7.3 Third Hypothesis Statement Proof

In the section 5.7.2, Public space capacity calculated on the basis of personal space. Hence, it proves that personal space capacity can be calculated on the basis of personal space.

Statement 3:

c. The actual capacity of a public space can be determined on the basis of personal space.

If personal space applied to a public space, actual capacity can be determined.

5.8 **Hypothesis Statement 4**

According to given statement as follows;

d. Personal space can be used to determine the sufficiency of a public space.

If personal space applied to occupancy and capacity of a public space it can also define the sufficiency of a public space

5.8.1 Public Space Sufficiency

The word sufficiency comes in the meaning of "enoughness".Sufficiency of a public space is a relative phenomenon, and could be better discussed if T.Hall's (1966) model of interpersonal space of man is considered.

Sufficiency of space comes in two meanings, first where enough personal space with in personal space bubble. Secondly, sufficiency of entire public space for overall occupancy of that space.

Sufficiency of personal space has been proved in the experiments where all personal postures were tested by placing with in the personal space radius. All personal postures sit well with in the personal space radius.

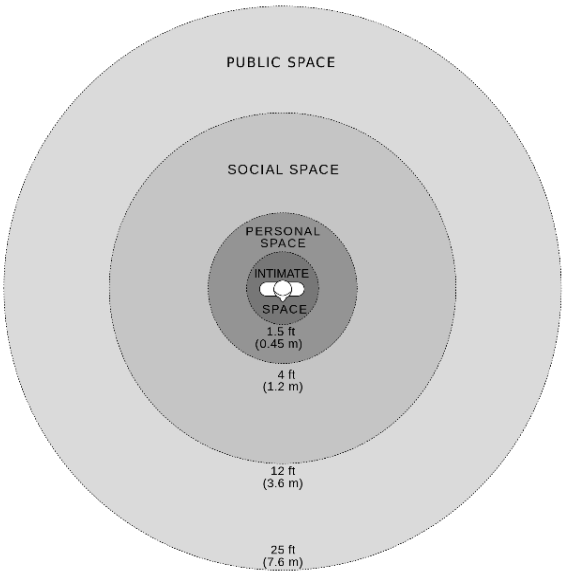

Fig: 108 A Chart showing Edward T.Hall's interpersonal distances of man

Occupancy of a public space has two implications;

One where occupancy of a public space refers to a term how many occupants in a public space at a particular time.

Secondly, where how much of the public space in terms of area is occupied at a particular instant.

Capacity:

Public Space Capacity can be defined as a number of people who can occupy a space, in terms of both physical space and limitations set by law.

Personal Space:

Personal space is a minimum essential space required per person in a public space, and it is 1.2m in radius and 4.5m^2 in area.

5.8.2 Actual Space Capacity

Actual capacity is a number of people which occupy a space during the particular period of time.

5.8.3 Actual Public space Capacity (in terms of personal space)

Actual capacity can be defined as number of personal spaces occupied in public space during the particular period of time.

5.8.4 Effective Space Capacity

Effective capacity refers to a number of people that can theoretically occupy a space during a particular period of time.

5.8.5 Effective Public Space Capacity (in terms of personal space)

Effective public space capacity can be defined as theoretical availability of total number of personal spaces in a public space during a particular period of time.

5.8.6 Sufficiency of a Public Space

Sufficiency of a space can be calculated by deducting actual capacity from effective capacity.

Sufficiency= Effective Capacity - Actual Capacity

Sufficiency of a public space is a relationship between effective capacity and actual capacity. If effective capacity is more than or equal to actual capacity, public space can be termed as sufficient and vice versa. Actual capacity is related to occupancy of public space, as "*actual capacity can be defined as number of personal spaces occupied in public space during the particular period of time.*"

a) Effective Capacity≥ Actual capacity ; Public space is sufficient
b) Effective Capacity< Actual capacity ; Public space is insufficient

5.8.7 Calculations for sufficiency of a Public Space

Table 24 Karlplatz public space sufficiency

Karlplatz public space Sufficiency @ of personal Space	References:
Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available (Table 14page.102) = 7238.01m^2 Effective Capacity of Karlplatz = 7238.01/4.5= 1608 personal spaces Actual capacity of Karlplatz = 180 Persons Karlplatz Sufficiency= 1608-180= 1428 Personal spaces Effective Capacity> Actual capacity Result Karl's Platz is a Sufficient Space @ Personal space	Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

Table 25 Park area public space sufficiency

Park Area public space Sufficiency @ of personal Space Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available = 4754.58 m^2 (Park_Unpaved_Areas=4075.88 m^2) (Walkways=678.70 m^2) Effective Capacity of Park Area @ Personal Space= 4754.58/4.5 = 1056 Personal spaces Actual capacity of Karlplatz = 30 Persons Park area Sufficiency= 1056-30= 926 Personal spaces Effective Capacity> Actual capacity Result Karl's Platz is a Sufficient Space @ Personal space	References: Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

Table 26 Poststraße public space sufficiency

Poststraße public space Sufficiency @ of personal Space Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available = 1439.44 Effective Capacity of Poststraße @ Personal Space= 1439.44/4.5 = 320 Personal spaces Actual capacity of Karlplatz = 42 Persons Park area Sufficiency= 320-42= 278 Personal spaces Effective Capacity> Actual capacity Result Karl's Platz is a Sufficient Space @ Personal space	References: Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2 @7.6m Radius

Table 27 Lindenstraße public space sufficiency

Lindenstraße public space Sufficiency @ of personal Space Space occupied per person (Personal space area) = 4.5 m^2 (*Personal space area = impact area of Radius1.2m*) Total use able space available =7231.76 m^2	References: Personal space 4.5m^2 @1.2m Radius Social space 40.69m^2 @3.6m Radius Public space 57.76m^2

Effective Capacity of Lindenstraße @ Personal Space= 7231.76/4.5 = 1607 Personal spaces Actual Capacity of Lindenstraße = 170 Persons Park area Sufficiency= 1607-170= 1437 Personal spaces Effective Capacity> Actual capacity Result Karl's Platz is a Sufficient Space @ Personal space	@7.6m Radius

5.8.8 Fourth Hypothesis Statement Proof

According to given statement as follows;

Statement 4:

e. Personal space can be used to determine the sufficiency of a public space.

If personal space applied to occupancy and capacity of a public space it can also define the sufficiency of a public space

Hence proved that sufficiency of a public space can be determined by personal space.

5.9 Final Result

According to proposed research question:

How can personal space phenomena be used to determine certain Public Space parameters in context to its optimal use?

a) Occupancy of a Public Space

b) Capacity of a Public Space

c) Sufficiency of useable Space

From the results of above four hypothesis statements, it is proved that personal space phenomena can successfully be used to determine occupancy, capacity and sufficiency of a public space.

Chapter 6. Discussion and Recommendations

6.1 Personal Space vs Personal Posture

According to first Hypothesis statement:

Hypothesis Statement 1:

a. Personal space changes with the change of given personal posture.

It is assumed that people in different posture occupy different space, therefore each distinctive posture should be measured and compared with standard personal Space.

Statement 1 is proved to be wrong and is restated as following:

Restatement 1:

a): Personal Space doesn't change with the change of given personal postures.

In most of the cases personal postures do occupy different spaces but personal space bubble, defined space is sufficient to accommodate all personal postures taken in this project, secondary personal postures may be different according to cultural background and local behavior. Personal postures other than tested in this project should be validated on inter personal space model of Edward T. Hall 1966, before they could be applied. Personal postures in a public space depends mainly on the local culture as in case study area people come mostly with bicycles, walking trolley etc. there primary postures are common and universal secondary may change with the change of study area.

6.2 Occupancy of a Public Space

Personal space doesn't depend upon personal postures, therefore, occupancy is not dependent on personal postures, and rather it depends upon personal space. In order to develop a legitimate tool to measure occupancy of public space a standardization is required. If personal postures would have taken more space than personal space (already defined as 1.2m radius and 4.5m area), the redefinition of personal space was required. In this case, it doesn't and should be used as a standardized tool to measure occupancy. Occupancy of space could be defined in two ways, firstly, in which occupancy of entire space in terms of

persons for example occupancy of project site at a particular time is 508 persons and secondly, total occupancy of space in terms of the area over available space is 2286m^2 (508x4.5=2286 m^2).

Hypothesis Statement 2:

b. Occupancy of a public space can accurately be determined only by considering corresponding personal space posture.

If personal space changes with a change in personal posture, then occupancy based on personal posture should be different from standard personal space.

6.3 Capacity of a Public Space

In the section 5.7.2, Public space capacity calculated on the basis of personal space. Hence, it proves that personal space capacity can be calculated on the basis of personal space.

Hypothesis Statement 3:

c. The actual capacity of a public space can be determined on the basis of personal space.

If personal space applied to a public space, actual capacity can be determined.

As per hypothesis statement, the capacity of a public space in terms of actual capacity and effective capacity can be determined with the help of personal space defined by Edwards T.Hall (1966).

6.4 Sufficiency of a Public Space

According to given statement as follows;

Hypothesis Statement 4:

d. Personal space can be used to determine the sufficiency of a public space.

If personal space applied to occupancy and capacity of a public space it can also define the sufficiency of a public space

Hence, proved that sufficiency of a public space can be determined by personal space. Occupancy and capacity depend on personal space and sufficiency depend upon occupancy and capacity of public space.

The capacity of a public space is a direct derivative of its occupancy. Whereas sufficiency is derivative of it occupancy and capacity. Occupancy of a public space is the actual capacity of a public space. Whereas effective public space capacity can be defined as theoretical availability of total number of personal spaces in a public space during a particular period of time.

6.5 Mapping, Alternate Approach

One of the better way to perform this spatial analysis is to use working cad drawings prepared by the landscape architect. These drawing may have exact measurements and location information, and will definitely add more value to the results. At the time of design spaces are more thoroughly in focus and accuracy of measurements are more likely reliable.

6.6 Reconnaissance

Reconnaissance is foremost step to evoke the initiative and it is recommended by researchers. In this study a reconnaissance stage has been used as a serious step. At the end of reconnaissance a complete script of the entire research was framed, understanding of the local culture.

"A systematic field reconnaissance of the area was made on foot by a trained observer".[105]

6.7 Questionnaire

A small questionnaire or interview can help to frame the basic structure of a social study. Public participation can play an important role to take research much further. It is important not to establish any preemptive notion about local culture and norms only from observations.

"It is possible, however, to study both interviews and field studies more systematically, and to learn much more about the character and structure of the urban image". [106]

[105] Lynch, K. (1960). P 15
[106] Lynch, K. (1960). P 45

Chapter 7. Conclusions

7.1 Edward T.Hall (1966) Model of Interpersonal Distance

Scientific research is a progressive and an incremental process in nature. Hediger's (1955) work on animal for mutual distance was used by Hall to develop interpersonal space model. He defined personal space phenomena and coined a term for it. His model is comprehensive and universal in nature as far as present day human perception could imagine personal space requirements. In this project most of personal posture were tested on this model and Model was proved to be ample.

7.2 Sufficiency Model

Public space sufficiency model is based on "T.Hall (1966) Model of Interpersonal Distance" and will remain valid as far as Hall model remains valid.

T.Hall (1966) model is universal in nature and could be applied in any society as far as public space use remains in context. Personal space requirements and perception may vary but the model is based on an existing model designed carefully and encompassing universal requirements.

7.3 Personal Space as a yardstick

In this project, Personal space has been proved to be a potent yardstick to measure occupancy of a public space, Capacity of a public space, and sufficiency of a given public space for a given number of people.

7.4 Public Space Occupancy

Personal space has been used to determine occupancy of a public space, a site in Karlsplatz, Bernburg taken as an experimental site.

7.5 Public Space Capacity

Personal space has been used as a tool to determine the capacity of a public space.

7.6 Public Space Sufficiency

Personal space together with occupancy and capacity of a public space has been used to determine the sufficiency of a public space.

7.7 Local Behavior as a Spatial Analysis Criteria

A human being a social animal always wants to socialize therefore people have a cohesion they attract each other from private space out at the public space. More the people at a public space will make the magnet stronger and hence more people will be attracted to the public space. A human being a social animal more

behavior oriented than instinctive. People learn from each other, society and personal experiences. Therefore public behavior can be tamed according to the mutual social benefits of society by increasing interactions, teaching, and participation. But local behavior is a very innate trait of a society and is very deep in the psychology of that very society.

In order to identify useable spaces, some criteria are needed to be devised to use as a director to perform a spatial analysis. In this project local behavior, norms, and values have been taken as a guideline to determine analysis criteria.

7.8 Public Space status of Commercial Street or an urban square

In this project, another task was to prove project area as a legitimate public space. Personal space attributes were applied to commercial streets to prove it an urban space and proved theoretically that commercial streets and urban squares are public spaces. (Page 22 Section 2.4 Public Space Status of Commercial Streets and Urban Square)

7.9 Contingency Plan and Standardization

Engineering and design project success depends upon several factors and a contingency plan is one among them. In personal space bubble, space is given on the basis of personal postures, and are variables. In order to calculate occupancy of a public space accurately, a variety of available personal postures must be considered with their respective contingency measures. In a primary posture, space requirements are different for different postures, and with or without gear as mentioned in section 2.8.2.1.1. The Same approach can be used to apply and place personal postures in a personal space (defined as 1.2m Radius and 4.5m^2 Area) to verify the legitimacy of personal space to be used as a yardstick. Some personal postures measure less and some more but overall fit into personal space radius, therefore, personal space defined by T.Hall (1966) could be used as a legitimate standard tool.

Chapter 8. Prospects

Prospects of this research:

8.1 Personal space as a yardstick.

All scientific works lead to standardization of techniques in such a way that in future professionals can use those techniques directly to work out their related problems. In order to measure distances, we have measuring units like meters, yards, miles etc. In the case of public spaces, some yardstick should be available to determine its space occupancy, capacity, and sufficiency. This project has helped to resolve that issue. Personal space has been defined as a yardstick to measure most of the public space parameters in context to its optimal use.

8.2 Measures occupancy of a public space.

In the case of this research, a case study has been carried out to apply the results and prove that certain parameters of public space could be determined on the basis of personal space. Occupancy of a public space is one of the main parameters of any public space which affects its use in such a way that it comprises the basic unit (person with personal space bubble) of its measurement. Occupancy of the given public space has also been determined in this project.

8.3 Measures capacity of a public space.

The capacity of public spaces is another parameter which affects quality of life in a public space. More the capacity offers more space to its users and hence better quality of public space life. Public space provision is neutral in the provision and by law. Access to public spaces is free and open. As access to public spaces can't be restricted, therefore, lower capacity with more occupancy may trigger public health issues, security issues, congestion and crowding, public space management, maintenance issues and vandalism.

8.4 Determines sufficiency of a public space.

Public spaces are a public asset and are common spaces. Community shares such spaces and are vital in maintaining everyday social life. Public spaces are a true reflection of society, and a stage to exhibit social values and culture. Public spaces are the places from where one can learn about that society, for example

What people wear?

What do they eat?

How they behave?

How they live their everyday life?

What are most popular trends?

Public spaces offer sharing point and conducting medium to exchange experiences. Public spaces should offer sufficient space to fulfill its role of being an exhibit for social and cultural values of that community. Sufficiency of public spaces is yet another very important parameter defined in this project.

8.5 An index to determine the quality of life

Personal space can be an index to determine the quality of life in public space on the availability of space per person. Public spaces are also exhibited of the quality of life of a society. The quality of life offered in a society is visible in its public space. The quality of public spaces indicates directly the quality of life in that society. Sufficiency of space in a public space is the first indicator of quality besides adequate facilities, infrastructure, and maintenance. Personal space can be termed as an index to measure the quality of life offered by that particular public space.

In the pilot project study conducted in Bernburg, Germany could be referred to how it can prove to be an index of quality of life in a public space. Interpersonal distance model provided by Edward T.Hall (1966) has been used to apply elaborate full picture.

In the Table 20 Karlplatz public capacity*, it is clear that the capacity of Karlsplatz @ of personal space is 1608 persons but the number of people found at the time of people mapping was 180 persons. If we match people presence and the capacity, it matches the capacity of Karlsplatz @ of social space i.e. 177 Persons. It means that the people in Karlsplatz enjoying the availability of space @ social space.*

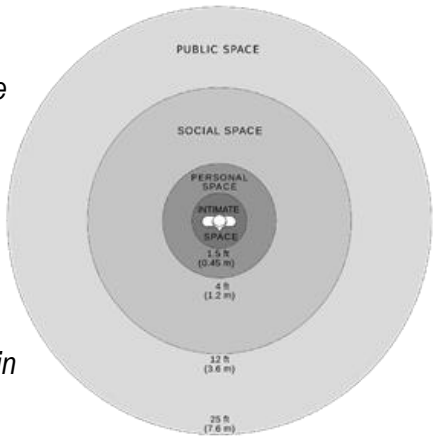

Fig: 109 T.Hall Model (1966)

*Personal space (4.5m² @ radius 1.2m) is the standard minimum space required for any person to be conveniently present in a public space. Next to personal space there are social space (*38.48*m² @ radius 3.6m) and public space (*181.46 *m² @ 7.6m) rings. Space available more than personal space will further increase the availability of space. Availability of more space means convenience of maneuverability, the safety of interaction.*

8.6 The Minimal basis for space requirements.

Personal space also defines the minimal basis for space requirements per person in a public space.

There are three basic human postures in a public space termed as primary postures. With the changing world, people may appear with different gears and could be termed as secondary postures Section 3.2.1 Page 48. Six of the most common postures available in pilot project site were tested. All six personal posture occupy different space but overall sit inside the personal space matrix defined by Edward T.Hall (1966) personal space ring. For standardization personal space (4.5m² @ radius 1.2m) can be taken as standard minimum space required by any person in a public space.

8.7 Determine public space requirements for a neighborhood.

Personal space can be a tool to determine public space requirements for a neighborhood.

The size of public space is a part of long-term planning for a society. The population of a society is temporal in nature and naturally, it trends upwards. In planning, if public spaces are provided for the next thirty to fifty years. And the population growth rate is known for certain society then its population can be predicted in next fifty years.

Public spaces are with the right of presence to everybody in the community. A personal space slot should be left for each person to that community.

According to Wikipedia, Bernburg in year 2008

Total population= 36,105

Areas = 113.4 km²

Population growth rate = 0.06

Population in 2050 = 36,105x0.06x42 yrs. = 90984.6 population

Personal spaces required today = 90984.6

Personal space required= 90984.6 x4.5= 409430.7 m²

Hypothetically @ 0.06 population growth rate today Bernburg need 409430.7 m² public spaces to meet its needs in next 50 years from 2008.

8.8 Resize existing public spaces

It can be a tool to resize existing public spaces according to future needs of the neighborhood.

Occupancy of a public space depends upon the population of the community and expected external tourism of that area. If both factors are known and rate of change could be calculated then the future need of public space can be calculated as explained in above point 7.

8.9 Maintain useable space demand

It can help maintain useable space demand for future needs in context to maintain the quality of public life. Personal spaces are parcels of useable spaces as only useable spaces are approachable in a public space. Useable spaces in a public space are places of presence whereas unusable space is breathing spaces of public space. Sufficiency of useable space in public space partially negotiates quality of life. The quality of life in a public space can completely be explained if both usable and unusable spaces are jointly considered. How much breathing space required for a useable space in public space is another discussion, but personal space still can define minimum standards requirements of required space in a public space.

8.10 Social indicator of a society

It can be a social indicator of a society or community @ what available space they are enjoying their public spaces.

In the Fig: 110 *an everyday business street in China shows that people are so close that they using public space almost at intimate space level. Whereas in Bernburg people are using public space in Lindenstraße @ social space.*

Fig: 110 Everyday business street in China

*Lindenstraße is also a business street but the quality of life in terms of space is much higher than this Indian stree*t.

Source: Fig.110.[107]

[107] http://www.stoplusjednicka.cz/sites/default/files/obrazky/2014/10/nanjing_dnes.jpg

8.11 Furthermore

i. It can be used to monitor urban ecology.

ii. It can also be applied to mobile location data to determine public space parameters.

iii. Motion detectors can be assigned personal space values to use it for determining certain public space parameters.

iv. It can be applied on mobile location data to determine public interaction in a public space, determining mobs, their behavior and threats analysis.

v. It can help determine the flow of mob, congestion, and crowding.

vi. It can help to estimate the number of people in a certain public space gathering.

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