SHROUQ
ALTAMIMI

THE SPATIAL DIMENSIONS OF SOCIALLY
SUSTAINABLE WORKPLACES THROUGH THE LENS
OF JORDANIAN INTERIOR ARCHITECTS

Ph.D. THESIS

Nicosia
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Ph.D. THESIS

Shrouq Altamimi

Supervisor

Assist. Prof. Dr. Simge Bardak Denerel

Co-Supervisor

Assoc. Prof. Dr. Aminreza Iranmanesh

Nicosia

June, 2023

Approval

We certify that we have read the thesis submitted by SHROUQ SAMIH ISMAIL ABU RAJAB ALTAMIMI titled **"The Spatial Dimensions of Socially Sustainable Workplaces through the Lens of Jordanian Interior Architects"** and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Ph.D. of Interior Architecture.

Examining Committee	Name-Surname	Signature
Head of the Committee:	Prof. Dr. Özge Özden Fuller	.....
Committee Member*:	Prof. Dr. Zeynep Üstün Onur	.....
Committee Member*:	Assoc. Prof. Dr. Can Kara	.....
Committee Member*:	Assist. Prof. Dr. Hassina Nafa	.....
Committee Member*:	Assist. Prof. Dr. Buket Asilsoy	.....
Supervisor:	Assist. Prof. Dr. Simge Bardak Denerel	.....
Co-Supervisor:	Assoc. Prof. Dr. Aminreza Iranmanesh	.....

Approved by the Head of the Department

27 /06 /2023

.....

Assist. Prof. Dr. Çiğdem Yağman Çağnan

Head of Department

Approved by the Institute of Graduate Studies

...../2023

Prof. Dr. Kemal Hüsnü Can Başer

Head of the Institute

Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Shrouq Altamimi

27/06/2023

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When I embarked on the journey to pursue my doctoral studies, I had no idea about the profound experiences that were waiting for me along this lengthy path. Now that this journey has come to an end, I am grateful for all the tough moments, the sleepless nights, and every obstacle I had to overcome and learn a great deal from.

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Shrouq Altamimi

Abstract

The Spatial Dimensions of Socially Sustainable Workplaces through the Lens of Jordanian Interior Architects

Altamimi, Shrouq
Supervisor: Assist. Prof. Dr. Simge Bardak Denerel
Co-Supervisor: Assoc. Prof. Dr. Aminreza Iranmanesh
PhD, Department of Interior Architecture
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Sustainability has become a major priority for industry and academia in the interior design and architecture sectors. Current research on building sustainability, however, is mostly focused on environmental and economic aspects, with social sustainability frequently overlooked. This study highlights the need for workplace interior design guidance embodying the concept of social sustainability within the physical environment to enhance the quality of life and the job performance of employees. The study investigates the experiences of Jordanian interior design and architecture professionals within the realm of social sustainability as represented through four primary aspects: "Physiological Health and Comfort", "Efficiency and Ergonomics", "Privacy and Social Interaction", and "Spatial Organization (Design)". A survey was administered to 145 design professionals working in 35 interior design and architecture offices in Amman, Jordan, and the spatial attributes of these offices were analyzed. The study aims to explore the user experience within the office environment relative to Indoor Environmental Quality (IEQ), Quality of Work Life (QWL), and Quality of Life (QoL) under the wider context of social sustainability. Descriptive statistics, correlations, and regression models were utilized to analyze data. Overall, the study highlights the need for theoretical and practical rewards to encourage the implementation of socially sustainable development in workplace design, particularly in the context of Jordanian interior design and architecture offices. This study gives beneficial insights for the development of workplace design guidelines that highlight social sustainability aspects within the built environment.

***Keywords**:* social sustainability, interior design, office workspaces, quality of life, quality of work life, user satisfaction, productivity, quality of space

Özet

Ürdünlü İç Mimarların Bakış Açısıyla Sosyal Sürdürülebilir İşyerlerinin Mekansal Boyutları

Altamimi, Shrouq

Danışman: Yard. Doç. Dr. Simge Bardak Denerel

Eş-Danışman: Doç. Dr. Aminreza İranmanesh

İç Mimarlık Bölümü, Doktora Tezi

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Sürdürülebilirlik konusu, iç tasarım ve mimarlık sektörlerinde endüstri ve akademi için büyük bir öncelik haline gelmiştir. Bununla birlikte, bina sürdürülebilirliği ile ilgili mevcut araştırmalar çoğunlukla çevresel ve ekonomik yönlere odaklanmış ve sosyal sürdürülebilirlik sıklıkla göz ardı edilmiştir. Bu çalışma, çalışanların yaşam kalitesini ve iş performansını artırmak için fiziksel ortamda sosyal sürdürülebilirlik kavramını somutlaştıran işyeri iç tasarım rehberliğine duyulan ihtiyacı vurgulamaktadır. Çalışma, Ürdünlü iç tasarım ve mimarlık profesyonellerinin sosyal sürdürülebilirlik alanındaki deneyimlerini dört temel açıdan temsil ediyor: "Fizyolojik Sağlık ve Konfor", "Verimlilik ve Ergonomi", "Gizlilik ve Sosyal Etkileşim" ve "Uzamsal Organizasyon (tasarım)". Çalışmada, Ürdün Amman'daki 35 iç tasarım ve mimarlık ofisinde çalışan 145 tasarım uzmanına bir anket uygulanarak bu ofislerin mekansal özellikleri analiz edilmiştir. Çalışma, daha geniş sosyal sürdürülebilirlik bağlamında İç Mekan Çevre Kalitesi (IEQ), İş Yaşamı Kalitesi (QWL) ve Yaşam Kalitesi (QoL) ile ilgili ofis ortamındaki kullanıcı deneyimini keşfetmeyi amaçlamaktadır. Verileri analiz etmek için tanımlayıcı istatistikler, korelasyonlar ve regresyon modelleri kullanılmıştır. Genel olarak bu çalışma, özellikle Ürdün iç tasarım ve mimarlık ofisleri bağlamında ve işyeri tasarımında sosyal olarak sürdürülebilir kalkınmanın uygulanmasını teşvik etmek için teorik ve pratik ödüllere duyulan ihtiyacı vurgulamakta ayrıca yapılı çevre içindeki sosyal sürdürülebilirlik yönlerini vurgulayan işyeri tasarım kılavuzlarının geliştirilmesi için önemli olan kategorileri önermektedir.

Anahtar Kelimeler: sosyal sürdürülebilirlik, iç mekan tasarımı, ofis çalışma alanları, yaşam kalitesi, iş yaşam kalitesi, kullanıcı memnuniyeti, üretkenlik, mekan kalitesi

Table of Contents

Approval i

Declaration ii

Acknowledgements iii

Abstract iv

Özet v

Table of Contents vi

List of Tables x

List of Figures xii

List of Abbreviations xiv

CHAPTER I

Introduction 1

- Statement of the Problem 2
- Purpose of the Study 3
- Research Questions / Hypotheses 4
- Significance of the Study 5
- Limitations 6

CHAPTER II

Literature Review 8

- The General Concept of Sustainability 8
  - The Relation Between the Three Pillars of Sustainability 9
- Social Sustainability 13
  - Main Aspects of Social Sustainability 16
  - Social Sustainability in the Built Environment 19
- A Summary of Typical Definitions for Social Sustainability 23

Environmental Psychology – Another Perspective on Social Sustainability in the Built Environment 24
Workplace Environmental Quality (EQ) or (IEQ) 29
Functional Comfort and Environmental Quality (EQ) 29
Quality of Work Life (QWL) 33
Quality of Life (QoL) 38
Building-In-Use (BIU) Assessment Tool 45
Defining Social Sustainability for this Study 46
Physiological Health and Comfort 46
Efficiency and Ergonomics 47
Privacy and Social Interaction 47
Spatial Organization (Design) 48
Office Workspaces 49
The Concept of Office Workspaces 49
Office Space Origins 50
Developments in Office Workspace Design 53
Open Office Planning 55

CHAPTER III

Methodology 58
Research Design 58
Participants / Population & The Sample / Study Group 59
Data Collection Tools/Materials 60
Employee Questionnaire 61
Space Syntax – Grasshopper3D Plug-in 61
Integration Computational Tool 62
Difference Factor 63
Entropy Computational Tool 63

Control Computational Tool 64
Choice Computational Tool 65
Shortest Distance 66
Syntactic Tool Procedure 67
Complete Visual Script View 69
Data Analysis Procedures 69

CHAPTER IV

Findings and Results 70
Questionnaire Results 70
Comparative Analysis Between Cases 78
Space Syntax - Grasshopper3D Plug-in Results 81
Space Syntax - Grasshopper3D Plug-in Results 81
Depth 85
Difference factor 85
Integration 87
Entropy 89
Control 90
Choice 92

CHAPTER V

Discussion 94
The Configurational Dimensions of Interior Spaces 97

CHAPTER VI

Conclusion and Recommendations 102
Conclusion 102
Recommendations 104

References 106

Appendices 129

List of Tables

Table 1 Definitions for Social Sustainability 24
Table 2 The summary of the main subjects of literature review, definition, significance, and influential factors. 41
Table 3 Items addressed in the survey. 60
Table 4 Spearman's correlations between the general evaluation of "Physiological Health and Comfort" (categorical dependent variable: A_DV) and individual corresponding items. 72
Table 5 Spearman's correlations between the general evaluation of "Efficiency and Ergonomics" (categorical dependent variable: B_DV) and individual corresponding items. 73
Table 6 Spearman's correlations between the general evaluation of "Privacy and Social Interaction" (categorical dependent variable: C_DV) and individual corresponding items. 74
Table 7 Spearman's correlations between the general evaluation of "Spatial Organization (Design)" (categorical dependent variable: D_DV) and individual corresponding items. 75
Table 8 Spearman's correlations between the two main dependent variables (M_DV_1 & M_DV_2) and composite variables addressing the four independent categories..... 76
Table 9 Multiple regression model for the main two DVs..... 77
Table 10 ANOVA test among 35 case studies. 78
Table 11 Correlation among four categorical composite variables across the 35 case studies..... 79
Table 12 Correlation between the two main dependent variables of the study and four categorical composite variables. 80
Table 13 Multiple linear regression model for predicting the two main dependent variables through the four categories across the 35 case studies 81
Table 14 space types explored in the Space Syntax analysis. 82
Table 15 The correlation coefficient between the four categories (composite variables) and the difference factor. 87

Table 16 The correlation coefficient among integration value of different spatial types across 35 offices. 88
Table 17 The correlation coefficients between the space syntax entropy measures and the two main dependent variables across the 35 case studies. 89
Table 18 The correlation coefficient between the four categories (composite variables) and entropy value of different spatial types across 35 cases. 90
Table 19 The descriptive statistics of the space syntax control measures across the 35 case studies. 91
Table 20 The correlation coefficients between the space syntax control measures and the two main dependent variables across the 35 case studies. 92
Table 21 The correlation coefficient between the four categories (composite variables) and choice (betweenness) value of different spatial types across 35 cases……93
Table 22 Table of findings relevant to correlations between the space syntax measures and the two main dependent variables. 93
Table 23 Categories in order of observed statistical significance (left-to-right) and most significant items in each category (top-down) as reported via survey. 96
Table 24 the regression model including some of the space syntax variables that were shown to be significant..... 101

List of Figures

Figure 1 The “Venn diagram” model. – Source: (Al Saeed & Furlan, 2017)..... 11
Figure 2 The “Russian Doll” model. – Source: (Al Saeed & Furlan, 2017)..... 11
Figure 3 The Jarvis model. – Source: (Al Saeed & Furlan, 2017)..... 12
Figure 4 The model of the planning hexagon. – Source: (Lozano, 2008) 12
Figure 5 A visual of the interaction between human activities, including those economic nature, and their environmental context. – Source: (Giddings et al., 2002)……..12
Figure 6 Literature model. – Adapted from and expanded upon Jacqueline Vischer and Wifi (2017) (by the researcher). 28
Figure 7 The workspace comfort pyramid. – Source: (the researcher) adopted from Jacqueline Vischer (2005). 30
Figure 8 Literature Review Structure..... 57
Figure 9 Space Syntax main tool process. – Source: (The researcher). 62
Figure 10 Integration computational tool. – Source: (The researcher). 62
Figure 11 Example of integration result. – Source: (The researcher). 63
Figure 12 Example of difference factor result. – Source: (The researcher). 63
Figure 13 Entropy computational tool. – Source: (The researcher). 64
Figure 14 Example of entropy result. – Source: (The researcher). 64
Figure 15 Control computational tool. – Source: (The researcher). 65
Figure 16 Example of control result. – Source: (The researcher). 65
Figure 17 Choice computational tool. – Source: (The researcher). 66
Figure 18 Example of choice result. – Source: (The researcher). 66
Figure 19 Example of shortest distance result. – Source: (The researcher). 67
Figure 20 Example of different points representing every interior space. – Source: (The researcher). 68
Figure 21 Example of defining curves(lines) as connections between spaces. – Source: (The researcher). 68
Figure 22 Example of specifying interior spaces names and defining their areas and the total area. – Source: (The researcher)..... 68
Figure 23 Example of complete visual script view. – Source: (The researcher). 69

Figure 24 Descriptive statistics of the independent variables and associated Cronbach's alpha for each group. 70
Figure 25 The process of investigating and overlaying the results of the survey and space syntax analysis across the 35 case studies. 83
Figure 26 An example of the space syntax analysis outcome (Office #3) including Depth, difference factor, integration, entropy, control, and choice. 84
Figure 27 scatterplot of difference factor in relation with the main dependent variable. 86

List of Abbreviations

TRNC:	Turkish Republic of North Cyprus
MNE:	Ministry of National Education
EQ:	Environmental Quality
IEQ:	Indoor Environmental Quality
QWL:	Quality of Work Life
QoL:	Quality of Life
BIU:	Building-In-Use Assessment Tool

CHAPTER I
Introduction

Given the social, economic, and ecological challenges anticipated to be faced by humanity and our planet over the times to come, the essential need for sustainable development in human communities is occupying an increasingly central position today. As such, it is important to incorporate sustainable design concepts into all venues, particularly those that are at the core of modern society.

The interior design and architecture industry has an extremely significant impact on society, and sustainability has long been a priority for both industry and academia. Over the lifecycle of all forms of design and architecture projects, environmental, economic, and social factors must be considered. Current building sustainability research focuses primarily on environmental and economic concerns. Social sustainability, on the other hand, is a complex concept that is consequently often ignored or downplayed in relevant studies. The research on social sustainability is fragmented and requires further investigation (Weingaertner & Moberg, 2014). Social sustainability needs more consideration in discussions in academia because it sets a framework for studying and enhancing the human-centric aspects of growth and development, which tend to be ignored or marginalized in traditional economic and environmental methods. Social sustainability emphasizes the role of community as the medium of interaction between the economy and the environment by focusing on the human dimensions of sustainability (McGuinn, FRIES-TERSCH, JONES, & CREPALDI, 2020).

Design and architecture offices are on the leading edge of innovation in terms of built space creation. The work of individuals and professionals employed by these offices essentially defines the design currents that dominate modern society. Interior design and architecture offices are good candidates for this study because they have undergone drastic and clear changes in terms of the work technology and the way functional tasks are performed in recent years. Historically, interior design and architecture work entailed manual drafting on large papers. This essentially defined the shape, form, and interior design of the spaces utilized for this type of work; manual drafting on paper necessitated the presence of spacious rooms and large tables. However, with continuous developments in technology, these offices today are completely dependent on computers and various software programs that

effectively facilitate the design process. Consequently, the big tables have mostly been replaced with narrow, long ones where workers can sit and work on their computers next to each other.

Utilizing socially sustainable designs for design and architecture offices is anticipated to amplify the notion of socially sustainable design across the urban fabric. This is likely the result of multiple dynamics, including the direct impact of a socially sustainable setting providing inspiration to interior design and architecture professionals as they synthesize other spaces, and the influence of user comfort and attractiveness that comes as a byproduct of socially sustainable designs. In fact, Jordan's geopolitical reality necessitates that this be treated as a priority – within realistic constraints – to promote socially sustainable design concepts in the Jordanian community. Architecture and design offices can be harnessed as a powerful tool to reinforce the notion of sustainable design and behaviour in the Jordanian society, and as such were chosen as the primary focus of this study.

Design and architecture offices encapsulate a diverse range of spaces, including reception and waiting areas, administration offices, staff workspaces, design workspaces, meeting rooms, creative thinking and brain storming spaces, halls, cafeterias, service areas, and other venues such as financial and marketing departments. This study demonstrates a number of general and specialized concepts that are deemed critical to understanding and implementing socially sustainable design within design and architecture offices. The study is intended to primarily focus on the notion of social sustainability. As will be shown at length in subsequent sections, numerous definitions and interpretations have been proposed for social sustainability. Therefore, for the purposes of this study, the definition of socially sustainable spaces will be strictly reduced to those spaces that meet four distinct, clearly defined criteria: physiological health and comfort, individual workspace efficiency and ergonomics, privacy and social interaction, and spatial organization (design). In selecting these metrics, the notion of social sustainability was examined through the lens of environmental psychology and quality of life research – a detailed overview of this theoretical link will be presented later within this thesis.

Statement of the Problem

The stereotypical image of static, compartmentalized workplaces conceptualized in the twentieth century has suffered a visible recession over the past

decade. The incessant advent of technological transformations has played a major role in popularizing remote work arrangements. This, combined with soaring real estate premiums driving populations outside metropolitan areas, now means that the working masses in office-based professions need not physically reside in an office space and can conduct functions from elsewhere. Since the presence of a traditional workplace is losing its position as an absolute necessity, these spaces may be experiencing a reinvention to justify their existence. The interior architecture of the modern workplace must then be designed to yield characteristics that incentivize individuals and employers to engage in such an environment. There is therefore a need for workplace design guidance that prioritizes parameters lying at the intersection of twenty-first century workforce-corporate interests embodying the notion of social sustainability within the built environment.

In light of the foregoing, there exists a need for a deliberate, methodical assessment of the degree to which the interior of workplaces embodies the concept of social sustainability. This is especially true within Jordan's geopolitical context, which necessitates focus on implementing and promoting socially sustainable design concepts. Therefore, architecture and design offices were used as an effective tool to highlight the concept of sustainable design within this context. This is the main problem this study sets out to tackle.

Purpose of the Study

The aim of this study is to develop knowledge on how interior design relates to social sustainability by identifying and evaluating features of social sustainability to understand and thereafter implement it as a method within the design phase of interior spaces. This basis is to be subsequently harnessed in finding a working model for promoting social sustainability aspects within the design practice by identifying design elements that are most efficient in maximizing social sustainability within modern design and architecture offices. This is intended to be achieved through satisfying the following objectives in the context of interior design and architecture offices in Jordan:

1. Proposing a clear, usable definition for social sustainability in the built environment. This aims to allow the current study and future treatments of the topic to bypass the ambiguity that can be claimed to surround this topic.

2. Collecting information from users on the current practice of office interior design, the preferences of these parties on select aspects of the design process, and the perceived value of socially sustainable design elements as defined in this study.

3. Identifying a set of design elements that are most efficient in maximizing functional comfort and social sustainability. This effort is informed by the collected data and design/space analysis of case studies in relation to the four indicators of social sustainability in the built environment. This comes with the ultimate purpose of promoting the integration of principles of social sustainability in the interior design process.

Research Questions/Hypotheses

This dissertation explores two interconnected hypotheses. These hypotheses are proposed to assess the influence of spatial attributes and design elements on the overall level of social sustainability offered within workplaces.

H1: It is hypothesized that overall employee satisfaction and productivity in the workplace are correlated with detailed employee functional comfort scores under each of the four categories considered.

H2: It is also hypothesized that the layout and spatial attributes of workplace spaces represented by space syntax metrics are correlated with overall employee satisfaction and productivity along with employee functional comfort scores under each of the four categories considered.

These hypotheses will be assessed by distributing a questionnaire to space users and studying the layout of target offices to directly answer the following questions:

1) What distribution do questionnaire responses imply for each of the four indicators? In other words, does the variability of participant responses resemble a uniform distribution of responses where each surveyed participant appears to be equally likely to state given responses, or do the responses suggest the presence of collective common trends that a significant subset of users seem more likely to embrace?

2) For each of the four indicators, do participant responses indicate a trend of weak, moderate, or strong participant appreciation for the importance of incorporating the indicator into workplace interior design?

3) What level of correlation exists between functional comfort responses under each of the four categories considered and responses to the two main questions concerning overall employee satisfaction and productivity?

4) What level of correlation exists between functional comfort responses under each of the four categories considered and each of the space syntax metrics obtained upon analyzing the layout and partitioning of the studied workplaces?

5) What level of correlation exists between responses to the two main questions concerning overall employee satisfaction and productivity and each of the space syntax metrics obtained upon analyzing the layout and partitioning of the studied workplaces?

It is understood that the types of questionnaire questions posed in this research effort have inherently variable outcomes and subjective answers that will vary per person. This research project aims to systemically study this variability in order to extract recommendations that maximize the collective social benefit as described later in this document.

Significance of the Study

This study will proceed by comparatively examining the status-quo of design and architecture offices in Jordan and establishing an understanding of the critical parameters that dictate the level of social sustainability – through its four indicators adopted within this study – in these spaces. This understanding, in turn, will be harnessed to identify a set of design elements that are most efficient in enhancing functional comfort, which can then be prioritized to inform socially sustainable designs of interior design and architecture offices in Jordan. Ultimately, the intent is to contribute to enriching the culture of social sustainability at the user, designer, and legislator levels. In specific, the study will contribute to the relevant body of knowledge in a number of ways, as follows:

1) Presenting a theoretical link between social sustainability ideas and measurable functional comfort metrics – no such link has been proposed by the literature.

2) Building-in-Use (BIU) Assessments and similar tools were developed and used in North America and Europe to assess the office workspaces, meaning that a gap exists in their applicability and use in the Middle East (including Jordan):

- This research project collects data that can be used to form the seed of a future metric (similar to the BIU "norm") for measuring functional comfort in Jordan.

3) By identifying the key aspects impacting functional comfort, the results of this study will be used to identify which design decisions are most efficient for improving the functional comfort and social sustainability of interior design/architecture offices in Jordan.

4) Maximizing Return-on-Investment (ROI) is critical in a challenging economy like Jordan's – identifying design decisions that improve employee productivity will enhance social sustainability. Emphasis will be placed on assessing the impact of spatial and physical design decisions on the overall user experience within the structures in question.

Limitations

The thesis focuses on the social dimension of sustainability and the way it can be applied in the interior design of design and architecture offices, but also seeks to highlight the qualities and key aspects of social sustainability and understand how they contribute to these spaces. Social sustainability is a vast topic; this thesis explores the topic from a narrow spatial scope addressing office environments in Jordan. From this perspective, the space is the container of its social dynamics, and by extension a contributor to the level of social sustainability experienced by users. Social sustainability refers to the concept of creating and maintaining a society that promotes social well-being, equity, and inclusivity over the long term. Accordingly, topics such as economic and environmental aspects are not addressed. Not all principles related to social sustainability will be included; items such as social economic, civic, and political issues are outside the focus of this study, and aspects

related to interior design and architecture constitute the primary focus. Further, a specific set of design-related social sustainability indicators within the context of the built environment are selected and analysed. This study only discusses social sustainability in the design process and does not discuss the construction phase.

CHAPTER II
Literature Review

The General Concept of Sustainability

"**Sustainability**" is an important concept that has was defined differently by many scholars through numerous angles. Linguistically, according to the Oxford dictionary, the word "**sustainable**" is defined as "able to be maintained at a certain rate or level; conserving an ecological balance by avoiding depletion of natural resources". The term "**sustainable design**" can be defined as the design process that seeks to reduce the environmental decay and uses environmentally preferable materials and renewable energy resources. In the context of economics, "sustainability" is used in communities where the resources are rarely found and also where economic growth and fast returns are preferred (Tzonis, 2007).

Relative to architecture and the built environment, the WCED (1987) defined sustainability as "a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional changes are made consistent with future as well as present needs". The term "sustainability" also has a lot of definitions that highlight different aspects; some of these definitions emphasize the importance of indoor environmental quality, the comfort of space users, and increasing the energy efficiency by employing passive cooling devices and eco-friendly materials to reduce the influence of the built environment on humans and the environment (Alshuwaikhat & Nkwenti, 2002). The concept of sustainability is also associated with utilizing technology in an ethical and socially responsible manner, and with a sense of mindfulness of the community and the surrounding nature (Johnson, 1995).

The notion of sustainability primarily revolves around three main axes: sociocultural, environmental, and economic qualities. These three dimensions of sustainability could be denoted by the three pillars, or "3Ps", of sustainability: the people, profit, and planet (Al-Kodmany, 2018). A description of the "3Ps" is as follows:

- "People" represents community well-being and equity (the social dimension).
- "Profit" represents economic vitality (the economic dimension).
- "Planet" represents conservation of the environment (the environmental dimension).

The use of local materials and reducing operating costs are the main considerations to maintain economic sustainability. Environmentally speaking, architects, designers, and engineers have to take the local climate into consideration to achieve thermal comfort and an energy efficient built environment. Last, but not least, sociocultural sustainability is mainly concerned about improving the quality of life and designing for social impact (Schwarz & Krabbendam, 2013; Woodcraft, 2012).

Despite the central role the concept of sustainability plays in modern society, social sustainability has neither been well-recognized nor studied in depth, and it has certainly received less attention than its environmental and economic counterparts (Al-Kodmany, 2018; Colantonio, 2011; Colantonio, Dixon, Ganser, Carpenter, & Ngombe, 2009; Cuthill, 2010; Magee, Scerri, & James, 2012; Partridge, 2005).

The Relation Between the Three Pillars of Sustainability

The commonly used notion of sustainable development has been assigned multiple interpretations. Sustainable development was considered an ecological vision in the first decade of its emergence (Åhman, 2013). In recent decades, however, a multi-focused agenda was developed that strongly links and reconciles the contradictions among environmental, economic, and social concepts. Other terms like the "triple-bottom-line" are used to denote and explain sustainable development (McKenzie, 2004). The economist and environmentalist Elkington (1999) proposed defining of the triple bottom line as a target degree of overall sustainability which can only be achieved by satisfying a minimum threshold within the context of environmental, social, and economic spheres. However, in further studies, social sustainability has become a key concept of sustainability alongside its other two aspects – the economic and ecological.

There are three generally accepted models to represent the relationship that exists between the three dimensions of sustainability: the Venn diagram, the "Russian Doll" model, and the Jarvis model. The different sustainability pillars are all conceived as being separate but independently related in all of these models (Giddings, Hopwood, & O'Brien, 2002; Manzi, Lucas, Jones, & Allen, 2010). The model of overlapping circles, also known as the Venn diagram (see Figure 1), consists of three circles which are interconnected, and sustainable development refers to the area of intersection (Manzi et al., 2010; McKenzie, 2004). On the other hand,

in the “Russian Doll” model (see Figure 2), the outermost and the innermost circle represent the environmental and the economic, respectively, whereas the social aspect is described as a function of these two facets and is represented by the middle circle (Manzi et al., 2010; McKenzie, 2004). The third model, called the “three-dimensional intersections” or the Jarvis model (see Figure 3), states that social sustainability is specifically concerned with the intersection between the activities of individuals, the environment in which those actions take place, and the relation between human life and the institutional system. Such a view, as Jarvis says, has been taken too rarely by popular voices in the discourse on sustainability issues (Manzi et al., 2010). The model of the planning hexagon is less known than the other mentioned models (see Figure 4). This graphical model illustrates how more variables and systems like economy, environment, individuals, group norms, technical skills, and legal and planning systems are linked to each other, and shows the relationships between them (Lozano, 2008). Giddings et al. (2002) proposed a completely different model for sustainable development, which suggests that economy is directly driven by human action and is thus treated as part of human activity (see Figure 5). As a consequence, this should remove the separation between human activities and material or cultural well-being. This carries the underlying assumption that human activities are in a state of continuous exchange and interaction with environmental surroundings (Giddings et al., 2002; Manzi et al., 2010). This is similar to the social sustainability framework and model presented by Cuthill (2010), which will be addressed in the following pages. Both frameworks hold that human activity is the most significant element influencing all aspects of sustainability.

Figure 1

The "Venn diagram" model. – Source: (Al Saeed & Furlan, 2017)

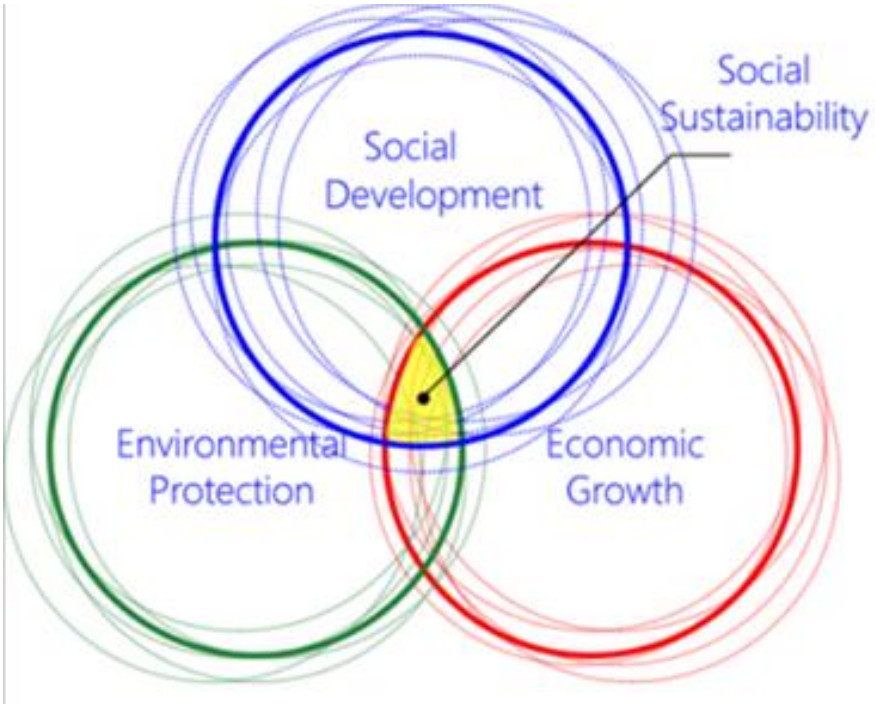


Figure 2

The "Russian Doll" model. – Source: (Al Saeed & Furlan, 2017)

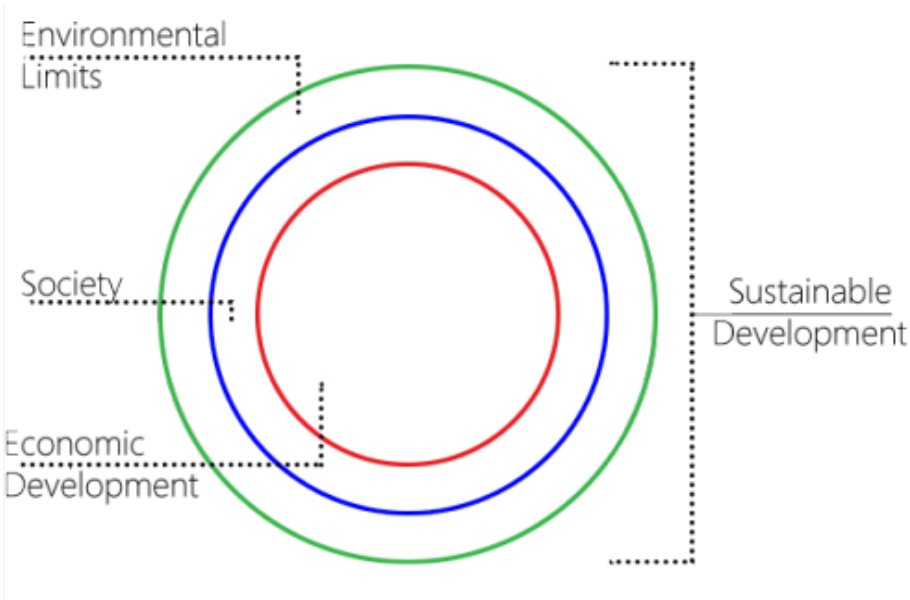


Figure 3

The Jarvis model. – Source: (Al Saeed & Furlan, 2017)

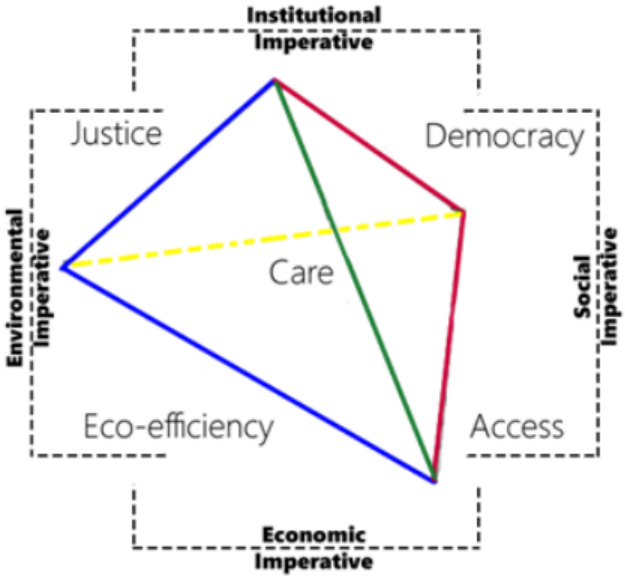


Figure 4

The model of the planning hexagon. – Source: (Lozano, 2008)

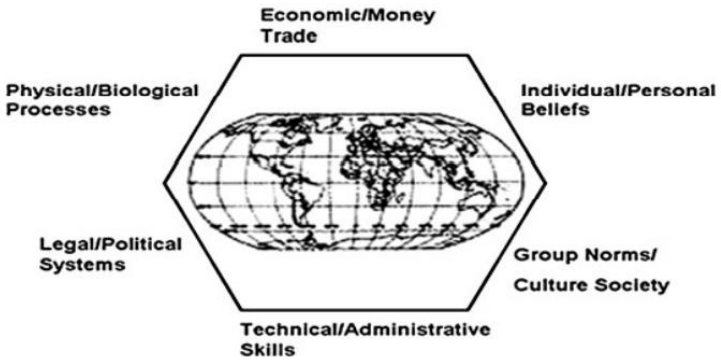
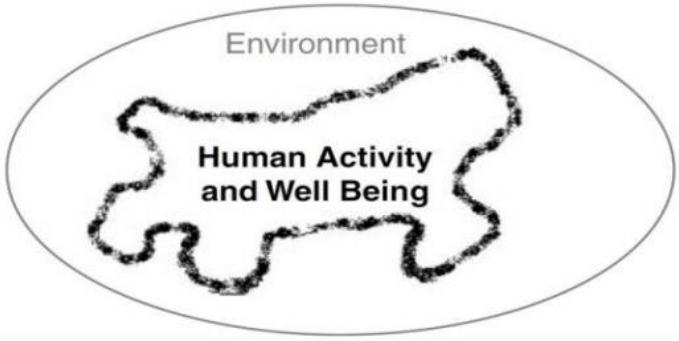


Figure 5

A visual of the interaction between human activities, including those economic nature, and their environmental context. – Source: (Giddings et al., 2002)



Social Sustainability

The idea of social sustainability was generally ignored compared to the environmental and economic facets of the sustainability over the first few years after the introduction of the sustainable growth concept in 1987. The major focus of attention tended to be environmental and economic concerns, with social issues being downplayed in this context. A shift in perspective ensued in the 1990s, and social sustainability began to draw considerably further attention from that point onwards. While extensive, the expanding body of research on this topic has yet to present a universal consensus on a consistent definition and characterization of the notion of social sustainability (Åhman, 2013; Golić, Kosorić, Kosić, Vučković, & Kujundžić, 2023; Jaeger, Tàbara, & Jaeger, 2011; Littig & Griessler, 2005; Weingaertner & Moberg, 2014).

Whether social sustainability is a mechanism to protect preexisting social structures or to propel the wheel of sustainable development forward remains subject to debate (Sachs, 1999). Thus, this literature review will discuss and evaluate the primary social sustainability definitions and aspects currently prominent. A description of the core aspects to this notion for the purposes of this study will be clearly presented. A number of scholars adopt the view that the social facet is central to the overall construct of sustainable development.

Social sustainability is concerned with creating a decent level of QoL for humans at the current time and in times to come (Newman, 2003; Partridge, 2005). It is also defined as a ‘process that can achieve a life-enhancing condition within communities’ (McKenzie, 2004). This kind of impact can be developed by promoting a number of different features, including the following (Al-Jokhadar, 2018):

- Fairness in access to key services.
- Obtaining the required form of a cultural relation system to please people individually or collectively.
- Recognizing the value of community and raising responsibility to maintain the coherence of the system.
- Determining points of emphasis and essential community needs and demands.

As previously stated, Cuthill (2010) argued that the social sustainability aspect of economic and environmental concerns was strongly expressed. He believes that the environmental problem is in fact a social problem since environmental sustainability is achieved by controlling human impact on the environment. He also asserts that economic considerations are a subset of human interactions, particularly in the context of economic justice.

Vallance, Perkins, and Dixon (2011) proposed a structure in which three subcategories of this term were established in describing the concept of social sustainability. First, development sustainability identifies basic human needs including education, jobs, equity, justice, freedom to effectively make decisions and develop oneself, allocation of wealth and power, and the availability of essential facilities and services. Second, bridge sustainability assures the changes in behavior necessary to achieve the goals related to the biophysical environment. Finally, maintenance sustainability entails preserving the social and cultural aspects of human life and addressing people's reactions to emerging changes (Vallance et al., 2011).

Another definition by Polèse, Stren, and Stren (2000) described social sustainability as a progress and development that can be accomplished by achieving a balance in the evolution of civic society, and this development can lead to the flourishing environment humans seek after . They also addressed the critical role played by social inclusion, equity, and cultural diversity in their definition of social sustainability. The definition that they stated refers to the urban environment and the significance of social aspects including cultural diversity, civic society, social integration, the physical environment, and the economic dimension. Moreover, for housing and built enclosures, other descriptions were proposed. Another definition for social sustainability was proposed by Woodcraft, Hackett, and Caistor-Arendar (2011). They described social sustainability as a procedure to create a society that is more prosperous through a close and an inclusive understanding of human needs. This entails placing well-being as a central pillar in the design process and achieving sustainable spaces by way of catering to the physical and social needs of space users (Woodcraft et al., 2011). Chiu (2003) identified three lenses through which one is to view and explain social sustainability relative to housing and built enclosures instead of providing a definition. Within this framework, societal attributes are shaped such that other aspects of sustainability related to economy and the environment are addressed. Through the first lens, she believed that social sustainability is affected by

social standards and values. Through the second lens, she used the term "environment-oriented", assuming that social sustainability should support environmental and ecological sustainability. The third lens, which places higher emphasis on people relative to the second, applies to the preservation or enhancement of well-being for contemporary and forthcoming generations. The author concluded that a reasonable balance between these lenses is central to formulating a well-rounded understanding of social sustainability.

Hawke Research, led by the Stephen McKenzie Institute, has also defined social sustainability as a duality between a desirable state within human communities and a process through which this state is constructed (McKenzie, 2004). Hence, this notion is explained as a process and a condition, rather than a classical objective. The authors propose five key aspects to signify this desired condition: quality of life, diversity, equity, interconnection, and ultimately democracy and governance (McKenzie, 2004). There is not full consensus as to whether social sustainability should be defined independently or in terms of other contexts, particularly in relation to the environment. In this realm, E. Becker and Jahn (1999) have defined social sustainability as permanent relationships between society and nature that lead to society's viability.

Likewise, Littig and Griessler (2005) proposed that interactions and relations inside the society – work, connections, and experiences among communities – mediate social sustainability and involve the relationship between society and nature. Further, they generally referred to social sustainability as social quality. (Murphy, 2012) also notes that a well-presented view of the interdependency between the multiple aspects of sustainability is essential to understanding sustainable development. According to Littig and Griessler (2005), social sustainability can be obtained by fulfilling human needs and conserving natural recourses, where the work of society, community, as well as other institutional arrangements is crucial. They believe that career and the policy of society and institutions should cater to an extensive set of human necessities without infringing on the boundaries of environmental preservation, and should eventually lead to a state of dignified social justice and social engagement (Littig & Griessler, 2005). The long-term sustainability of communities and societies have been discussed by other scholars. The definition of social sustainability given by Biart (2002) highlights the importance of essential and minimal prerequisites for long-term sustainability of

societies and communities. He also claims that the challenges related to society's survival in the long-term should be identified in a clear way in order to ensure social sustainability.

Main Aspects of Social Sustainability

Some scholars have presented core aspects of social sustainability rather than a general and inclusive definition of the concept of social sustainability (Jaeger et al., 2011). It can be argued that basic needs and equity have been considered as the most important aspects of this concept. There is an opinion stating that income and property distribution should be taken as the most fundamental human needs, whereas the micro level of social sustainability includes education, training, social connections, participation and communication, safety, and social security (Spangenberg, 2004).

Other researchers view social sustainability as the product of two key elements (Colantonio et al., 2009). The first is basic needs that concentrate on human life and the physical aspects of human society such as food, housing, and health. The second relates to aspects concerned with social disparity and involves a wide variety of concepts such as equity, fair access to education and main services (McKenzie, 2004), and the redistribution of wealth within and across generations (Partridge, 2005).

Åhman (2013) identified equity as a core principle of social sustainability, and proposed that it has different applicable categories. Those include quality of life, diversity and integration, education, sense of place, social cohesion, and social capital.

According to (Sachs, 1999), social sustainability entails a state of social homogeneity, equitable incomes, and fair access to goods, employment, and services. Sachs also considers the basic values of democracy and equity as essential for defining the concept of social sustainability. He considered the assurance of all human rights including social, economic, cultural, civic, and political to be crucial for establishing a socially sustainable society (Sachs, 1999).

Furthermore, a conceptual framework that is based on four categories of social sustainability was developed by Murphy (2012): equity, social cohesion, participation, and public awareness. Cuthill (2010) identified another framework

which indicates that the main aspects of social sustainability are social infrastructure, social capital, social justice, equity, and eventually engaged governance.

A common aspect typically treated as central to the notion of social sustainability is quality of life. Although it can be difficult to describe "quality of life" given its subjective nature, the term provides an effective approach to focus on the qualitative (human) element of social sustainability. This fundamentally revolves around the improvement of the quality of the people's lives. The phrase "quality of life" is used by the UK Government as a synonym for sustainable development due to the belief that it can be more commonly accepted and recognized by the general community. It is essential to understand that achieving a certain level of quality of life for people nowadays should not be reached by sacrificing the well-being of future generations (Partridge, 2005). This term also refers to focusing on elevating the collective QoL of people in an equitable manner especially relative to marginalized groups – QoL should not be strictly achieved for upper-class demographics by way of wastefully focusing funds and resources on that social class. Quality of life is a primary principle in this context, but is not an isolated principle from other related principles like equity (Partridge, 2005).

Social inclusion and cohesion constitute another aspect typically deemed vital to realizing social sustainability. The idea of inclusion is closely linked to the idea of equity. Many scholars stress that the present social exclusion rate is one of the barriers to achieving social sustainability. Social exclusion is the manner in which poverty, inequality, and associated social issues work to isolate people, both socially from the advantages and resources of full social and economic inclusion and physically by means of unequal access to transportation, employment, or public services (Partridge, 2005).

Therefore, an integral aspect of socially sustainable strategies is a clear solution to social exclusion. Social sustainability is "the polar opposite of exclusion in terms [of] both territorial and social" aspects per Polèse et al. (2000). Moving for social sustainability includes focusing on how to achieve greater participation or inclusion in social, economic, and political life within disadvantaged communities and reflecting on ways to further incorporate or integrate these parties. This aim is close to the WACOSS model defined as the "promotion of interconnectedness within and outside the community at the formal, informal, and institutional level."

Another key aspect is the access to resources, services, and opportunities. Achieving a socially sustainable community requires an improvement in the amount of access to resources and facilities, services, and opportunities for those already facing social exclusion. This includes overcoming the multiple facets of inequality within the context of living conditions and residential settings, jobs and employment, resources, services and amenities, and inclusion within cultural, social, and political contexts. This requires special consideration to the classes of individuals who have previously been threatened in their access to services and opportunities (Partridge, 2005).

In addition to the aspects addressed above, another set of typically treated aspects in this context is the umbrella notion of satisfying basic human needs. To ensure that such needs are fulfilled, the primary set of human needs should be well-defined. One of the best ways to recognize these needs is to go through Maslow's hierarchy of human needs. Maslow stated in his theory that in order for humans to have the motivation to interact with their surroundings in a manner that satisfies higher level needs, their basic needs as defined in his hierarchy must be satisfied first (Maslow, 1943).

The primary model consists of five categories ordered by importance as levels navigated by human motivation:

- Level (1) – The physiological needs: essential needs for living (the need for air, food, water, sleep, sex, homeostasis, and excretion).
- Level (2) – The safety needs: the needs of feeling secure, which include security of body, finance, family, and freedom from fear.
- Level (3) – The love-belonging needs: the need for social connection such as family, friends, and intimate relationships.
- Level (4) – The esteem needs: the need for self-esteem, confidence, respect of others, achievement, importance, power, and recognition.
- Level (5) – The need for self-actualization: the need for development, self-fulfillment, achieving full potential, problem solving, acceptance of facts. This includes creative activities and realizing the possibilities of making accomplishments.

Maslow has taken personal variations and different externalities into consideration; he expanded his primary model into a wider comprehensive model to include three additional levels in his hierarchy (McLeod, 2007):

- Level (6) – The cognitive needs: the need for knowledge and understanding, learning, curiosity, meaning, predictability, and exploration.
- Level (7) – The aesthetic needs: the need to search for beauty, creativity, form, and balance.
- Level (8) – The need for self-transcendence: the need for helping others, spiritual experiences, and giving the best for humanity.

Other scholars have made some efforts to develop other systems to gauge social sustainability. Schwarz and Krabbendam (2013) established a set of four main qualities for socially sustainable designs: "(1) sharing; (2) reflecting social experiences; (3) connecting people and their living environment with nature; and (4) focusing on proportion and human scale" (Al-Jokhadar, 2018).

This research is focused on the social sustainability of interior architecture, and is not intended to address all socio-economic, civic, and political issues. It is therefore a constraint of this study that the researcher will not encapsulate all principles related to social sustainability. Instead, only aspects deemed to be related to interior design and architecture and most relevant to the overall purpose of the study will be addressed.

Social Sustainability in the Built Environment

Based on characterization of human need and several studies regarding human behavior and social sustainability, Amer Al-Jokhadar (2018) identified 13 social indicators that should be observed in the design process of built spaces in order to manage human needs and improve quality of life. These indicators are intertwined with spatial design and are intended to simplify the design process of buildings in addition to achieving the desired social qualities. The 13 social indicators are listed below:

- *Social Indicator (1): Density and Crowding*

It is important for designers to study common spaces such as gathering halls and patios, and the width of paths and hallways in buildings (Al-Kodmany, 2018).

This can help achieve less crowded spaces which are more comfortable for building users.

- *Social Indicator (2): Hierarchy of Spaces*

The hierarchy in transition between spaces from public zones into specific function areas and from major to minor spaces is necessary to take into consideration during the building design process. This is vital to obtaining the needed level of comfort for space users (Mitchel, 2010; B. B. Taylor & Gallery, 1985).

- *Social Indicator (3): Social Interaction and Area of Spaces*

Socializing among building users can enhance the sense of community belonging, sharing among individuals, and social support. This can be promoted by designing the gathering spaces with more attention and care to improve the quality of those spaces where users meet and talk and their children play. Furthermore, the area of these spaces should be appropriate compared to the number of users to achieve comfortable spaces for intended activities (Goethert, 2010).

- *Social Indicator (4): Thermal Comfort*

Thermal comfort can be obtained by controlling two main categories of factors; the first category is related to the humans themselves and the other is related to the environment. Human related factors primarily relate to the level of clothing and the level of activity. On the other hand, factors that are related to the environment are strongly linked to space architecture and design details. Such factors include air temperature, air velocity, relative humidity, and mean radiant temperature (Mohamed, 2010).

There are numerous design details that can be harnessed to control the thermal performance of buildings. For example, designers and architects can control thermal comfort inside buildings in hot arid regions by exploiting some planning details like the orientation of the building and the spaces, space proportions, and space dimensions. Moreover, creating satisfying solutions for internal and attached open spaces can be beneficial. Other approaches include selecting the appropriate building envelop materials and color, incorporating more green areas and extra vegetation, controlling the area of glazed facades, allowing daylight and natural ventilation into the enclosure by using building elements and natural ventilation devices. Such elements and devices include wind catchers, treated architectural openings, special roof constructions, and evaporative cooling devices like water features (Fincher & Boduch, 2009; UKEssays, 2018).

- *Social Indicator (5): Accessibility*

The ability to easily reach and access spaces inside the building is a major aspect of spatial design. Therefore, transitional spaces and circulation element design are rather important in terms of dimensions and area. Another important consideration is special treatments such as levels, ramps, handrails, and way finding systems elements. These aspects strongly affect the ease of accessibility and user movement inside buildings.

Accordingly, the order of the facilities and different functions in multi-floor buildings should be carefully arranged, and level differences should be avoided or carefully considered for elder people and children. On the other hand, building entrances should have different alternatives of circulation for users and should allow additional flexibility (Al-Jokhadar, 2018).

- *Social Indicator (6): Visual Privacy*

This indicator deals with protecting the building from direct views by properly arranging space zones and choosing the right angles and spots for openings. Other solutions like partitions, greenery, or screens can be quite useful to maintain visual privacy of buildings (Bianca, 2000; Zako, 2006).

In public spaces, this indicator is treated differently because it could take other forms than usual; visual privacy cannot be controlled in such spaces because users will be in sight of others all over the building. However, this kind of privacy can be translated to maintenance of the personal comfort zone that every individual should have while moving in public spaces.

- *Social Indicator (7): Acoustic Privacy*

Environmental noise or noise pollution can strongly affect the comfort of building users (UKEssays, 2018). This indicator deals with protecting interior spaces from noise. This can be fulfilled by studying the zone distribution in interiors and separating quiet zones from more active zones. Moreover, the spatial boundaries of interior space should be carefully treated to achieve this quality, so the designer should be aware of the use of special materials for walls, flooring, and ceilings. Likewise, window treatments such as windows with staggered openings or double windows serve an important function in this context. Sound reflections coming from outside the space can be also be reduced by designers and architects when their design outlines take the appropriate proportions of space height relative to other dimensions (Mortada, 2003; Şerefhanoğlu Sözen & Gedík, 2007; Sobh & Belk,

2011). Further, adequate wall thicknesses and the use of sound isolation materials and acoustic panels can have a major impact on acoustic quality, and additive elements such as balconies and terraces can be effective in noise reduction (Ragette, 2003).

- *Social Indicator (8): Olfactory Privacy*

Smells that are produced in sanitary facilities or in kitchens should be well controlled within the interior space because they can annoy users and ruin their comfort (Fincher & Boduch, 2009; Othman, Aird, & Buys, 2015). This can be controlled by assigning an appropriate orientation to openings and open spaces, or through the introduction of green, flowery areas.

- *Social Indicator (9): Spirituality*

In some cases; the orientation of the space could have a symbolic or specific spiritual meaning, such as prayer rooms, worship zones, or even yoga spaces. Ordinary rooms can also have a spiritual atmosphere. Some elements such as water features and greeneries may also add a lot to this atmosphere (Al-Jokhadar, 2018).

- *Social Indicator (10): Safety and Security*

The need for safe and secure spaces is a serious priority and a major matter for all users, adults and children alike. As such, balconies and terraces should have suitable fences and gates, and entrances should be secured (Al-Jokhadar, 2018). Outdoor treatments for open spaces should be employed, and the materials of wall cladding and flooring should be wisely chosen depending on space activity requirements.

- *Social Indicator (11): Views to Exterior*

Users of buildings typically connect with the exterior environment through the varied views that the spaces present by way of openings, glazed facades, or balconies and terraces in upper floors. This, of course, should not come at the expense of privacy, which is an important consideration in designing these features (Al-Jokhadar, 2018).

- *Social Indicator (12): Availability of Services*

Availability of service areas such as storage areas, suitable number of sanitary services in comparison with the area of the building, and secondary entrances can be considered as a major design requirement (Al-Jokhadar, 2018). Another consideration that typically leaves a positive impact on users is a building’s

location relative to easy access to different transportation modes and nearby essential services.

- *Social Indicator (13): Hygiene*

Hygienic atmosphere is a fundamental requirement within buildings. Sufficient natural ventilation and daylight in the inner spaces of buildings are essential needs for the good health of users and the reduction of sickness cases and dampness (Fincher & Boduch, 2009). Special solutions, such as separating service areas from other clean spaces entrances, halls, and open spaces using architectural elements such as gates, thresholds, or sunken areas could be useful in dust and dirt mitigation. Another potential solution to block undesired wind currents carrying sand and dust is the arrangement of open areas inside buildings. This issue could also be handled by the proper orientation of entrances and the use of special treatments such as architectural windbreaks.

A Summary of Typical Definitions for Social Sustainability

Based on the foregoing, the core principles of social sustainability have mostly been separated into macro and micro aspects. Macro level aspects treat physical well-being and basic human needs, such as accommodation, food, and clothes, while micro level aspects are concerned with concepts like equity and quality of life. Social sustainability can be defined as a state and process within a society in pursuit of basic human needs and values of social justice and inclusion, homogeneity and integration, diversity, sense of place, social amenity, and social security for current and future generations. Preservation of natural resources and environmental sustainability are of paramount importance to this notion. It is noted that prior definitions of social sustainability within the built environment have generally taken the form of specific indicators as opposed to abstract concepts.

Table 1

Definitions for Social Sustainability

Key Aspects in Defining Social Sustainability	Scholar(s)
Quality of life, diversity, equity, social security, interconnection, and ultimately democracy and government	McKenzie (2004)
Marco level: income and property distribution. Micro level: education, training, social connections, participation and communication, safety, and social security	Spangenberg (2004)
Social quality	Littig and Griessler (2005)
Human life and the physical aspects of society such as food, housing, health; Social disparity and equity.	Colantonio et al. (2009)
Social infrastructure, social capital, social justice,equity, and engaged governance.	Cuthill (2010)
Equity	Vallance et al. (2011)
Social and cultural life, social amenities, systems for citizen engagement, space for people and places to evolve	Woodcraft et al. (2011)
Equity, quality of life, diversity and integration, education, sense of place, social cohesion, social capital.	Åhman (2013)

Environmental Psychology – Another Perspective on Social Sustainability in the Built Environment

Research under disciplines like environmental psychology has considered the impact of environmental factors on space occupants for decades (Fleury-Bahi, Pol, & Navarro, 2017). The general approach behind this type of research is to study potential links between environmental attributes and the various aspects of human well-being, task performance, quality of life, etc. An example of environmental psychology research in the context of workplaces is that conducted by Bruce (2008), which suggests that workplace distractions can lead to a 40% reduction in occupant productivity and a 27% increase in employee errors. As stated previously, numerous definitions have been adopted for the concept of quality of life, one of which is the extent to which one's life experience features satisfaction relative to their necessities

and desires from a physical and psychological standpoint (Rice, 1984). Literature in this context seldom addresses the concept of social sustainability explicitly, but there exists a clear bridge between this subset of environmental psychology research and social sustainability – almost all published definitions of social sustainability rely explicitly or implicitly on the notion of quality of life to characterize sustainable arrangements, and the aforementioned type of environmental psychology research typically studies possibilities for enhancing this very metric. Therefore, an analysis of the pre-existing body of work on environmental psychology and quality of life is a natural approach to studying viable ways for achieving social sustainability in the built environment (see Figure 6).

Environmental psychologists have produced a wealth of literature on ways to measure the degree to which the physical environment satisfies user needs; numerous types and examples of misfits are documented within such literature. A misfit is defined as an environment that places inadequate or excessive demands on users despite their adaptation and adjustment behaviors. Environmental psychology literature effectively integrates the concept of environmental fit (Alexander, 1970; Herring, Szigeti, & Vischer, 1977; Preiser, 1983; Zeisel, 2006).

There are specific elements of the physical workspace that may be recognized as most influential to the degree of fit between an employee and their work environment. Ergonomics is a field of study that produces explanations in this context. Ergonomics researchers have taken assessment tools that were originally created for military and manufacturing contexts and applied them to office furniture and equipment to protect workers from long-term muscle or nerve harm caused by bad posture or use of muscles. From an ergonomic perspective, stress ‘is frequently discussed in terms of the relationship between levels of performance and concepts such as arousal, signal detection theory, and different environmental demands’ (Cooper & Dewe, 2008). The ergonomic approach considers equipment and tools as well as elements of the workplace environment as extensions of the human body. The ergonomic features most frequently studied in workplace settings include natural and artificial light, noise and noise control, office furniture, and spatial layouts in offices (Jacqueline Vischer, 2007). The following is a brief overview of those features.

Lighting research typically distinguishes between the effects of artificial and nature light on space users. Researchers studying natural light have found that the

size and proximity of windows, the view to outdoor surroundings, and the ability to control blinds and the degree of shielding from glare are all linked to increased human comfort and productivity (Hedge, 2000; Leather, Pyrgas, Beale, & Lawrence, 1998; Shauna Mallory-Hill, 2004). Furthermore, significant studies have revealed that the medical needs and recovery rates of hospital patient are affected by the amount of natural light and the views they have from their hospital rooms (Ulrich, 1991; Verderber & Reuman, 1987). Boyce, Veitch, Newsham, Myer, and Hunter (2003) reviewed the effects of various types and levels of artificial lighting on task performance and inhabitant satisfaction and concluded that current office workspace lighting standards are favored by most people performing typical office tasks in a simulated office workspace environment where employees used controls to adjust their lighting preferences. Study findings differed between visual comfort (lighting necessary to function successfully on office tasks) and satisfaction (lighting regarded to be aesthetically pleasing).

Recent research on office noise has adopted methods originally developed to measure the level of noise in industrial environments (e.g. factories). Noise is widely regarded as the most significant contributor to the discomfort and reduced productivity experienced by employees working in workspaces with open floor plans (Hedge, 1986; Oldham, 1988; Stokols & Scharf, 1990; Sundstrom, Herbert, & Brown, 1982). Research on acoustic comfort focused on linking physical metrics such as signal-to-noise ratios at various densities, background noise levels and intensities, and speech intelligibility in varied physical conditions with inhabitant perceptions of distraction and discomfort (Ayr, Cirillo, & Martellotta, 2001; Chu & Warnock, 2002; Mital, McGlothlin, & Faard, 1992). Increasing office density and levels of collaborative work in contemporary workplace environments have undercut efforts to manage office noise levels through more absorbent surfaces, sound-masking technology, and behavioral controls.

Many environmental psychology studies of workplaces were concerned with space planning and furniture layouts in open-plan offices. According to studies, these environmental elements have the biggest impact on employee satisfaction and performance (Michael Brill, 1984; Hatch, 1987; Sullivan, 1991; Jacqueline Vischer, 1989). In terms of furniture and spatial layout, studies have focused on factors like the height and density of workstation partitions, the amount and accessibility of file and item storage, and the dimensions of furniture and work surfaces, all of which

have been found to have a significant impact on employee satisfaction and team productivity. According to one research effort, an additional investment in ergonomic tables and chairs for employees is expected to result in a five-month payback period in terms of enhanced productivity (Miles, 2000). Numerous research efforts show that staff members are not comfortable with open-plan layouts and would rather have private, closed-off spaces (Brennan, Chugh, & Kline, 2002; Fried, Slowik, Ben-David, & Tiegs, 2001; S. W. Ornstein, 1999). Furthermore, spatial layout has a big impact on factors relating to psychological comfort like territoriality and privacy. The size and location of an office are linked to a worker's status. Partitioning affects both visual and acoustic privacy, and the amount of office storage is related to territoriality and status (Fischer, Tarquinio, & Vischer, 2004; McCusker, 2002; Jacqueline Vischer, 2005; JC Vischer, McCuaig, Nadeau, Melillo, & Castonguay-Vien, 2003).

The analysis conducted by McCoy and Evans (2005) on physical workspace related stress extends beyond ergonomics to classify as stressful conditions as those where physical environment features interfere with the achievement of work objectives. Workspace stressors have a negative impact on employee performance when they are intense or persistent; they slow down worker ability to process and understand the amount and predictability of signals, which are increased with the complexity of tasks. Space layout, architectural form details, ambient conditions and resources, and view or visual access from the workspace are examples of potential stressors (in other words, factors that interfere with task performance, motivation, and social interactions). Environmental stressors such as the aforementioned can have a negative impact on physiological processes, reduce motivation and performance, and prevent social interaction.

Space-related issues include layout degree of openness, the ratio of open workstations to private, closed office spaces, partition height, distance between the open workstations, and access to necessary resources like technology and equipment, meeting rooms, and restrooms. Ambient conditions which include sound, visual openness, light, ventilation, and thermal comfort are strongly linked to spatial organization.

Architectural elements such as colors and decorations, signage, artwork, and interior design features all have meaning and can have symbolic significance that has an emotional influence on individuals. Some workspace environments, for instance,

promote personalized and individual decoration, others provide prominent landmark features that help individuals or groups define their territory, while some feature symbolic status such as proximity to windows (positive) or restrooms (negative). Architectural elements may influence "emotion focused" coping behavior in conditions of workplace stress.

By definition, stress is caused when there is a misfit between the demands placed on employees and their control on the physical environment where they meet these demands. McCoy and Evans (2005) highlight the role of the temporal dimension: "an environmental element that is temporarily annoying cannot be identified as a stressor in the same way as that same annoying element's effect over time, when it becomes a daily hassle". The long-term influence of negative environmental elements may also result in a delayed reaction, affecting performance after the stressor is eliminated.

Until recently, environmental psychology research in the workplace environment concentrated on assessing worker satisfaction (both job and environmental satisfaction). This method, based on stimulus–response logic, considers user satisfaction as a measured behavioral response to aspects of the physical environment. However, this approach does not control much of the personal and experiential effects and prejudices that affect worker perceptions of the quality of their workplace (Jacqueline Vischer, 2007, 2008b). The universal and inaccurate concept of satisfaction does not account for the complexity of the transactional nature of the relationship between people and environment. Recent studies on environmental comfort explain the concept of fit between worker and workplace, providing a more solid theoretical base for workplace stress research.

Figure 6

Literature model. – Adapted from and expanded upon Jacqueline Vischer and Wifi (2017) (by the researcher).

Workplace Environmental Quality (EQ) or (IEQ)

Environmental quality (EQ) is a generic term used to assess how users feel about the physical spaces they inhabit (Khattab, 1993; Pearce, 2018; Rapoport, 1990). It can also be defined as “the combination of environmental elements that interact with users of the environment to enable that environment to be the best possible one for the activities that go on in it” (Jacqueline Vischer, 1989). Environmental quality (EQ) has frequently been used in studies on employee necessities in workplace environments (Elzeyadi, 2001; Heinzerling, Schiavon, Webster, & Arens, 2013). EQ is a key aspect of quality of work life (QWL) and a major factor in determining the quality of life (QoL) of employees (Jacqueline Vischer & Wifi, 2017). Indoor environmental quality (IEQ) – a sub category of (EQ) – is a key factor in promoting social sustainability by addressing the impact of interior space physical characteristics on user experience (Wong, Mui, & Tsang, 2018). The term "indoor environmental quality" (IEQ) describes a variety of elements that have an impact on the way individuals utilize and engage with space. This frequently includes four categories: acoustics, air quality, lighting, and thermal comfort (Jung & El Samanoudy, 2023; T. S. Larsen et al., 2020; Mujan, Anđelković, Munćan, Kljajić, & Ružić, 2019; Wong, Mui, & Hui, 2008). The debate of quality of work life (QWL) has witnessed growth as a result of its influence on the broader concept of quality of life (QoL) (Jacqueline Vischer & Wifi, 2017).

Functional Comfort and Environmental Quality (EQ)

Defining environmental quality in terms of the functional comfort ratings that inhabitants assign to their experience in the workplace provides valuable insight on employee QWL and, consequently, their QoL. The notion of comfort includes a diverse range of indoor environments, such as residential buildings, office workplaces, healthcare facilities, educational institutions, industrial facilities, and commercial buildings. The human tendency towards seeking comfort in everyday life is a well-established phenomenon, with individuals spending a significant proportion of their time, approximately 85-90%, within interior spaces. A building's level of comfort is a key factor for identifying its modern characteristics (Ganesh, Sinha, Verma, & Dewangan, 2021). Functional comfort is one indicator of environmental quality (Jacqueline Vischer, 2007), showing that people who are able to perform their tasks efficiently and successfully, with no stress and with a feeling of the

environment's support, inhabit an environment of good quality and find it to be comfortable (Jacqueline Vischer & Wifi, 2017).

The self-perceived ratings assigned by employees in a given space are a function of their use of the surrounding spatial attributes along with the depth and detailing of their knowledge of their tasks' requirements and their work, while their experiences of comfort are filtered through internal mental interactions, expectations, past experiences, acquired behaviors, emotions, and personality traits (Jacqueline Vischer, 2007, 2008b; Jacqueline Vischer & Wifi, 2017).

Figure 7

The workspace comfort pyramid. – Source: (the researcher) adopted from Jacqueline Vischer (2005).

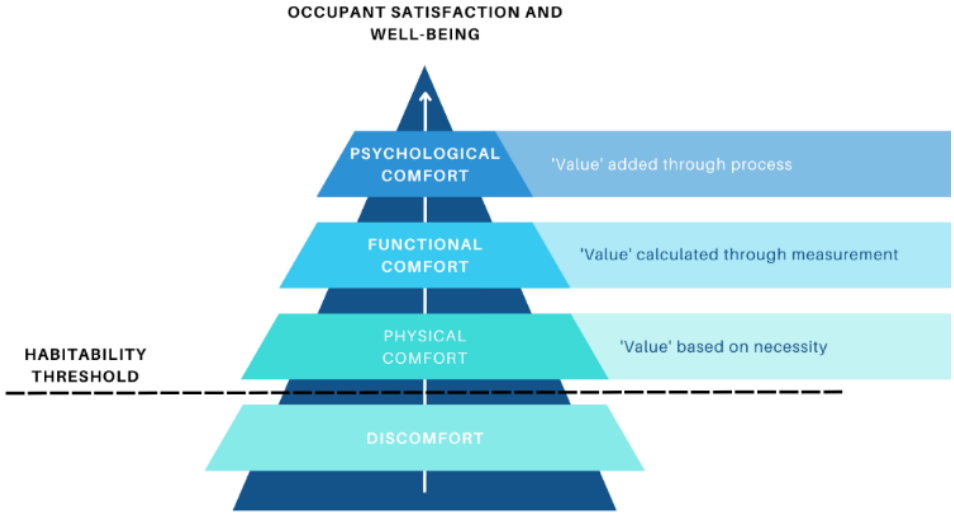


Figure 7, adopted from Jacqueline Vischer and Wifi (2017), presents physical comfort as the base of inhabitant experience in workplaces, and demonstrates how this aspect sets the minimum necessary requirements and standards for basic habitability. People feel that their well-being and health may be at risk if their physical comfort is compromised, and in some situations such as when indoor air quality features issues like contamination they will be unable or unwilling to perform their work tasks. Contemporary office buildings typically meet physical comfort criteria except in the case of emergencies. Nonetheless, achieving the basic level of health and safety requirements mandated by building regulations and the minimum level of physical comfort needed does not necessarily guarantee a context

that caters to the diverse functional needs of workplace users (De Jonge & Schaufeli, 1998; Jacqueline Vischer, 2007, 2008b; Jacqueline Vischer & Wifi, 2017).

Figure 7 also highlights the fact that spaces with a sufficient level of functional comfort facilitate the performance of users without having to expend additional effort and experience stress to overcome space constraints (Cartwright & Cooper, 1997; Jacqueline Vischer, 2008a). All spaces can be characterized in accordance with their level of functional comfort. The level of task support is measured through systematic data gathered from space users (Lamb & Kwok, 2016; Jacqueline Vischer & Wifi, 2017). Numerous studies on functional comfort have showed that only a restricted set of spatial attributes have a direct influence on task performance.

According to Jacqueline Vischer and Wifi (2017), those dimensions include:
– Thermal comfort, ventilation, and indoor air quality (Mujan et al., 2019)
– Lighting and illumination of the environment (Sun, Lian, & Lan, 2019)
– Windows and daylighting (Li & Tsang, 2008)
– Acoustic comfort and noise management (Roskams, Haynes, Lee, & Park, 2019)
– Access to privacy for concentration and confidentiality (Y. S. Lee, 2010)
– Workstation dimensions, storage, enclosure, and layouts (Nag, 2019)
– Access to collaborative and shared spaces (Orel & Alonso Almeida, 2019)
– Cleaning and maintenance (Sediso & Lee, 2016)
– Safety and security (Elyna Myeda, Nizam Kamaruzzaman, & Pitt, 2011).

Various methods exist for assessing each dimension. For instance, a variety of lighting types are available to be used for workspaces, the majority of which function more than sufficiently in modern interior spaces. However, the level of lighting adequacy is a function of the exact task at hand. Extended computer work sessions necessitate a context with relatively dim lights and limited background lighting, yet tasks like choosing colors and materials, judging visual displays, and performing graphic design work all need direct and color-sensitive lighting units. Employees, who are experts in their job tasks, can determine whether the level of lighting they have supports their work or not. Consequently they can provide insight on the EQ and functional comfort level of their workplace setting (Jacqueline Vischer & Wifi, 2017).

Although the precise nature and degree of functional comfort dimensions display a level of variance between businesses and work types, functional comfort is

also influenced by the sufficiency and convenience of building support spaces like cafeterias, elevators, and restrooms. Staff feel overstrained and uncomfortable and may find it difficult to communicate when these and other essential environmental supports are inadequate or lacking. They take longer to finish their work and are more likely to make mistakes under those circumstances, which has a negative impact on their quality of life. Continual functional discomfort is an indicator of low QWL and is linked to increased stress levels (Jacqueline Vischer, 2007).

Psychological comfort occupies the top of the comfort pyramid in Figure 7. The judgment of Office employees in relation to ambient conditions including illumination and thermal comfort reflect a psychological dimension just like all concepts of quality, including EQ. For instance, if it is too warm inside the space, people begin to doubt the indoor air quality and develop concerns about air pollution. Although inhabitants may not always necessarily need natural light, they have strong feelings about windows. Some people may find noise level in the background to be disturbing, while others do not. Rapoport's aforementioned symbolic meanings also have an influence on psychological comfort. From a behavioral point of view, territoriality, privacy, and control are the three factors that determine psychological comfort and which can be measured. A sense of territory is a feeling of belonging and ownership. Privacy is best described as the urge to autonomously regulate how accessible you are to others. There are at two or more environmental control interfaces: mechanical control offers users autonomy over ambient conditions (e.g. thermal conditions), whereas empowerment control reflects the degree to which users who inhabit and use office workspace are involved in making decisions (Jacqueline Vischer & Wifi, 2017). Employees must feel in control of interferences and the multiple directions to which their attention may be subconsciously attracted. Aspects like the nature and trends of interaction and social contact among colleagues are often more determinantal than tangible spatial attributes in this context. When technology makes it possible for people to work from different places, territorial appropriation is not restricted to the confines of the spatial context. Instead, employees find other ways to take ownership of their territory.

It is noted that an important distinction must be made between the physical and the perceived characteristics of interior spaces (Rapoport, 1977). Physical characteristics are assessed by way of measuring tangible data such as temperature, humidity, and luminosity conditions. Perceived conditions, on the other hand, can

only be measured through social and behavioral tools including interviews, surveys, and questionnaires. While generally elusive to collect and analyze, the impact of environmental quality on user quality of life is heavily based on user perception of these characteristics as opposed to being directly related to physical ambient condition measurements. Vischer and Wifi, among others, stress the fact that properly collected user perception data is fundamental to measuring functional comfort (which can in turn be used to characterize wider notions like environmental quality, quality of work life, and quality of life), and should not be dismissed as subjective.

Quality of Work Life (QWL)

Quality of work life is the contribution of the work environment towards the overall level of a given employee's QoL – this transcends the mere notion of satisfaction and happiness (Varghese & Jayan, 2013). The quality of work life (QWL) concept relies on the idea that satisfying various levels of employee needs (like survival, social, ego, and self-actualization) is correlated with the organizational resources and capacities mobilized to satisfy those needs (Efraty & Sirgy, 1990). The degree to which a person is succeeding in achieving his or her job goals determines the quality of their work life. Professional individual goals are arranged in a hierarchy, and the closer individuals come to accomplishing those goals, the higher their quality of life. This has positive effects on the performance of the company and society as a whole (Ishfaq, Al-Hajieh, & Alharthi, 2022; Martel & Dupuis, 2006). Varghese and Jayan (2013) have also described quality of work life as "a multidimensional construct, which includes: job security, better reward system, higher pay, opportunity for growth, participative groups, and increased organizational productivity". The quality of work life concept emphasizes how workplace users assess their current context relative to their objectives and their perceived capabilities to achieve their goals; this places the workplace environment at the center of attention (Leitão, Pereira, & Gonçalves, 2019; Nayak & Sahoo, 2015). Improvement in the quality of work life (QWL) is related to four kinds of activities according to Nadler and Lawler (1983): "Participative problem solving, Work restructuring, Innovative reward systems, Improving the Work Environment". Although the other activities retain spatial qualities and would subsequently be impacted by the work environment, this research effort places its primary focus on

the last of those activities. Since the late 1970s, researchers have separately studied QWL as a subcategory of QoL research (Davis & Cherns, 1975; Gallie, 2003; Hackman & Suttle, 1977; Lawler, 1975; Levine, Taylor, & Davis, 1984; R. Walton, 1973, 1980). Researchers that study quality of life agree that improving QWL may lead to a higher sense of self-perceived QoL (Elizur & Shye, 1990). Studies from all across the world show that QWL has an important effect on overall QoL (e.g. Narehan, Hairunnisa, Norfadzillah, & Freziamella, 2014; Nguyen & Nguyen, 2012; Sirgy, Reilly, Wu, & Efraty, 2008). A person's QWL is influenced, like QoL, by the extent to which their work life objectives, ambitions, expectations, and requirements are met. The quality of work life (QWL) concept arose from the necessity to reduce the negative impacts of work on workers, the goal of improving worker wellbeing and health, and the need to enhance the quality of the workplace environment through modifying work conditions and space design.

QWL is a dynamic, multi-dimensional concept that focuses on the wellbeing of employees. While addressing employee emotional needs to enhance the feeling of satisfaction with their work experience, QWL is also concerned with the productivity of the workforce. Nonetheless, job satisfaction and quality of work life (QWL) are not one and the same (Nadler & Lawler, 1983). Quality of work life (QWL) is essential to the operational efficiency and success of employees. When implementing a work enhancement plan, QWL is used for boosting motivation and includes factors like employee safety and security, ease of work, satisfaction, worker dependency, and room for development (Azadehdel & Chooran, 2015; Kulkarni, 2013). Quality of work life hinges on the belief that the company’s staff and talent pool represent its most valuable asset, and therefore must be treated respectfully and with dignity (Narehan et al., 2014; Straw & Heckscher, 1983). QWL combines job-related criteria, including work satisfaction, income, and connections with coworkers with intangibles like satisfaction with life and sense of wellbeing (Danna & Griffin, 1999). Health and safety, growth and security, self-development, social assimilation, life space, social relevance, fair compensation, and constitutionalism are the eight elements that have an impact on employee quality of work life (R. Walton, 1973, 1980; R. E. Walton, 1985). Within the workplace, a model of needs includes job requirements, the workspace environment, the way supervisors behave, organizational commitment, and ancillary programs. Workplace requirements can be obtained through activities, resources, and outcomes arising from employee

engagement (Sirgy, Efraty, Siegel, & Lee, 2001). Later research considers the physical workspace as a factor that influence productivity, job satisfaction, and the quality of work life (Candido et al., 2019; Cummings & Worley, 2005; Jacqueline Vischer & Wifi, 2017).

Workplace spatial needs are highlighted through concepts like the functional comfort pyramid of (Jacqueline Vischer, 1989, 2005, 2012) and Preiser's habitability framework (Preiser, 1983). These constructs can be used to rank the different qualities of a workspace. Later in this chapter, functional comfort is addressed; it is based on the habitability framework, which links the built environment with space users and inhabitant needs within the workspace. According to Preiser's definition of habitability, it is the level to which a naturally-occurring or a man-constructed environment that meets human and environmental soundness criteria is suitable for a person or a collection of people. This definition may be interpreted differently depending on the culture considered (Preiser, 1983). In order for a workplace to be considered habitable, it must satisfy three types of space user needs: health and safety, functional and task performance, and psychological comfort. Enhancing habitability by improving the match between the worker and the workplace environment results in a higher quality workspace and an improvement in quality of work life (QWL) (Su & Zabilski, 2022; Zheng, 2022). Because quality of work life (QWL) is considered a critical aspect in a company's level of sustainability and viability, finding strategies to improve worker QWL is an investment in both the individual employees and the company's feasibility (Sheel, Sindhwani, Goel, & Pathak, 2012). task type, physical conditions like space design, used materials and technologies, and social and economic considerations like administrative policy and work-life balance have all been found to have an influence on individual QWL (Cunningham & Eberle, 1990; Elizur & Shye, 1990).

A low QWL is frequently linked to higher workplace stress. North American employees work indoors for more than half of their work time, so lowering the level of stress induced by work is a priority by all parties involved at the execution, management, design, research, and clinical practice levels (Bagnara, Mariani, & Parlangeli, 2001). The phrase "workplace stress" was invented to describe tension and stress accrued due to functionally uncomfortable and inconvenient workplaces (Jacqueline Vischer, 2007). High workplace stress is linked to sleep issues, anxiety, depression, low levels of work life satisfaction, diminished loyalty to organizations,

poor performance, and absence (Cartwright & Cooper, 1997; Csikszentmihalyi, 2014; Jong-Min Woo & Teodor T Postolache, 2008; McCoy & Evans, 2005; Nadler & Lawler, 1983; Nag, 2019; Jacqueline Vischer, 2007; R. Walton, 1980). According to research, giving workers more environmental control can minimize workplace stress (Caplan, 1983; Csikszentmihalyi, 2014; Karasek, 1990; Nadler & Lawler, 1983; R. Walton, 1980). Environmental control can be managed in mechanical and instrumental ways including light switches and dimmers, furniture design adjustments, and thermostats, or it can be handled through social and psychological techniques such as giving employees access to information regarding office environment decisions and engaging them in the workspace design and planning process. Giving space users more environmental control is referred to as environmental empowerment, and it has an influence on employee' well-being (Meyerson & Kline, 2008; Jacqueline Vischer, 2005, 2007; Jacqueline Vischer & Malkoski, 2015).

The literature strongly suggests that workspace users expend effort and time to adjust to poorly planned and designed workspaces; thisreduces the effort and time they spend to work on their tasks (Jacqueline Vischer, 2008a, 2008b). Aside from the negative impacts of absenteeism caused by ailments such as respiratory diseases, eye fatigue, and spine and neck problems, the challenge of working in an uncomfortable setting has behavioral effects. Those include low employee spirits, less drive, higher rates of quitting, and poor performance. All of these factors have an impact on company productivity (Al-Omari & Okasheh, 2017; Haynes, Suckley, & Nunnington, 2017; Heerwagen, Kampschroer, Powell, & Loftness, 2004; Heinzerling et al., 2013; Sundstrom, Town, Rice, Osborn, & Brill, 1994; Jacqueline Vischer, 1989, 2008b; JC Vischer et al., 2003).

In contrast, many studies have shown that workplaces where environmental factors like luminance levels, thermal conditions, noise level, fixtures and furnishings, visual quality, and architectural attributes are appropriately tuned according to the tasks at hand have positive impacts on employee work morale and productivity (M. Brill, Weidemann, & Associates, 2001; Fischer et al., 2004; William J. Fisk, 2000; McCoy & Evans, 2005; Monk, 1997). Research has found that the level of ventilation, overall illumination and the amount of natural lighting, and acoustic characteristics are strongly connected to employee satisfaction and productivity (F. D. Becker, 1981; Humphreys, 2005; J. Veitch, Charles, Newsham,

Marquardt, & Geerts, 2004). Furthermore, employee attitudes and behaviors are also influenced by factors such as indoor air quality, lighting, thermal conditions, and visual access to the outdoors in the workplace (L. Larsen, Adams, Deal, Kweon, & Tyler, 1998; J. A. Veitch & Gifford, 1996). Indoor plants and views of the outdoors are examples of natural elements that reduce mental strain and provide restorative value (Caplan, 1983; Chang & Chen, 2005; Haber, 1975; Kaplan, 1993).

Environmental factors can also influence well-being and emotional health. For instance, people are happier and more motivated at work when there is natural light (Hameed & Amjad, 2009; Heschong, Wright, & Okura, 2013). Employee health is also related to improved lighting and thermal conditions, indoor air quality, and ergonomic furnishings (Dilani, 2004; Milton, Glencross, & Walters, 2000; J. A. Veitch & Newsham, 2000). Estimates suggest that somewhere between 16 to 37 million cold and flu cases can be prevented annually by improving environmental quality within the interior of American office buildings (William J Fisk et al., 2002; Milton et al., 2000).

The layout of the space and the furniture it contains also influence the quality of work life (QWL) of space users (Afroz & Haque, 2021). There have been a lot of studies and publications in popular journals about the typically negative effects of "open-plan" layouts (Haynes et al., 2017; Konnikova, 2014; Rashid & Zimring, 2008). Scott Adams mocked cubicles within the set of comics "Dilbert" in the 1990s (Adams, 2000). That said, most such critics have made little effort to define exactly what is meant by the term "open plan", which originally appeared in the 1940s to describe broadly distributed workplace configurations which are partitioned by vegetation, high furnishings, and, afterwards, dedicated movable barriers. According to the company values and culture, the industry within which the company functions, and other factors, contemporary workplace interior design comes with variable degrees of openness. The private individual office is quickly losing prominence as management and staff embrace flexibility and modularity to promote teamwork and collaboration. The open-plan layout can be necessary from a design perspective to facilitate adjustments within the modern office setting. Office design trends, including the incorporation of modular, flexible furnishings, aim to increase the level of design adaptability to accommodate continuous currents of change (Tarricone & Luca, 2002).

Some fundamental quality of work life (QWL) values such as equal space distribution, communication, and collaboration opportunities are supported by the open-plan workspace (Samani & Rasid, 2014). According to research, an open workspace environment promotes mutual support behaviors, as well as collaboration and engagement among colleagues (Monaghan & Ayoko, 2019). Quick and dependable communication is essential in modern-day office workplace environments, and task performance accuracy and speed have a direct influence on productivity (Quinlan & Mayhew, 2000). Nonetheless, crowded open-plan designs cause noise distractions, and inadequate sound and visual privacy can negatively influence task performance (Chu & Warnock, 2002; Evans & Johnson, 2000; Sundstrom, Burt, & Kamp, 1980; Sundstrom et al., 1982). In terms of work performance, user perceptions of quality in green or sustainable buildings are not fundamentally different from user perceptions within conventional buildings (Abbaszadeh, Zagreus, Lehrer, & Huizenga, 2006; Baird & Field, 2013; I. H. Lee & Kim, 2009; Paul & Taylor, 2008). Employees in green or sustainable buildings tend to be more satisfied with their working conditions in terms of air quality, temperature conditions, and overall satisfaction. However, the variations within the ratings of sustainable and conventional buildings in terms of spatial layout, acoustics, and light are limited. In general, green-certified and green-intent buildings are evaluated more positively by their users than conventional buildings. However, the differences are not always obvious when comparing particular conditions. Green-building user ratings may be biased by the expectation that such designs are anticipated to result in improvements across multiple facets (Leaman & Bordass, 2007).

Quality of Life (QoL)

Though the notion of QoL seems to be subjective and difficult to characterize, it can provide a valuable vessel for qualitatively assessing the "human" aspect of social sustainability – this notion is mainly concerned with improving the quality of individual' lives (Perlaviciute & Steg, 2018). Quality of life (QoL) has played a significant role in social sustainability discussions (Koning, 2001). The UK government uses the term “quality of life” as a synonym for "sustainable development" since they feel the former term can be more easily understood by the general public. Quality of life (QoL) is often addressed either independently or as a key aspect of the notion of sustainable development. The importance of QoL in

promoting sustainable development has led to an increase in the number of research efforts addressing this construct (Lan Yuan, 2001). QoL can be efficiently adopted as an important indicator of social sustainability at the micro-level (individual perspective of social sustainability) (UK, 2005; van Zeijl-Rozema, Cörvers, Kemp, & Martens, 2008). As mentioned previously, QoL is also based on the premise that future generations should not have to pay the price for short-term QoL enhancements(Detr, 2000). The term must also emphasize improvements that are possible to make to the lives of disadvantaged groups in particular– QoL should not be strictly achieved for upper-class demographics by way of wastefully focusing funds and resources on that social class (Partridge, 2005).

QoL is directly influenced by QWL, which is impacted by workplace setting. As stated previously, one definition for the notion of QoL is the extent to which one's life experience features satisfaction relative to their necessities and desires from a physical and psychological standpoint (Rice, 1984). QoL is defined by the WHO as one's reflection on their standing relative to their communal setting, value system, objectives, expectations, demands, standards, and worries.(WHO, 1995). The concept of QoL is discussed in relation to office workplace environments within this study.

According to research, the predictors and results of quality of life elicit some form of a compounding effect: when QoL is elevated, one's level of satisfaction and positive emotion rises, which makes it more likely for the individual to perceive their life in a more positive light (Meeberg, 1993). Ideologically, QoL's significance comes from promoting support for individuals to live in optimal ways within their environments. The way that each person evaluates their quality of life depends on their perceptions, needs, personal nuances, preferences, culture, and expectations (Schalock, Keith, Hoffman, & Karan, 1989).

Considering its eclectic nature, a number of demographic and sociocultural aspects impact the notion of QoL (Rice, McFarlin, Hunt, & Near, 1985). Each aspect of one's life can be evaluated independently; aspects such as occupation, social status, community interrelations, and personal attributes impact QoL. Perceived QoL is the consequence of the accumulation of numerous life experiences; the distribution of QoL for different individuals is determined by the extent to which their needs and requirements are fulfilled in each aspect (Nguyen & Nguyen, 2012; Rice, 1984; Jacqueline Vischer & Wifi, 2017).

One dimension of human life is the built enclosures that individuals inhabit along with the combination of interior spaces and the outside contexts where they reside, produce, and interact. In western countries, it is believed that individuals spend around 90% of the time inside building enclosures. In that sense, buildings have the power to cast significant biological and psychological effects on the health and well-being of their users (Day, 2002). Environmental psychology researchers have expended significant effort over tens of years studying the impact of numerous forms of built and natural environments on inhabitant health, comfort, safety, attachments, behavior, and attitudes.

A robust knowledge of human needs is necessary to formulate an understanding of the wider concept of QoL. Numerous environmental psychology studies discuss how the physical environment meets or fails to satisfy people's needs. Starting with Maslow's hierarchy (Schalock et al., 1989; Ventegodt, Merrick, & Andersen, 2003), human needs have been categorized in a variety of ways. The categories in this hierarchy are arranged in the shape of a pyramid, starting from basic survival needs at the base and progressing to needs that are important but still essential (less basic needs). The aforementioned categories include physiological needs, safety, esteem, love, and self-actualization. The higher a person's QoL is, the more their needs are satisfied. Needs also encapsulate the effect of surroundings and ambient conditions, and the degree to which these elements impact behavioral trends. Within this framework, building enclosures that cater to user needs are viewed to be more efficient and successful.

The following Table 2 summarizes the literature review, definitions, significance, and factors of influence relevant to EQ, functional comfort, QWL, and QoL.

Table 2

The summary of the main subjects of literature review, definition, significance, and influential factors.

Main Subject	Aspect	Key Sentence	Scholar(s)
Environmental quality (EQ)	**Definitions**	A generic term used to assess how users feel about the physical spaces they inhabit	(Khattab, 1993; Pearce, 2018; Rapoport, 1990)
		The combination of environmental elements that interact with users	(Jacqueline Vischer, 1989)
		The term has frequently been used in studies on user needs in workplace environments	(Elzeyadi, 2001; Heinzerling et al., 2013)
	Significance	EQ is a key aspect of quality of work life (QWL) and a major factor in determining the quality of life (QoL) of employees	(Jacqueline Vischer & Wifi, 2017)
		It is a key factor in promoting social sustainability by addressing the impact of interior space physical characteristics on user experience	(Wong et al., 2018)
	Influential factors	-Acoustics -Air quality -Lighting -Thermal comfort	(Jung & El Samanoudy, 2023; T. S. Larsen et al., 2020; Mujan et al., 2019; Wong et al., 2008)
Functional comfort	**Definition**	It is an indicator of environmental quality	(Jacqueline Vischer, 2007)
	Significance	A building's level of comfort is a key factor for identifying its modern characteristics	(Ganesh et al., 2021)
		An environment that has functional comfort is where people are able to perform their task efficiently and successfully, with no stress and with a feeling of the environment's support and a sense of comfort	(Jacqueline Vischer & Wifi, 2017)
		The worker's experiences of comfort are filtered through cognitive processes, expectations, past experiences, learned behaviors, emotions, and personality traits	(Jacqueline Vischer, 2007, 2008b; Jacqueline Vischer & Wifi, 2017)
		The level of task support can be measured through systematic data gathered from space users.	(Lamb & Kwok, 2016; Jacqueline Vischer & Wifi, 2017)
	Influential factors	Thermal comfort, ventilation, and indoor air quality	(Mujan et al., 2019)
		Lighting and illumination of the environment	(Sun et al., 2019)
		Windows and daylighting	(Li & Tsang, 2008)
		Acoustic comfort and noise management	(Roskams et al., 2019)
		Access to privacy for concentration and confidentiality	(Y. S. Lee, 2010)

		Workstation dimensions, storage, enclosure, and layouts	(Nag, 2019)
		Access to collaborative and shared spaces	(Orel & Alonso Almeida, 2019)
		Cleaning and maintenance	(Sediso & Lee, 2016)
		Safety and security	(Elyna Myeda et al., 2011)
Quality of Work Life (QWL)	**Definitions**	Satisfying various levels of employee needs is correlated with the organizational resources and capacities mobilized to satisfy those needs	(Efraty & Sirgy, 1990)
		The degree to which a person is succeeding in achieving his or her job goals	(Ishfaq et al., 2022; Martel & Dupuis, 2006)
		"a multidimensional construct, which includes: job security, better reward system, higher pay, opportunity for growth, participative groups, and increased organizational productivity."	(Varghese & Jayan, 2013)
		Employee evaluation of their work environment in relation to their objectives and their perceived capability to achieve their goals	(Leitão et al., 2019; Nayak & Sahoo, 2015)
		QWL improvement is related to four kinds of activities: "Participative problem solving, Work restructuring, Innovative rewards systems, Improving the work environment."	(Nadler & Lawler, 1983)
		QWL is a subcategory of QoL	(Davis & Cherns, 1975; Gallie, 2003; Hackman & Suttle, 1977; Lawler, 1975; Levine et al., 1984; R. Walton, 1973, 1980)
		QWL is a dynamic, multi-dimensional concept that focuses on the well-being of employees. While addressing employee emotional needs to enhance their feeling of satisfaction with the work experience, QWL is also concerned with the productivity of the workforce.	(Nadler & Lawler, 1983)
		QWL is linked to boosting motivation and includes factors like employee safety and security, ease of work, satisfaction, worker dependency, and room for development	(Azadehdel & Chooran, 2015; Kulkarni, 2013)
		QWL is based on the belief that employees are the most significant and valuable resource in the company and must be treated respectfully and with dignity	(Narehan et al., 2014; Straw & Heckscher, 1983)
		Quality of work life (QWL) considers the physical workspace	(Candido et al., 2019; Cummings & Worley, 2005; Jacqueline Vischer & Wifi, 2017)

		to be a factor that influences productivity and job satisfaction	
		Vischer's functional comfort pyramid and Preiser's habitability framework can be used to rank the different qualities of a workspace	(Jacqueline Vischer, 1989, 2005, 2012) (Preiser, 1983)
	Significance	QWL is considered to be a critical aspect in a company's sustainability and viability. Therefore, finding strategies to improve worker QWL is an investment in both individual employees and the company's feasibility	(Sheel et al., 2012)
	Influential factors	A habitable workplace must satisfy three areas of space user' needs: health and safety, functional and task performance, and psychological comfort. Enhancing habitability by improving the match between the worker and the workplace environment results in a higher quality workspace and an improvement in quality of work life (QWL)	(Su & Zabilski, 2022; Zheng, 2022)
		Health and safety, growth and security, self-development, social integration, life space, social relevance, fair compensation, and constitutionalism are the eight elements that have an impact on employee QWL	(R. Walton, 1973, 1980; R. E. Walton, 1985)
		The job task, physical conditions such as space design, used materials, and technologies, and social and economic aspects such as administrative policy and work-life balance all influence QWL	(Cunningham & Eberle, 1990; Elizur & Shye, 1990)
		Workplace stress is linked to negative health and behavioral outcomes, while environmental control can reduce stress levels. Environmental control can be achieved mechanically or instrumentally, and socially or psychologically	(Cartwright & Cooper, 1997; Csikszentmihalyi, 2014; Jong-Min Woo & Teodor T Postolache, 2008; McCoy & Evans, 2005; Nadler & Lawler, 1983; Nag, 2019; Jacqueline Vischer, 2007; R. Walton, 1980)
		Giving space users more environmental control is referred to as environmental empowerment, and it has an influence on employee' well-being	(Meyerson & Kline, 2008; Jacqueline Vischer, 2005, 2007; Jacqueline Vischer & Malkoski, 2015)
		Employee productivity and job satisfaction can be negatively impacted by poorly planned and designed workplaces	(Jacqueline Vischer, 2008a, 2008b)
		Unsupportive or uncomfortable physical environments have behavioral affects. Those include	(Al-Omari & Okasheh, 2017; Haynes et al., 2017; Heerwagen et al., 2004; Heinzerling et al.,

		low employee morale, less motivation, staff turnover, and poor work performance. All of these factors have an impact on overall company productivity	2013; Sundstrom et al., 1994; Jacqueline Vischer, 1989, 2008b; JC Vischer et al., 2003)
		Indoor plants and views of the outdoors are examples of natural elements that reduce mental strain and provide restorative value	(Caplan, 1983; Chang & Chen, 2005; Haber, 1975; Kaplan, 1993)
		The layout of the space and furniture also influence quality of work life (QWL)	(Afroz & Haque, 2021)
		In terms of user satisfaction and work performance, green or sustainable buildings have different quality criteria than conventional buildings, with users in green buildings rating air quality, thermal comfort, and overall satisfaction higher than those in conventional buildings	(Abbaszadeh et al., 2006; Baird & Field, 2013; I. H. Lee & Kim, 2009; Paul & Taylor, 2008) (Leaman & Bordass, 2007)
Quality of life (QoL)	**Definitions**	Though the term "quality of life" is difficult to define and necessarily subjective, it can provide a valuable means of concentrating on the qualitative "human" aspect of social sustainability. This concept is mainly concerned with improving the quality of individual lives	(Perlaviciute & Steg, 2018)
		WHO defines QoL as the "individual's perception of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations, standards, and concerns"	(WHO, 1995)
		Maslow's theory of human needs remains a reliable framework for understanding quality of life. Meeting human needs leads to a better QoL, both in terms of individual happiness and the effectiveness of the built environment. Therefore, a successful built environment is one that meets the needs of inhabitants and enhances their well-being.	(Schalock et al., 1989; Ventegodt et al., 2003)
	Significance	The significance of QoL in enhancing sustainable development has led to an increase in the number of research efforts addressing this construct.	(Lan Yuan, 2001)
		QoL can used efficiently adopted as an important indicator of social sustainability at the micro-level	(UK, 2005; van Zeijl-Rozema et al., 2008)

		(individual perspective of social sustainability)	
	Influential factors	QWL directly affects QoL, which is defined as the degree to which an individual's experience of life satisfies their wants and needs	(Nguyen & Nguyen, 2012; Rice, 1984; Jacqueline Vischer & Wifi, 2017)
		QoL is important ideologically because it supports people in living the best way they can in their environments.	(Schalock et al., 1989)
		The built environment, including both indoor and outdoor spaces, significantly impacts human life experience (health, comfort, and well-being)	(Day, 2002)

Building-In-Use (BIU) Assessment Tool

The Building-In-Use (BIU) Assessment tool, which was invented in the 1990s (Jacqueline Vischer, 2018), is one of the earliest tools utilized for gathering accurate data in workplace environments. Its objective is to standardize the collected data and information from space user surveys to ensure that users feedback is useful for assessing building performance (Jacqueline Vischer, 1989). A short standardized questionnaire is used to get feedback from space users through their ratings of building conditions and features. The accumulation of standardized data makes it possible to build a database from which typical patterns of space user responses to office workspace environments can be identified. Individual building scores are compared to database norms to offer a framework for assessing the meaning of user ratings of their workplace environment and to determining whether this environment is superior or inferior to typical office building workspaces. Many concepts and constructs have emerged as a result of this tool's development, its usage in a broad range of workplace environments, and the rich variety of research findings it produced (Jacqueline Vischer, 1996, 2018).

Workplaces and office spaces are becoming increasingly diversified in the modern day. Contemporary workspaces include a variety of personal and shared spaces, services, and access to advanced technological tools. Previously, office planning was based on the simple division of workspaces into large rooms containing rows of desks and a few private offices for managers (Gillen, 2006). Firms nowadays are increasingly investing in workspaces that actively support employee job tasks by applying quality criteria in addition to cost considerations during the design process (Jacqueline Vischer, 2005, 2012; Jacqueline Vischer & Malkoski, 2015). According

to studies, workplace management and design have an influence on how workers feel about their jobs, as well as their work performance, loyalty, engagement, and, the overall value human capital brings to the firm (Jacqueline Vischer, 2008b). The concept behind BIU Assessment is that the correlation between space users and the space itself is interactive and dynamic. This means that the user experience within the workplace environment includes the results of their behaviors in that environment, and their experience of this environment is impacted by the activities they perform (Jacqueline Vischer, 2008a).

Defining Social Sustainability for this Study

As demonstrated in this chapter, it is largely recognized in the literature that social sustainability – both within the context of the built environment and beyond – has a number of different definitions and can be studied from a multitude of angles. The lack of clarity on how social sustainability is defined has been known to restrict the amount of research directed towards this important metric. However, there is nearly a consensus between available resources that the notion of quality of life is an integral, defining aspect of social sustainability. Therefore, the extensive body of research on environmental psychology highlighting the impact of environmental attributes of built environments on the quality of work life and the quality of life forms a natural framework to study social sustainability in the built environment. This is consistent with prior studies on social sustainability in the built environment like Al-Jokhadar's. For the purpose of this research, the most fundamental aspects central to the notion of social sustainability in the built environment are rearranged into four distinct, clearly defined criteria. Each criterion directly impacts a built environment's ability to positively impact the user experience and the quality of life of occupants by way of maximizing functional comfort, thereby defining whether a given space can be classified as socially sustainable. The selected indicators are delineated as follows:

Physiological Health and Comfort

This aspect addresses the ambient attributes of the physical environment and their impact on occupant health, comfort, and task performance. This includes the perceived comfort with temperature and humidity conditions, the perceived level of air quality, the perceived adequacy of natural and artificial lighting, and the

perceived level of acoustic distractions or noise in the workspace. All those space attributes directly factor into the functional comfort of workplace users, and therefore impact their quality of life and their ability to perform their tasks properly (Jacqueline Vischer, 2008b). In that sense, a socially sustainable workplace is one featuring positive user perception of these attributes relative to user comfort and the nature of tasks conducted by users. Actual measurement of these values using physical investigation tools is helpful to characterize any gaps between user perception and typically acceptable ambient conditions, but user perception data collected through surveys and interviews arguably has equal or greater relevance to their quality of life and should be studied carefully.

Efficiency and Ergonomics

This aspect is concerned with the impact of workspace local design decisions regarding the size, configuration, dimensions, orientation, furniture, and storage capacity of the workspace assigned to users. This aspect is also concerned with the level of modularity and adjustability afforded to users, as well as the level of cleanliness and functionality of the amenities available in the workplace. As will be described in the "office workspaces" section of the literature review, there is a fair amount of variability within this set of design decisions. Different types of tasks and duties are better suited to distinct combinations of these attributes. Therefore, employee feedback through surveys or interviews is the best resource to characterize the impact of this type of space attributes on their level of functional comfort. That said, this should ideally be coupled with input from the organizational management to ensure consistency between user and organization priorities (Corlett & Clark, 2003). A socially sustainable workplace, in this context, is one in which these design decisions are carefully selected to maximize user functional comfort without compromising organizational priorities.

Privacy and Social Interaction

This aspect addresses the balance between the ability of space users to socialize and work collaboratively together, while still being able to establish the needed territory to work independently and maintain a sufficient level of privacy. Implicit under this aspect is the general sense of safety and security experienced by users in the workplace. enabling them to conduct tasks independently and

collectively. The level of social interaction in a given workplace is impacted by the availability of common spaces and the proximity and delineation between individual workspaces (Bouncken, Aslam, & Qiu, 2021; Spinuzzi, 2012). Socially sustainable spaces are those spaces that provide sufficient subspaces for promoting social interaction between users without compromising personal comfortableness and the ability of individuals to carry out their intended tasks and functions.

Spatial Organization (Design)

This aspect addresses the level of efficiency with which space is distributed within the workplace relative to the intended function, and whether a suitable hierarchy of space is established. The spatial organization of interior spaces and the quality of their connection (e.g., level of openness, space arrangement, variability of work areas, and accessibility) are significant factors in employee satisfaction with their workspace (Brunia, De Been, & van der Voordt, 2016). In interior design and architecture, hierarchy is generally used to highlight the importance or significance of a specific part or space in a building by its size, shape, or location in relation to the other spaces in the building. Spatial hierarchy is a gradation that occurs during the transition from public to private space; interior spaces within a building are typically designed to deliberately relate to each other in a certain manner. The interaction of spaces may be defined by spatial relationships (Candido et al., 2019; Connellan et al., 2013). The following are some examples of common spatial relationships used in interior design (Ching, 2023):

1) Space within a space.
2) Interlocking spaces.
3) Adjacent spaces.
4) Spaces linked by a common space.

In this context, socially sustainable spaces are those spaces in which shared and private subspaces, along with the transitions between the two, are distributed in a manner that emphasizes the primary function of the space and directs users towards participating in fulfilling this function, and where space is distributed in a manner that preserves a level of justice and equality between users. This aspect is also concerned with the level of mobility that users of different ability levels experience in the workplace, including ease of access to shared spaces, amenities, and the

exterior environment. In this regard, socially sustainable spaces are those spaces that facilitate movement of users with different ability levels.

Office Workspaces

The Concept of Office Workspaces

The term "Office" is derived from the Latin word "officium", which may refer to a movable bureau or an abstract notion of a formal position for administrative, managerial, and judicial actions. For years, an office has become an entity that denotes the physical environment (the physical objects and people found inside and around a workplace), the spatial (the place where people work), and the built environment (architecture and urban design) (Dale & Burrell, 2007). There are numerous understandings regarding what constitutes an office.

The conventional definition of an office is a place-dependent workplace (buildings), which may be represented as a workspace, workplace, private-public space, built environment, or physical environment, all of which are interchangeable (tangible entities). Additionally, space is considered as the imaginative materialization or the physical entity of an organization's power relations (Casey, 2003; Spicer, 2006; S. Taylor & Spicer, 2007). The design and architecture of offices, physical surroundings, and private workspaces create rich reservoirs of organizational symbolism (S. S. Taylor & Hansen, 2005). In general, an office is a location where the variety of processes and functions of an enterprise are executed and managed, such as: customer service, database management, human resources management, process mapping, sales and marketing, accounting, purchasing, payroll, facility management, records management, and so on.

The concept of offices has evolved throughout time as along with the information and communication technology explosion. The rise of knowledge work had a significant impact on the world of work in office workplaces, resulting in a possible blurring of the boundaries between public and private workspaces. This pushed work into homes, transportation, and leisure time (Bell & Taylor, 2004; Fleming & Spicer, 2004). The proportion of the workforce conducting work remotely outside of classical work premises has been significantly on the rise, and the upcoming generation of employees and professionals have expectations that far exceed merely having a dedicated space for work. With the advent of remote work settings, the modern workspace must undergo a period of redesign to recreate an

incentive for the new generation to use such spaces. Issues like monotony, inflexibility, indoor air and light quality, and the array of stresses – mental and physical – that are linked to today's work environment need to be addressed by way of a modern workplace design framework.

Office Space Origins

Historical evidence suggests that office spaces first emerged as an extension to monarch and ruling class complexes, primarily to maintain and produce written scripts. Civilizations at least as early as ancient Egyptians (3200 – 525 BC) appear to have utilized some form of workspaces. Ruins of the ancient Egyptian city of Amarna suggest that the city appears to have featured administrative workplaces concerned with disciplines including water supply, infrastructure and engineering, military affairs, and economic affairs (Hascher, Arnold, Jeska, & Klauck, 2002). Sociopolitical centers within ancient Greek and Roman cities featured formal administrative buildings like councils, people's assemblies, and jury courts. Scriptoriums, which are open spaces intended for ministerial and educational functions, were common in Europe between the Sixth and Twelfth centuries. Similarly, formal documents of monarchies were filed in dedicated spaces.

Though still primarily in reference to building enclosures utilized to carry out military and civic state duties, usage of the term "office" started to emerge during the European Renaissance. Since the early Eighteenth century, Britain became home to a number of large-scale, specialized office spaces, including those of the British Royal Navy, the Old Admiralty (Ripley Building – 1726), the East India Company, and Oriel Chambers of Liverpool (1864). Built in 1729, The East India Company's office building at Leaden Hall Street in London is a good indicative example of the early evolution of office buildings. The East India Company was responsible for trade operations in the Indian subcontinent and surrounding areas in Asia. Eventually, this company became the de facto ruler of India as a British Colony in the mid Eighteenth century, marking its place as one of the most powerful organizations to ever exist. The multifaceted economic and geopolitical functions conducted by this company ultimately led to generation of massive amounts of documents and records. Ships full of documents used to arrive from India to London at 8-month intervals, and offices like the one at Leaden Hall Street used to house thousands of employees who would process and analyze this information to further the Company's operations.

The Industrial Revolution brought along an entirely new array of occupations revolving around banking, fossil fuels, railways, telecommunication, retail, healthcare, insurance, and other disciplines. This led to the advent of upsized, gigantic office buildings across Europe. A notable example that constitutes what could be described as the early precedent of Twentieth century skyscrapers is the Oriel Chambers of Liverpool. Though its height of five-stories was far eclipsed by later skyscrapers, this office building featured the pioneering usage of structural steel skeletons with exterior glass cladding. This architectural arrangement allowed unprecedented amounts of natural light to enter this office building, therefore maximizing capacity for usable office space without artificial intervention. Numerous structures in the United States like the Boley Building in Kansas City (1909) followed suit during after the 1880s, and the explosion of skyscraper construction took place later in the Twentieth century.

Early Twentieth century office architecture predominantly featured what is known as cellular offices, which generally comprise rows of closed office spaces surrounding some open central architectural feature like a corridor, atrium, or large room (Hascher et al., 2002). This style was primarily adopted to accommodate restrictions on structure depth at the time, and to maximize the quality of natural lighting and ventilation. On the other side of the Atlantic, however, skyscrapers and open-plan office buildings took over the scene in the United States due to the rapid advancement in construction technology and the flexibility of architectural and interior design regulations. A landmark structure of early Twentieth century US architecture is the Sears, Roebuck, and Co. building constructed in Chicago 1906, featuring about 465,000 m^2 of office space in a nine-story configuration, and extending over two city blocks. This building, which housed about 22,000 employees to support the company's mail-order operations, was unparalleled globally at the time.

Another notable example in North America was created by the famous American architect Frank Lloyd Wright in 1904 in Buffalo, New York. Wright conceived of the first "purpose-designed environment" in the Larkin Building, which he designed to house the operations of a mail-order soup company. This building featured the incorporation of the industrial production model within the design of the office space. This space is not a particularly bright example of open office spaces – it is characterized by the notorious bullpen design style, featuring monotonous rows of

identical, unseparated workspaces within a large room. The Larkin Building was a six-story structure within which employees processing mail orders and carrying out company function were seated in the atrium, creating rows of crowded, self-repeating workspaces oriented towards a single direction (Hua, 2007). In contrast, managers and supervisors were assigned dedicated, private office spaces separated by glass walls. This arrangement, along with poor incandescent lighting and artificial air circulation systems, yielded a dull, uncomfortable work environment for the vast majority of building occupants.

The evolution of office spaces across all continents – including Asia-Pacific regions undergoing hypergrowth – steadily progressed over the Twentieth century. This was primarily fueled by technological advancement and continually shifting sociocultural values, environmental constraints, and location-specific building regulations (Thomas Arnold, 2002). Rectangular high-rise buildings with glazed facades (known as "glass boxes" in Western terminology) became increasingly abundant after the second World War (Van Meel, 2000). The notion of office space optimization, which was particularly aimed at maximizing the number of employees per unit area and streamlining employee communication within the space, took center stage as part of the theoretical underpinning of office space design. The 1950s featured the advent of newfound design concepts in Europe: the Bertelsmann building in Gutersloh, Germany designed by the Quickborner team embodied the transformative buerolandschaft (German for office landscape) design framework (Christiansson & Eiserman, 1998). Another notable example of the contemporary open-plan office building of that era is the Osram GmbH Administration Building in Munich constructed in 1962. Primarily known for its unique layout, this building is considered to be among the first serious design manifestations of the notion of achieving workplace efficiency by way of improving employee interaction and the flow of information (Hassanain, 2006; Laing, 2006a). The space featured an unobstructed, large space decorated with traditional furniture, curved screens, and sizable potted plants to synthesize a natural-feeling arrangement for office teams. Execution of this design concept was facilitated by central air-conditioning systems, acoustic ceilings, fluorescent lighting, and carefully selected interior accessories.

Developments in Office Workspace Design

Frederick William Taylor's "The Principles of Scientific Management", which was essentially the culmination of the known management professional and mechanical engineer's experience at the Bethlehem Steel Mills in Chicago, was a groundbreaking work that laid the theoretical foundation for harmonizing and utilizing human workforce to achieve an efficient workplace and maximize return (F. W. Taylor, 1911). This work's potentially immense impact on American office design canons during the 1920s has arguably been manifested through the advent of extremely spacious open-office floor plans that were designed to maximize efficiency for regular everyday operations all the while satisfying the constraints of organizational hierarchy (Duffy & Powell, 1997). Ultimately, changes in office and workplace design trends were merely the result of the continuous evolution in the nature of tasks and operations carried out within office environments (Danielsson, 2005).

Over the years, office spaces and the functions they house have grown in complexity. This, in turn, led to the development of a number of regulations and classification systems to document and control parameters like safety/security, sustainable design elements, legal adherence to design and layout, and applicable technical specifications (e.g. networking systems). The Building Owners and Managers Association of Canada (BOMA, 2012), for instance, classified buildings into the three following categories:

1) Class A → Prestigious buildings with high-quality amenities in the best locations for premier office users. Class A itself is further partitioned into sub-classes (e.g. prestige, AAA, AA, A).
2) Class B → Well maintained and functional buildings with facilities that are slightly older and cost effective and that attract a wide range of users. This class is directly lower than Class A.
3) Class C → Lowest grade older office buildings generally situated in less desirable locations and having limited infrastructure.

It is noted that the abovementioned classes are general guidelines, and not formal building standards. The task of assigning an exact classification to building enclosures remains a more complex one for those building designs incorporating arbitrary features and lacking specificity in design and execution. At any rate, the evolution of office building design in terms of arrangement, use of space, and

planning continues to be driven by building management policies, the function of the space, and the professional culture of occupants. For analysis purposes, spaces within more modern corporate offices can be subdivided into workspaces, meeting spaces, and support spaces. Typically, the following spaces fall under the umbrella of workspaces:

1) Cubicles and dedicated private one-person office spaces. Tasks carried out in this space typically require confidentiality and a reasonable level of concentration.

2) Open-concept office spaces suited to house approximately 10 individuals. Such spaces are suitable for tasks for which regular team communication is necessary.

3) Team spaces that are semi-detached and have the capacity to house 4 to 8 individuals. These spaces facilitate internal dialogue within a more concentrated group.

4) Shared or serviced offices. These are private spaces, but they house shared facilities that can be harnessed by 2-3 individuals.

5) Short-term study booths.

6) Lounges or touchdowns, which are open or sheltered workspaces suitable for short-term tasks or sporadic interaction between a relatively small group of people.

The following spaces can be classified as meeting spaces:

1) Meeting spaces equipped to house approximately up to 12 people.

2) Brainstorming facilities that can host approximately 5-12 people.

3) Smaller meeting points designed to accommodate no more than 4 people.

Lastly, support spaces are intended to fill secondary office functions. Examples include filing and storage facilities, print/copy/scan areas, food closets and lunchrooms, reception spaces, corridors, physical activity rooms, wellness rooms, libraries, etc. Some corporate buildings also feature a secluded workspace designated as an executive suite. It is worthy of note that corporate buildings can be solely occupied by a single organization or can be partitioned among multiple organizations.

Duffy, Jaunzens, Laing, and Willis (2003) have synthesized another classification system for office environments based on an empirical analysis of spatial distribution and workflow within a number of office spaces. The authors emphasized the importance of understanding the anticipated structure of activities

when designing an office space, and proposed the following four template arrangements:

1) Hive – This arrangement primarily accommodates clerical, routine work activities, including functions like call centers, banking services, IT operations, administrative assistance, sales, and others. Such an arrangement typically comprises cellular or open-concept workspaces. Much of the tasks associated with this arrangement can be carried out routinely during business hours.

2) Den – This arrangement is geared towards highly collaborative functions (e.g. low groups, accountants, academic teams, and particular types of research and consulting). Typically, only a small subset of the tasks featured in this arrangement have to be carried out at the individual level.

3) Cell – This arrangement is best suited for functions that require a high level of individual concentration (e.g. design, insurance, media/advertisement). The Cell arrangement primarily comprises cellular offices that naturally allow for little interaction with exterior surroundings.

4) Club – This arrangement accommodates team offices with shared workspaces and high-value knowledge collaborative functions (e.g. IT, management consulting, advertisement teams). The resulting environment is typically collaborative, interactive, and autonomous, and occupancy levels can be generally sporadic in nature.

As is evident from the definition of the foregoing work modes, each mode is typically tied with particular functions and spatial configurations. Hive arrangements feature low autonomy and interaction and are typically related to the aforementioned bullpen workplace configuration. Dens, on the other hand, are bustling and lively with natural interaction, but also feature a low level of occupant autonomy. Cells remain the most independent, secluded, and concentration friendly of all arrangements, therefore naturally offering the smallest opportunity for interaction. Clubs are generally designed as open spaces that promote flexibility, autonomy, and collaboration.

Open Office Planning

The academic and professional communities continue to strive for an optimal balance between different workplace design elements. The open-plan office (i.e. buerolandschaft) previously discussed offers multiple advantages in terms of

collaboration, equity, and flexibility, but also features inherent drawbacks in terms of lack of hierarchy, privacy, and concentration. Rigid traditionally arranged high/low rise offices, on the other hand, are undergoing a constant process of change to accommodate developments on the level of culture, structural arrangements, market conditions, individualism, privacy, and other sociocultural factors.

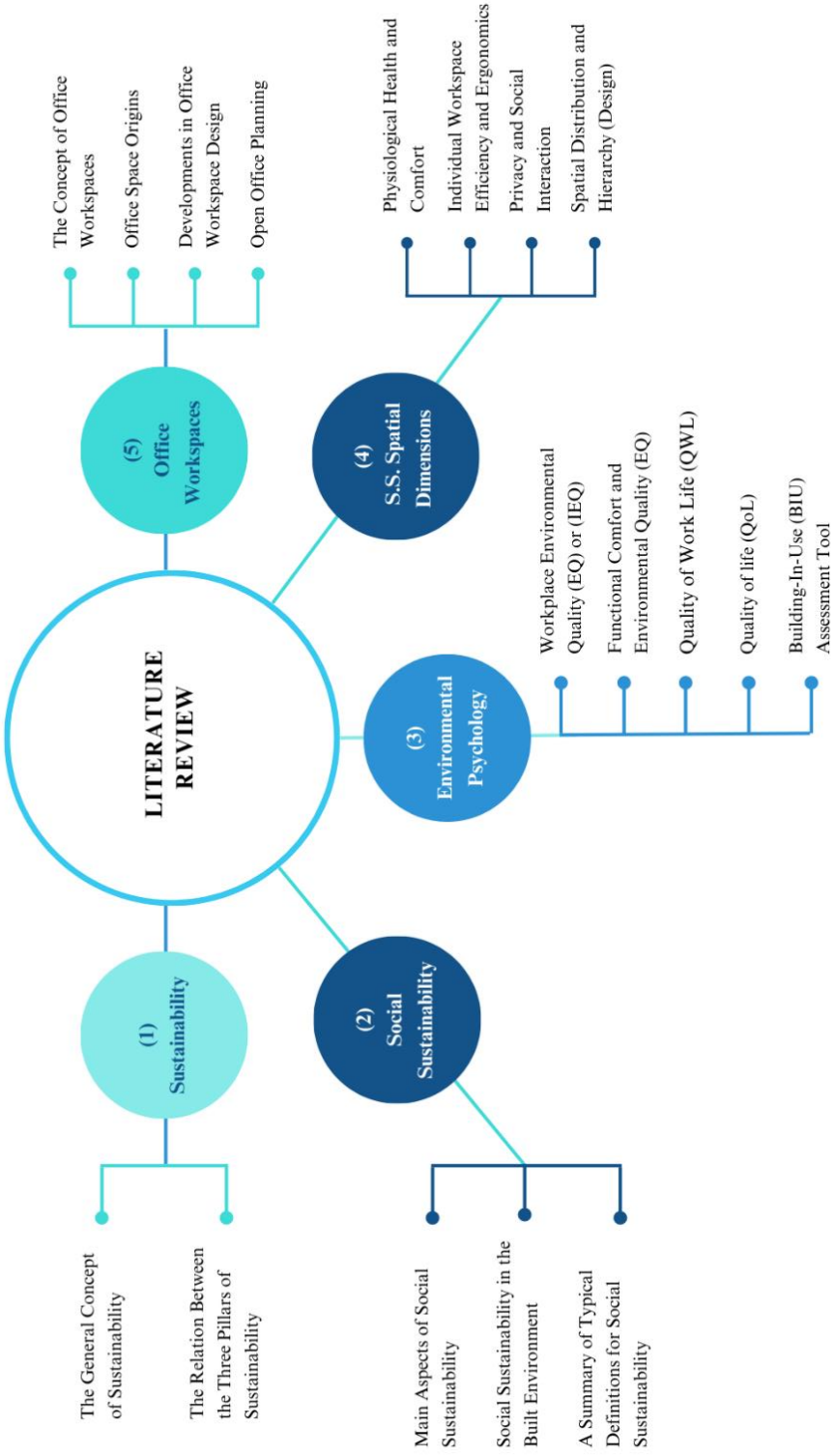
In that sense, there is an ongoing push for maintaining employee engagement and satisfaction through workplace design (Earle, 2003). A common approach to this is synthesizing workplaces that offer a marriage between collaborative and private spaces. Generally speaking, such "combi" office environments have found a reasonable level of acceptance within the corporate circles, particularly since they strike a balance between collaborative landscapes and cubicle-like spaces (Thomas Arnold, 2002; Laing, 2006a, 2006b). Further, open office spaces located centrally within buildings are believed to enhance employee interaction. In these settings, furniture design – including specialized sitting/standing equipment – can be customized to accommodate privacy concerns by way of providing adequate partitions and common filing spaces, and through enhancing the overall acoustic properties of the shared space. Moving secluded private office spaces centrally within the arrangement and orienting them towards surrounding open-plan areas can have the advantage of maximizing the number of occupants with an unobstructed view and overall natural lighting levels (Harrison, Wheeler, & Whitehead, 2003).

As remote work arrangements continue to gain popularity, new office designs with more flexibility and a higher user incentive remain in high demand. Today's office design trends feature a tendency towards shared workspaces that are utilized intermittently by different users with emphasis on innovative, satisfaction-driven common space design. An early notable example in this context is the adoption of the "hot desking" concept by the Norwegian telecommunications company Telenor Group – this concept does not entail assigning specific workspaces to individuals, and rather relies on the flexible common usage of shared spaces as needed to maximize special use efficiency (Harrison et al., 2003). Obviously, this does not come without drawbacks – the sense of personalization can be somewhat hindered by this workspace style, and storage of immobile materials (though such items are less abundant in many industries today) remains a challenge. Still, the industry and academia continue to make adjustments and compromises to arrive at arrangements

that maximize employee satisfaction without hindering efficiency of real estate allocation. The following Figure 8 illustrates the literature review structure.

Figure 8

Literature Review Structure



CHAPTER III
Methodology

Research Design

In order to assess the hypotheses and achieve the aims behind the study, a mixed methods approach featuring both qualitative and quantitative techniques was utilized. An extensive literature review was conducted to establish the theoretical framework for this study. A questionnaire directed to space users to get answers to research questions was utilized. The critical analytical method was harnessed to study and derive conclusions based on the collected data stemming from sources such as case studies and real-life projects. Questionnaires were not intended to be restricted to particular age or gender groups. The idea is to maximize the sample size with the intent of providing robust insight regarding interior design and architecture offices in Jordan. Quantitative techniques were used to analyze and study the interior spaces of the chosen case studies. Upon completion of data collection and space analysis, this information was analyzed and compared to directly test the research hypotheses.

In that sense, and in light of the relevant literature and the intended scope of this study, the survey was built around the four categories described within the forementioned sections. Under the umbrella of each category, a number of survey questions are denoted as independent variables (IVs), and a single question is denoted as a dependent variable (A_DV, B_DV, C_DV, and D_DV). Two survey questions are designated as main dependent variables that are not encompassed within any of the four categories; one of the two variables is utilized as a metric for overall user satisfaction (M_DV_1) and the other for the level of perceived productivity (M_DV_2); these main variables are intended to capture the general relationship of spatial attributes to the quality of life and the quality of work life, respectively. Reference should be made to Table 2 for a presentation of this breakdown.

Participants/Population and Sample

The sample adopted for this study covered interior design and architecture office employees in Amman, Jordan. An internet-based questionnaire was administered to employees within 35 interior design and architecture firms in this geography with the aim of assessing the office workplaces represented by this large demographic. The total number of interior design and architecture offices in Jordan was not established with full certainty; there is not a formal association for interior designers in Jordan, and the practice of architecture in Jordan is regulated under the wider umbrella of engineering practice. As such, the intent of the survey exercise was to collect as many responses as possible, without a pre-specified target. A total of 145 responses were collected from full-time employees, two of which were discarded upon the review and filtering process to yield a net sample size featuring 143 responses – a reasonable response rate of 98.6%. The reason for excluding these two responses was the lack of completeness and internal consistency: one of the responses featured repetitive feedback, and the other featured blank feedback to most questionnaire parts. The sample studied featured 55 males (38.5%) and 88 females (61.5%). 50.3% of the participants were under the age of 30, 36.4% were between 30 and 40 years of age, 9.8% were between 40 and 50 years of age, and 3.5% were above 50. The respondents were primarily interior designers, architects, and civil engineers ranging from junior to senior within organizational and project hierarchies. Although the final sample size is relatively small, it is reasonable to the limited timeframe and financial resources and representative of the region addressed by the study. The following Table 3 shows the items addressed in the survey.

Table 3

Items addressed in the survey.

Category	Scale (Independent Variables)	The Dependent Variable for Each Category	Main Dependent Variables
A: Physiological Health and Comfort	A_Q1_ General cleanliness and hygiene	A_DV_ I feel that deliberate consideration of physiological health and comfort during the interior design process of workspaces will yield a space in which I feel more comfortable and able to better perform my duties.	M_DV_1_ I am satisfied with my workplace environment (satisfaction) M_DV_2_ My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity)
	A_Q2_ Thermal comfort		
	A_Q3_ Unpleasant odors		
	A_Q4_ Air humidity		
	A_Q5_ Air circulation		
	A_Q6_ Natural lighting		
	A_Q7_ Artificial lighting		
	A_Q8_ View to the outside		
	A_Q9_ Acoustically comfortable		
B: Efficiency and Ergonomics	B_Q1_ Size of office/workstation	B_DV_ I feel that deliberate consideration of individual workspace efficiency and ergonomics during the interior design process of workspaces will yield a space in which I feel more comfortable and able to better perform my duties.	
	B_Q2_ Furniture ergonomics		
	B_Q3_ Flexibility and personalization		
	B_Q4_ Work surfaces area		
	B_Q5_ Storage spaces		
	B_Q6_ Computer configuration		
C: Privacy and Social Interaction	C_Q1_ Safety and building security	C_DV_ I feel that deliberate consideration of creating a balance between social interaction and personal privacy within the workspace during the interior design process of workspaces will yield a space in which I feel more comfortable and able to better perform my duties.	
	C_Q2_ Density and over-crowdedness		
	C_Q3_ Availability of common rooms and shared spaces for social interaction		
	C_Q4_ Team proximity		
	C_Q5_ Visual and acoustic privacy		
D: Spatial Organization (Design)	D_Q1_ Fair distribution of spaces with respect to the functional space needs pertaining to their job duties	D_DV_ I feel that deliberate consideration of spatial distribution and hierarchy during the interior design process of workspaces will yield a space in which I feel more comfortable and able to better perform my duties.	
	D_Q2_ Availability of meeting/focus rooms		
	D_Q3_ Access to management		
	D_Q4_Access to information and archives		
	D_Q5_ Access to service and amenities		
	D_Q6_ Access to common areas		

Data Collection Tools/Materials

- Case-study space selection and description
- Employee questionnaire questions
- Design attribute analysis conducted through observation and using the Space Syntax – Grasshopper3D Plug-in.

Employee Questionnaire

The intent is to present a series of questions that attempt to capture employee feedback, preferences, and priorities in the workspace. As discussed, the types of parameters being examined are, inherently, subjective parameters, but useful data can still be extracted through this examination. The expected variability in responses addressing a given aspect is a mere reflection of variable preferences from individual to individual – the single most central task associated with designing any space is to incorporate elements that maximize space utility and user satisfaction for the largest user subset possible despite the dispersion of needs and tastes, all the while preserving basic space requirements for all users indiscriminately. It is noted that the general nature and arrangement of the questions to be asked is consistent with the standardized functional comfort survey and BIU assessments used in prior research work (Jacqueline Vischer, 1996, 2005).

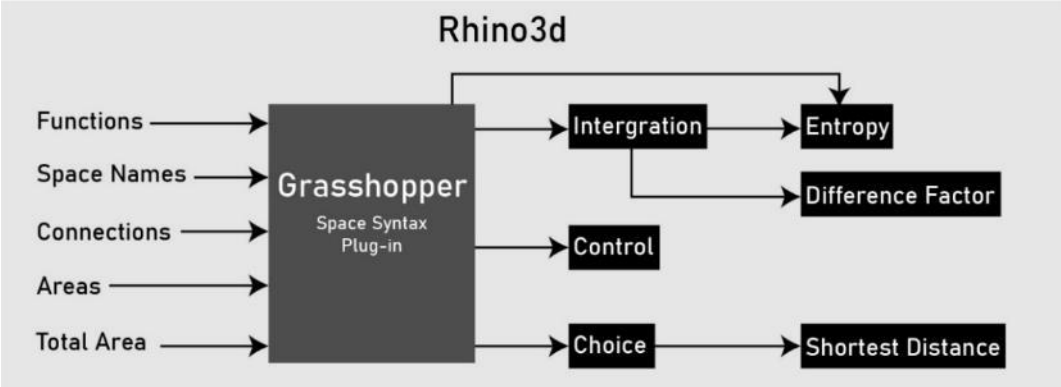
Space Syntax – Grasshopper3D Plug-in

In this procedure, the researcher will use the Space Syntax – Grasshopper3D Plug-in, which is a tool within the Rhinoceros 3D software. This plug-in gives indications of the social interpretation of the space, space distribution, hospitality, privacy, and hierarchy. Such parameters are useful for the analysis of the social and psychological aspects of the space, and they yield detailed statistical results that are presented in the form of four primary computational tools: integration, entropy, control, and choice. As a result of the main tools, there are other minor results like the difference factor and shortest distance. Each tool provides a detailed analysis for different spaces that will be explained in further detail within this section.

The primary tool within the Space Syntax framework requires four primary inputs: space names, connections between spaces, space areas, and total area. The core of this main tool is to provide data for the four computational analyses depending on these inputs (see Figure 9).

Figure 9

Space Syntax main tool process. – Source: (The researcher).



Integration Computational Tool

Integration analysis as described in 'The Social Logic of Space' (Bill Hillier & Hanson, 1984). Intuitively, the higher the integration value, the more likely for a space to be communal. Conversely, the lower the integration value, the higher the level of privacy achieved within a given space (Nourian, Rezvani, & Sariyildiz, 2013). This tool is helpful for determining whether an area should be classified as private, semi-public, or public. A list of relative colors linearly mapped from blue (little) to red (high) integration is produced (see Figures 10 and 11).

Figure 10

Integration computational tool. – Source: (The researcher).

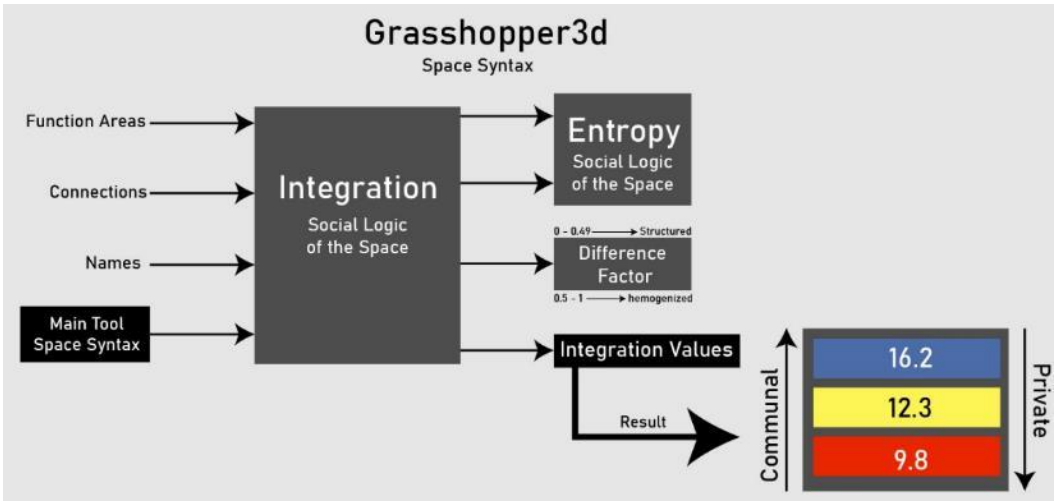
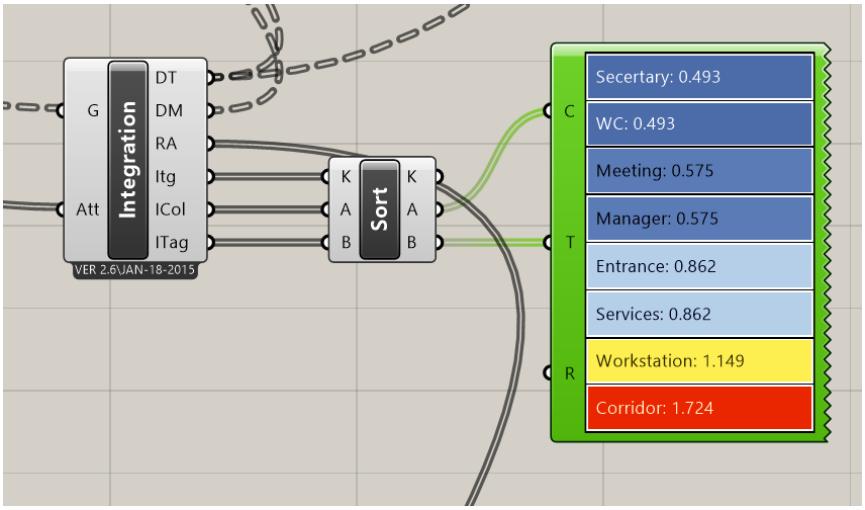


Figure 11

Example of integration result. – Source: (The researcher).

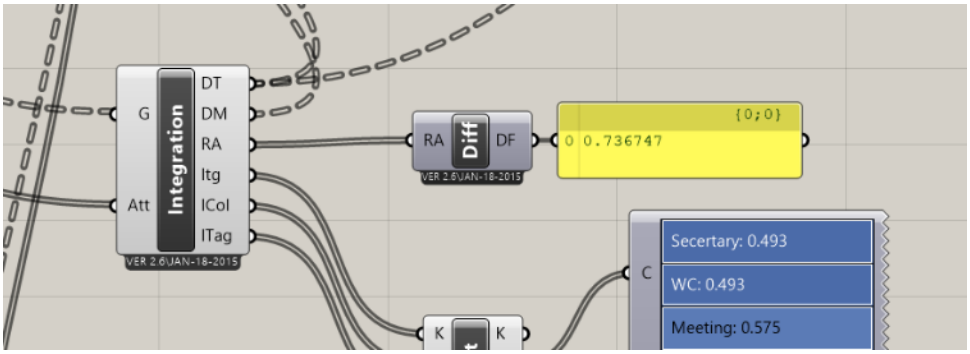


Difference Factor

This metric finds the (configurational) difference factor of an arrangement as defined in 'Decoding Homes & Houses' (Hanson, 2003). The closer this value is to zero, the more differentiated the spaces within a given configuration are. The closer this value is to one, the more homogenized the spaces within a given configuration are in terms of their integration (see Figure 12).

Figure 12

Example of difference factor result. – Source: (The researcher).



Entropy Computational Tool

According to Nourian et al. (2013), the entropy value at a certain subspace in a configuration characterizes the level of ease with which other subspaces can be accessed from that location. Intuitively, the higher the entropy value for a given space is, the more difficult it is to reach other spaces from that space and vice-versa.

A list of relative tones linearly mapped from brighter (little) to darker (high) entropy (Nourian et al., 2013) is produced (see Figures 13 and 14).

Figure 13

Entropy computational tool. – Source: (The researcher).

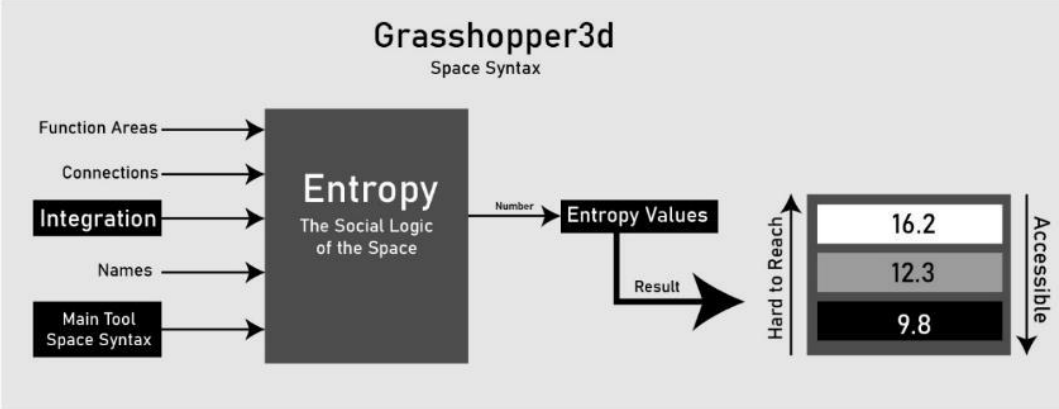
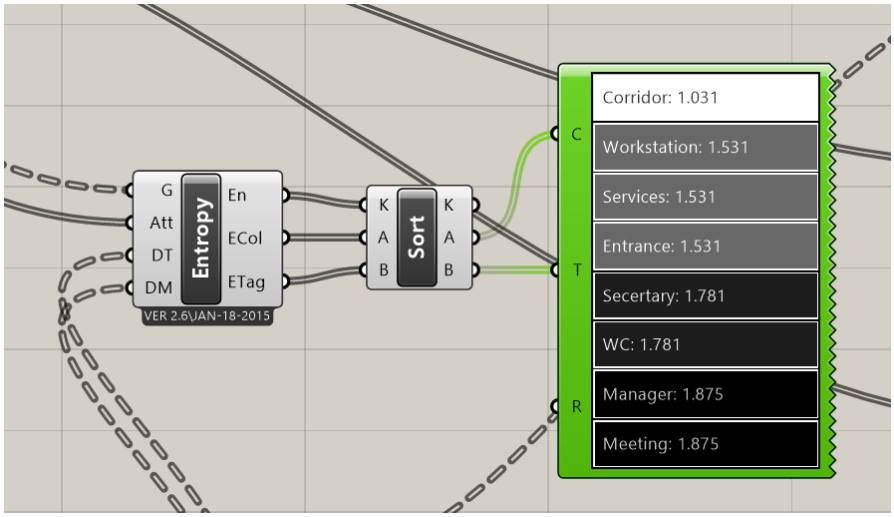


Figure 14

Example of entropy result. – Source: (The researcher).



Control Computational Tool

Control is a local measure that explores the degree to which each space serves as a potential destination to its neighboring spaces (Bill Hillier & Hanson, 1984). A list of relative tones linearly mapped from Brighter (little) to Darker (high) Control is produced (see Figures 15 and 16).

Figure 15

Control computational tool. – Source: (The researcher).

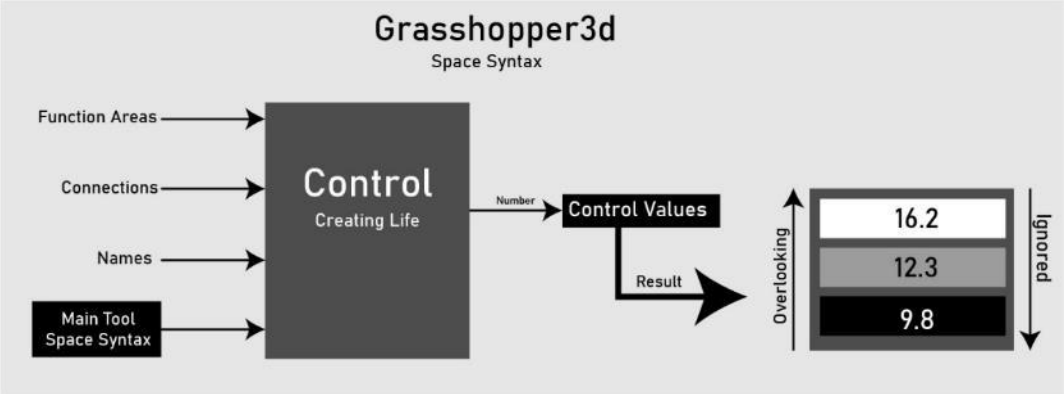
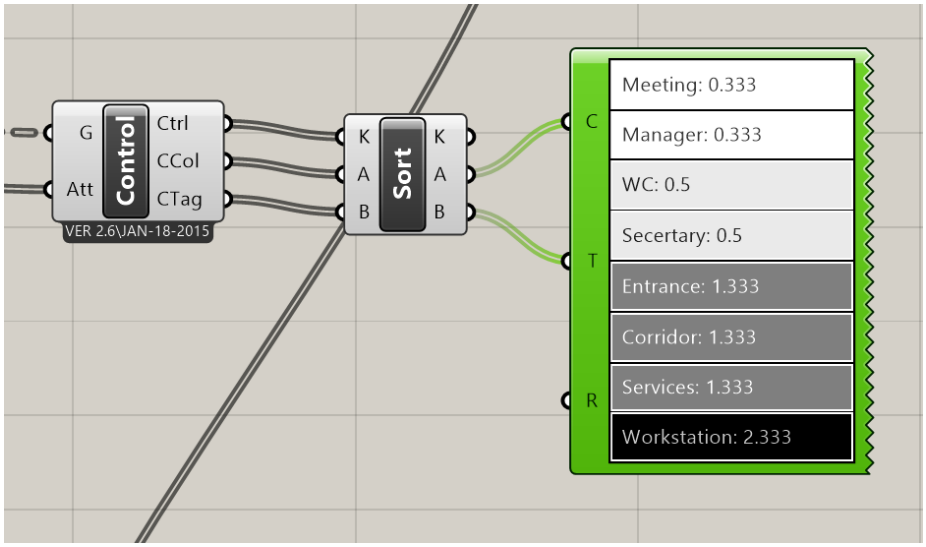


Figure 16

Example of control result. – Source: (The researcher).



Choice Computational Tool

According to Hillier and Shinichi, the choice parameter is a social indicator on how space is perceived by users (social integrity). It indicates how often a node (space) happens to be on a shortest path between other spaces. In other words, it measures 'the degree of choice each space represents (how likely it is to be passed through) on all shortest routes from all spaces to all other spaces in the system', and the duration the user can typically spend within the space. A list of relative tones linearly mapped from brighter (little) to darker (high) Choice is produced (Bill Hillier & Iida, 2005) (see Figures 17 and 18).

Figure 17

Choice computational tool. – Source: (The researcher).

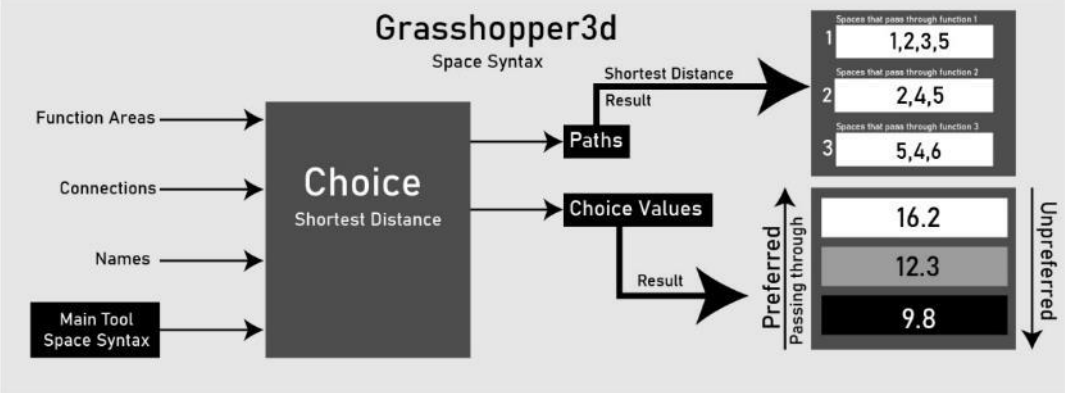
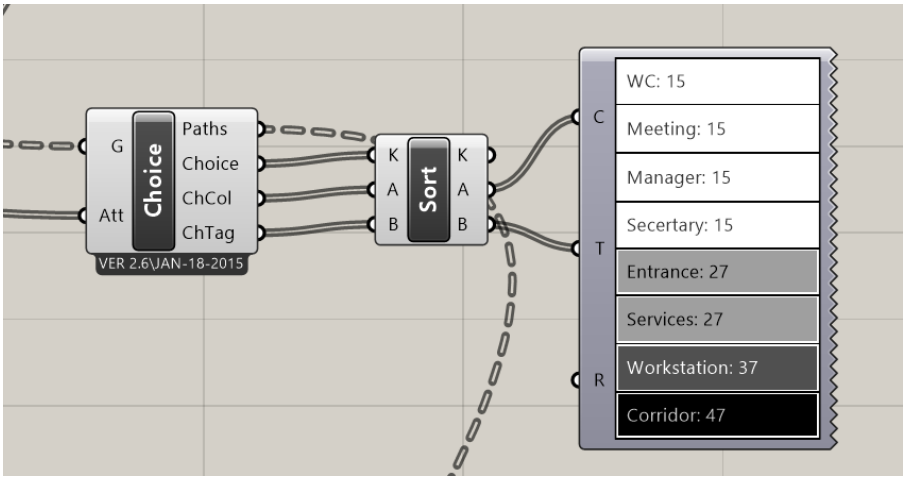


Figure 18

Example of choice result. – Source: (The researcher).

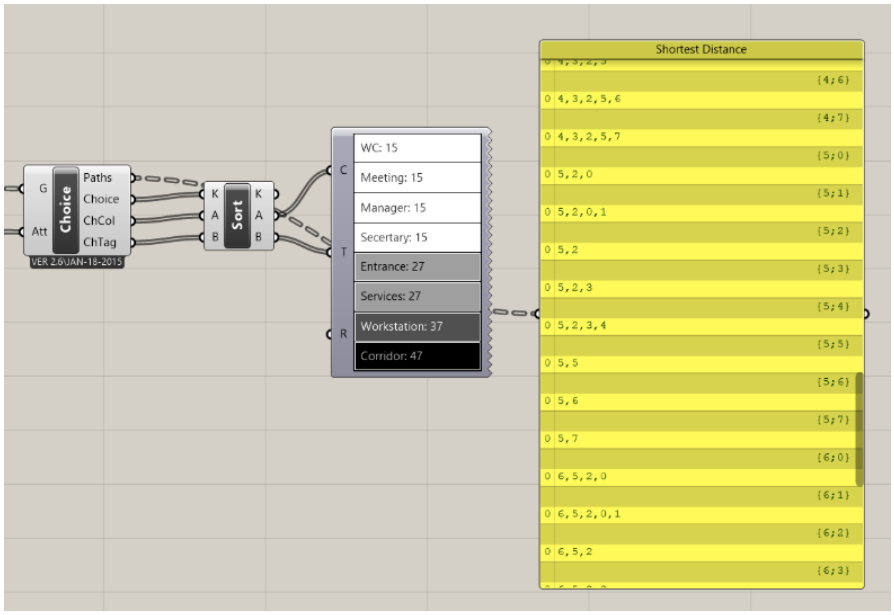


Shortest Distance

This metric characterizes graph-theoretic shortest paths between points. Graph-theoretic distance is not related to physical distance but is instead a function of depth within a graph setting representing the configuration. The paths are presented in origin-destination branches (Nourian et al., 2013) (see Figure 19).

Figure 19

Example of shortest distance result. – Source: (The researcher).



Syntactic Tool Procedure

1. Dividing the plan into interior spaces according to spatial function.
2. Calculating the area of every interior space and the total area of the plan in Autodesk AutoCAD.
3. Within Rhinoceros 3D, the researcher sets different points representing every interior space (see Figure 20).
4. Connecting interior spaces with lines as links to define the relations between those spaces (see Figure 21).
5. Within Grasshopper3D, the researcher defines points as interior spaces and curves (lines) as connections between spaces.

Figure 20

Example of different points representing every interior space. – Source: (The researcher).

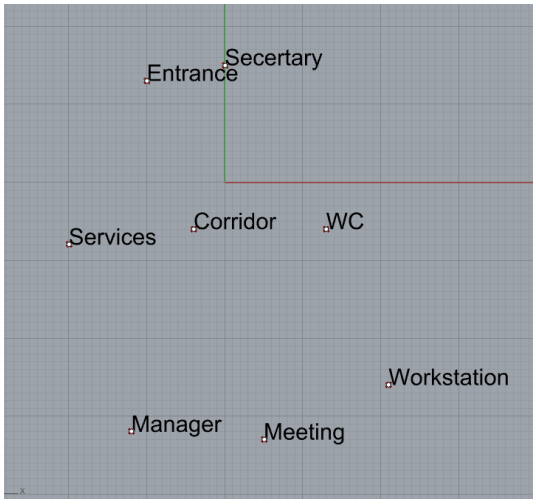
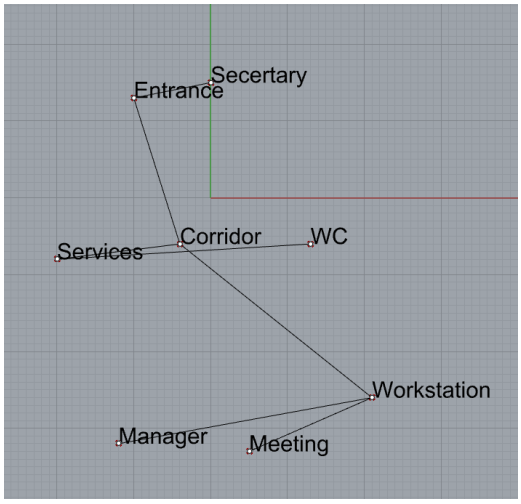


Figure 21

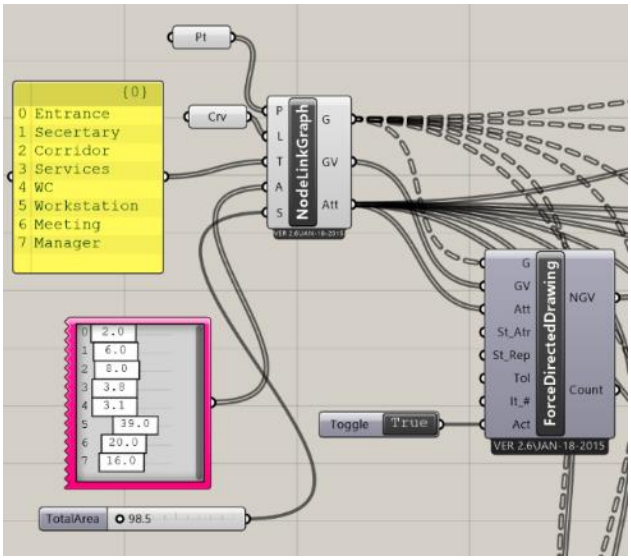
Example of defining curves(lines) as connections between spaces. – Source: (The researcher).



6. Specifying all the names of interior spaces according to function. This is done using a panel.
7. Defining the area of each interior space (see Figure 22).
8. Defining the total area of the plan within Grasshopper3D (see Figure 22).

Figure 22

Example of specifying interior spaces names and defining their areas and the total area. – Source: (The researcher).



9. Space Syntax (Syntactic) calculates basic outputs using functions that are defined and outputs 3 main parameters (Space Hierarchy, Areas in relation to function, Connections).

a. Connect the outputs of the main tool to extract the integration value.

b. Connect the outputs of the main tool to extract the entropy value.

c. Connect the outputs of the main tool to extract the control value.

d. Connect the outputs of the main tool to extract the choice value.

10. The program computes the desired outputs according to Pirouz Nourian functions (Nourian et al., 2013). .

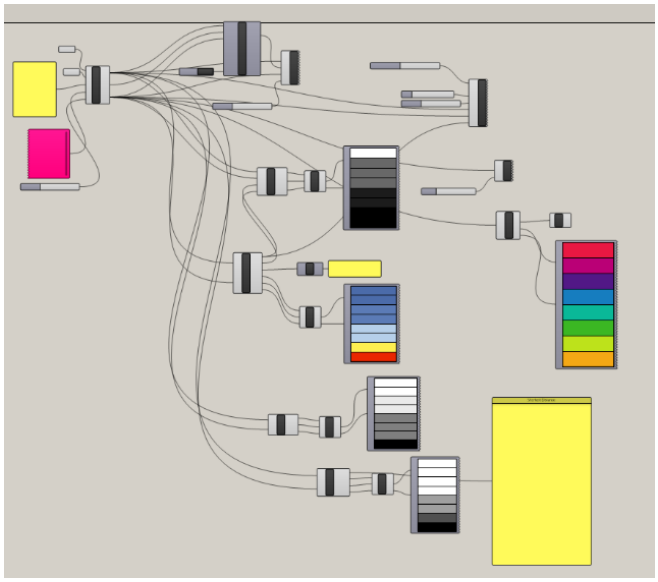
11. The main outputs of the program (integration, entropy, control, choice), along with the additional minor metrics (Difference Factor, Shortest distance), will be automatically given by the plug-in.

Complete Visual Script view

The following Figure 23 shows an example of complete visual script view.

Figure 23

Example of complete visual script view. – Source: (The researcher).



Data Analysis Procedures

- Employee questionnaire response analysis
- Case-study interior space characterization and analysis
- Space Syntax – Grasshopper3D Plug-in

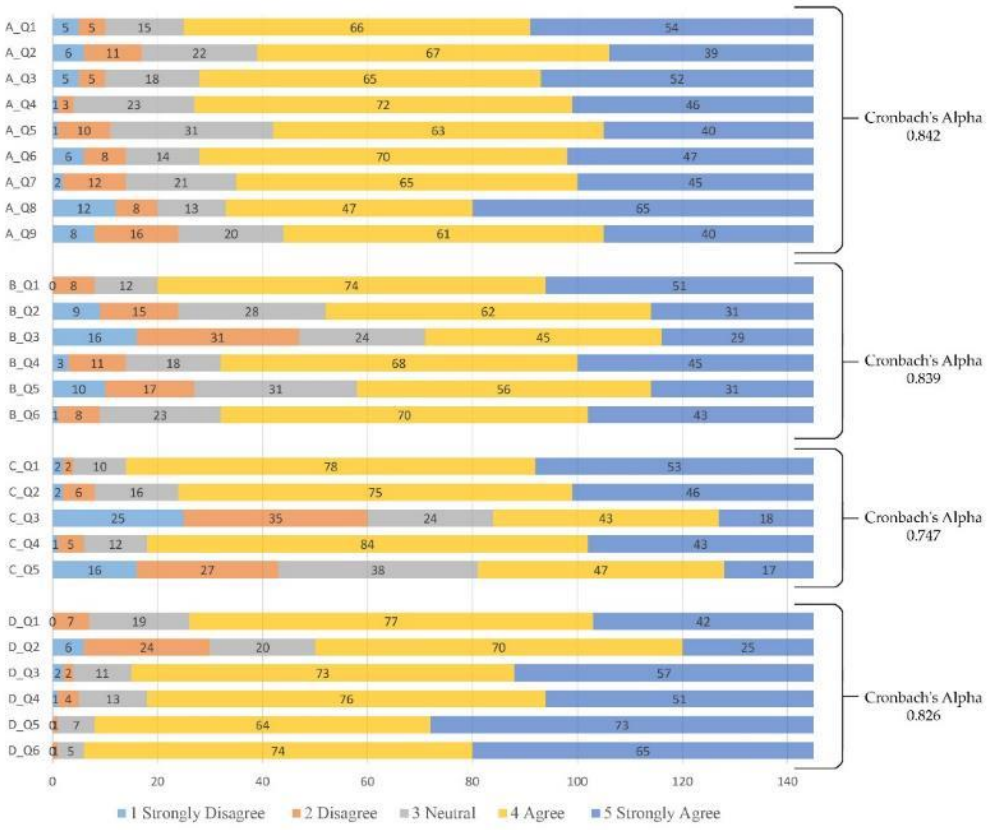
CHAPTER IV
Findings and Results

Questionnaire Results

Cronback's Alpha (α) was utilized to assess the internal consistency of the adopted scale (Cronbach & Shavelson, 2004). Relevant statistical literature cites this test as a valid tool for assessing scaled attitude measurements (Taber, 2018). Prior studies have utilized this test within the context of workplace user feedback (De Sio et al., 2017; Odu, 2023). Upon conducting the test on each set of independent variables, a high level of internal consistency was detected (see Taber, 2018).

Figure 24

Descriptive statistics of the independent variables and associated Cronbach's alpha for each group.



The results presented in Figure 24 indicate that the majority of responses imply positive feedback in relation to respondent workspace. Nonetheless, the results feature exceptions to this trend (e.g. B_Q3, C_Q3, and C_Q5), which necessitates

further assessment. In addition to the foregoing examples, A_Q8 appears to feature a higher proportion of “strong disagreement” when compared to other Category A questions. These deviations from general response trends are analyzed within the following paragraphs.

Responses within Category A (Physiological Health and Comfort) imply that most employees do not necessarily prefer outside view (reference should be made to question A_Q8). This seems to be well corroborated with the observations collected during office visits: most employees seemed to close window blinds to avoid the negative effects of sunlight glare on computer screens, such as distraction and reduced visibility.

The distribution of responses to Question B_Q3 within Category B (Efficiency and Ergonomics) implies a sense of user dissatisfaction in relation to the customizability and the flexibility of office spaces. This can be explained by the restricted mobility of office furniture within workspaces of limited area.

Further to the foregoing, it appears that Category C (Privacy and Social Interaction) features more negative responses than any of its counterpart categories. The general source of respondent negative feedback was the proportion of rooms and common spaces (question C_Q3) and visual/acoustic privacy (C_Q5). The former relates to workspace area partitioning, and the latter is tied to the fact that many of the studied workspaces featured open concepts of limited individual privacy.

Finally, responses under Category D (Spatial Organization) appear to be primarily positive, which implies a relatively high level of user satisfaction in relation to the spatial organization of office spaces.

The relationship between the considered non-parametric ordinal variables was explored by way of a number of Spearman rank correlation procedures with a 0.05 significance threshold (see Glasser & Winter, 1961). The first of these assessments purported to investigate the relationship between the independent variables in a given category and the dependent variable associated with that category (Refer to Table 3).

Table 4

Spearman's correlations between the general evaluation of "Physiological Health and Comfort" (categorical dependent variable: A_DV) and individual corresponding items.

			A_Q1_ General cleanliness and hygiene	A_Q2_ Thermal comfort	A_Q3_ Unpleasant odors	A_Q4_ Air humidity	A_Q5_ Air circulation	A_Q6_ Natural lighting	A_Q7_ Artificial lighting	A_Q8_ View to the outside	A_Q9_ Acoustically comfortable
Spearman's rho	A_DV: Physiological Health and Comfort	Correlation Coefficient	.330**	.320**	.345**	.233**	.086	.195*	.326**	.255**	.221**
		Sig. (2-tailed)	.000	.000	.000	.005	.302	.019	.000	.002	.008
		N	145	145	145	145	145	145	145	145	145

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Statistical significance is detected in most Category A (Physiological Health and Comfort) items. That being said, items like the lack of unpleasant odors, general hygiene, and artificial lighting appear to most strongly impact the dependent variable A_DV. On the other hand, air circulation appears to the have the weakest impact on this category's dependent variable (Table 4).

During office visits, it was noted that a majority of employees preferred artificial lighting with closed blinds and a relatively dim room over open windows with natural lighting. This is attributed to the fact that artificial lighting affords the user a higher level of control, which facilitates working with proprietary architecture and interior design software with minimal levels of eye strain and fatigue.

Further to the foregoing, employee comfort levels and physiological health are negatively impacted by unpleasant odors and poor general hygiene, which explains the significant impact these items possess on A_DV. Tangible improvements in employee well-being and health can be achieved by way of elevating overall office hygiene through adequate sanitation and maintenance practices like controlling the frequency of periodic surface, floor, and furnishing cleaning efforts.

Table 5

Spearman's correlations between the general evaluation of "Efficiency and Ergonomics" (categorical dependent variable: B_DV) and individual corresponding items.

			B_Q1_ Size of office/workstation	B_Q2_ Furniture ergonomics	B_Q3_ Flexibility and personalization	B_Q4_ Work surfaces area	B_Q5_ Storage spaces	B_Q6_ Computer configuration
Spearman's rho	B_DV: Efficiency and Ergonomics	Correlation Coefficient	.414**	.536**	.409**	.372**	.287**	. 298**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
		N	145	145	145	145	145	145

**. Correlation is significant at the 0.01 level (2-tailed).

Looking at Table 5, it is visible that correlation coefficients are higher within the realm of "Efficiency and Ergonomics". It appears that furniture ergonomics has the strongest impact on the dependent variable within this category. This is explained by the fact that employees highly value their comfort in the workplace given the long hours they spend at the office daily; user comfort can strongly impact productivity and satisfaction. Further, B_DV is also highly impacted by workspace unit size along with the degree of work environment personalization and flexibility. Workspaces that cater to user needs and allow a healthy level of flexibility and personalization have a positive effect on user productivity and satisfaction. Generally speaking, the results underscore the significance of ergonomic design considerations on employee productivity and satisfaction within workspaces.

Table 6

Spearman's correlations between the general evaluation of "Privacy and Social Interaction" (categorical dependent variable: C_DV) and individual corresponding items.

			C_Q1_ Safely and building security	C_Q2_ Density and over crowdedness	C_Q3_ Availability of common rooms and shared spaces for social interaction	C_Q4_ Team proximity	C_Q5_ Visual and acoustic privacy
Spearman's rho	C_DV: Privacy and Social Interaction	Correlation Coefficient	.298**	.288**	.121	.438**	.202*
		Sig. (2-tailed)	.000	.000	.148	.000	.015
		N	145	145	145	145	145
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Within the "Privacy and Social Interaction" category, team proximity appears to be the most impactful factor as shown in Table 6. This provides empirical support to the modern design approach aiming to promote open workstations that facilitate team cooperation. An interesting observation is the fact that the availability of common rooms and shared spaces does not appear to have a significant impact on the category's dependent variable, on which team proximity appeared to have the highest impact within this category. This could imply that respondents prefer private space or shared space, but it could also suggest an underlying worry of respondents related to the fact that a certain proportion of shared spaces could undermine overall individual privacy. The significance of striking a healthy balance between teamwork collaboration and individual privacy within workspaces is highly represented in these results. Teamwork and effective collaboration are undeniably critical, but promoting these aspects should not lead to a space that infringes on minimum thresholds related to individual comfort and privacy. This balance is crucial for satisfying team and individual needs, and is among the most central of challenges within the workspace design process.

Table 7

Spearman's correlations between the general evaluation of "Spatial Organization (Design)" (categorical dependent variable: D_DV) and individual corresponding items.

			D_Q1_ Fair distribution of spaces among with respect to the functional space needs pertaining to their job duties	D_Q2_ Availability of meeting/focus rooms	D_Q3_ Access to management	D_Q4_ Access to information and archives	D_Q5_ Access to services and amenities	D_Q6_ Access to common areas
Spearman's rho	D_DV: Spatial organization (design)	Correlation Coefficient	.399**	.127	.449**	.429**	.545**	.527**
		Sig. (2-tailed)	.000	.128	.000	.000	.000	.000
		N	145	145	145	145	145	145
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

As shown in Table 7, access to services and amenities carries the most impact on the dependent variable within the "Spatial Organization (Design)" category, followed by access to common areas and ease of physical access to management staff. The least impactful aspect within this category is the availability of meeting/focus rooms. The implications associated with these results are consistent with those obtained through analyzing the "Privacy and Social Interaction" category. Employees highly value the presence of equal access to services and amenities; the location of such elements is critical within the hierarchy of spaces. The respondents seem to demonstrate a level of sensitivity to "room" terminology within the context of common or shared areas; it appears that negative responses were provided when that term was included in the question, whereas access to common "areas" turned out to have a strong impact on D_DV. This can be attributed to the fact that common areas are often linked with rest, relaxation, and social interaction, whereas meeting rooms are typically associated with lengthy, boring meetings that lead to fatigue and strain. This suggests that a higher level of user productivity and satisfaction can be achieved by deliberately prioritizing the proportion of and ease of access to common areas over traditional meeting and focus rooms during the design process. The level of social interaction, casual rest, and relaxation facilitated by way of designing spaces with proper and accessible common areas can have a positive impact on the well-being and productivity of workplace occupants.

Table 8

Spearman's correlations between the two main dependent variables (M_DV_1 & M_DV_2) and composite variables addressing the four independent categories.

			Composite variables			
			A: Physiological Health and Comfort	B: Efficiency and Ergonomics	C: Privacy and Social Interaction	D: Spatial organization (design)
Spearman's rho	M_DV_1: I am satisfied with my workplace environment (satisfaction)	Correlation Coefficient	.597**	.629**	.665**	.515**
		Sig. (2-tailed)	.000	.000	.000	.000
		N	145	145	145	145
	M_DV_2: My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity)	Correlation Coefficient	.466**	.515**	.612**	.430**
		Sig. (2-tailed)	.000	.000	.000	.000
		N	145	145	145	145

**. Correlation is significant at the 0.01 level (2-tailed).

The primary metrics of employee satisfaction and productivity are represented with the two main dependent variables: M_DV_1 and M_DV_2. The independent variables within each category were represented with a single composite variable: one for (A) Physiological Health and Comfort, B) Efficiency and Ergonomics, C) Privacy and Social Interaction, and D) Spatial Organization (Design). The relationship between each of the four composite variables representing each category and the main dependent variables was assessed using Spearman's rank correlation procedures. Category C was found to have the strongest correlation to both M_DV_1 and M_DV_2, and M_DV_1 was shown to have a rather robust correlation with all four categories (Table 8). Multicollinearity testing was performed for correlation models (Alin, 2010).

The metric for employee satisfaction with regards to the workplace environment, M_DV_1, is shown to be rather strongly correlated to all four categories. Spearman's rank coefficients between M_DV_1 and the Categories A, B, C, and D are 0.597, 0.629, 0.665, and 0.515, respectively. The abovementioned correlation coefficients were calculated with corresponding p-values that are less than 0.01, which highlights the significance level at which these findings are established.

The metric for productivity, M_DV_2, is also shown to be strongly correlated to all four categories. Spearman's rank coefficients between M_DV_2 and the Categories A, B, C, and D are 0.466, 0.515, 0.612, and 0.430, respectively. The abovementioned correlation coefficients were calculated with corresponding p-values that are less than 0.01, which highlights the significance level at which these findings are established.

Table 9

Multiple regression model for the main two DVs.

Model Summary					
M_DV_1: I am satisfied with my workplace environment (satisfaction)	Predictors: (Constant), A: Physiological Health and Comfort B: Efficiency and Ergonomics C: Privacy and Social Interaction D: Spatial organization (design)	R	R Square	Adjusted R Square	Std. Error of the Estimate
		.708[a]	.501	.486	.6317
Model Summary					
M_DV_2: My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity)	Predictors: (Constant), A: Physiological Health and Comfort B: Efficiency and Ergonomics C: Privacy and Social Interaction D: Spatial organization (design)	R	R Square	Adjusted R Square	Std. Error of the Estimate
		.616[a]	.379	.362	.7428

A simple multilinear regression exercise was conducted to study the ability of the four composite variables representing Physiological Health and Comfort, Efficiency and Ergonomics, Privacy and Social Interaction, and Spatial Organization (design) to predict M_DV_1 and M_DV_2, the main dependent variables measuring satisfaction and productivity. Multicollinearity checks were also conducted, and the obtained results are shown to be within the recommended thresholds established within the literature addressing such statistical studies (Alin, 2010).

Through this multilinear regression exercise, it is shown that the union of the four categorical variables (Physiological Health and Comfort, Efficiency and Ergonomics, Privacy and Social Interaction, and Spatial Organization (Design)) is a strong predictor of M_DV_1, the satisfaction metric. The coefficient of determination measuring the goodness-of-fit for this exercise, R-Squared, is 0.501, which means that

this regression model is able to explain over 50% of the satisfaction metric variance. The R-Squared coefficient associated with the second regression model targeting M_DV_2, the productivity metric, is 0.379. This implies a relatively weaker predictive ability for the second regression model; the results suggest that less than 40% of the productivity metric variance is explained by the model.

Comparative Analysis Between Cases

In the next part of the analysis, the study aimed to conduct a comparison among the 35 case studies. In order to initiate a comparison, first, an ANOVA test was conducted to explore if the differences between the 35 cases are statistically significant. ANOVA (Analysis of Variance) can be used to affirm a comparative study between cases by determining whether or not the observed differences among the cases are statistically significant (Sirkin, 2006). It is commonly employed when comparing means across multiple groups or conditions. The threshold (p-value) for significance was set at 0.05. Accordingly, the outcome of ANOVA indicates significant variation in all four categories between cases to justify a comparative study. The difference seems to be the strongest regarding "C: Privacy and Social Interaction", which is in line with the previous general analysis. It seems that Privacy and Social Interaction is relatively variable across the cases and is the most sensitive dimension in addressing quality of work life, satisfaction, and productivity (See table 10).

Table 10

ANOVA test among 35 case studies.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
A: Physiological Health and Comfort	Between Groups	1884.427	34	55.424	1.624	.032
	Within Groups	3684.999	108	34.120		
	Total	5569.427	142			
B: Efficiency and Ergonomics	Between Groups	1477.501	34	43.456	2.247	.001
	Within Groups	2088.318	108	19.336		
	Total	3565.818	142			
C: Privacy and Social Interaction	Between Groups	874.600	34	25.724	2.379	.000
	Within Groups	1168.016	108	10.815		
	Total	2042.615	142			
D: Spatial Organization (Design)	Between Groups	670.022	34	19.707	1.705	.021
	Within Groups	1248.342	108	11.559		
	Total	1918.364	142			

After affirming the significance of differences among offices, the four categorical composite variables were compared (A: Physiological Health and Comfort, B: Efficiency and Ergonomics, C: Privacy and Social Interaction & D: Spatial Organization). For the purposes of this section, each office is represented by a single numerical measure capturing the average response of the employees within that office. It is evident within the correlation table (see table 11) that the relationships between the four items are significant and consistent across all 35 cases, yet the correlation level is not so high to reject the idea of their independent significance (multicollinearity is not high).

Table 11

Correlation among four categorical composite variables across the 35 case studies.

Correlations

		A: Physiological Health and Comfort	B: Efficiency and Ergonomics	C: Privacy and Social Interaction	D: Spatial Organization (Design)
A: Physiological Health and Comfort	Pearson Correlation	1	.725**	.741**	.720**
	Sig. (2-tailed)		.000	.000	.000
	N	35	35	35	35
B: Efficiency and Ergonomics	Pearson Correlation	.725**	1	.739**	.660**
	Sig. (2-tailed)	.000		.000	.000
	N	35	35	35	35
C: Privacy and Social Interaction	Pearson Correlation	.741**	.739**	1	.744**
	Sig. (2-tailed)	.000	.000		.000
	N	35	35	35	35
D: Spatial Organization (Design)	Pearson Correlation	.720**	.660**	.744**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	35	35	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

The next step of the analysis includes a correlation between the two main dependent variables of the study (M_DV_1 representing satisfaction, and M_DV_2 representing productivity) and the four composite categorical variables (A, B, C & D) (Table 12). Based on this comparison, Efficiency and Ergonomics seems to be the strongest predictor of both M_DV_1 (satisfaction) and M_DV_2 (productivity). Based on the correlation table, we observe significant positive correlations between both satisfaction with the workplace environment and productivity with the four categorical composite variables. These findings suggest that improvements in these composite variables are associated with higher levels of satisfaction and productivity in the workplace environment.

Table 12

Correlation between the two main dependent variables of the study and four categorical composite variables.

Correlations					
		A: Physiological Health and Comfort	B: Efficiency and Ergonomics	C: Privacy and Social Interaction	D: Spatial Organization (Design)
M_DV_1_ I am satisfied with my workplace environment (satisfaction).	Pearson Correlation	.476**	.624**	.469**	.489**
	Sig. (2-tailed)	.004	.000	.004	.003
	N	35	35	35	35
M_DV_2_My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity).	Pearson Correlation	.405*	.573**	.479**	.419*
	Sig. (2-tailed)	.016	.000	.004	.012
	N	35	35	35	35
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Accordingly, the multiple linear regression model was performed once more to explore the predictability of the two main variables by the combination of the four categorical composite variables. In both models, the predictors (D: Spatial Organization (Design), B: Efficiency and Ergonomics, A: Physiological Health and Comfort, C: Privacy and Social Interaction) are significantly associated with the respective dependent variables (satisfaction and productivity) (Table 13). Across the 35 case studies, more than 65% of all variations in satisfaction (M_DV_1) can be explained by the four categories. This number is even higher regarding productivity (M_DV_2), accounting for 71% of all variations. The high R-squared values indicate that the predictors explain a substantial proportion of the variability in the dependent variables. The adjusted R-squared values also consider the complexity of the models by adjusting for the number of predictors and the sample size.

Overall, these findings suggest that the combination of Physiological Health and Comfort, Efficiency and Ergonomics, Privacy and Social interaction, and Spatial Organization (Design) significantly contribute to satisfaction with the workplace environment and productivity in conducting duties effectively, efficiently, and with low stress.

Table 13

Multiple linear regression model for predicting the two main dependent variables through the four categories across the 35 case studies

Model Summary				
Models	R	R Square	Adjusted R Square	Std. Error of the Estimate
1. Dependent Variable: M_DV_1_ I am satisfied with my workplace environment (satisfaction).	.817[a]	.668	.624	.384
a. Predictors: (Constant), D: Spatial Organization (Design), B: Efficiency and Ergonomics, A: Physiological Health and Comfort, C: Privacy and Social Interaction				

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2. Dependent Variable: M_DV_2_My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity).	.846[b]	.716	.678	.309
b. Predictors: (Constant), D: Spatial Organization (Design), B: Efficiency and Ergonomics, A: Physiological Health and Comfort, C: Privacy and Social Interaction				

Space Syntax - Grasshopper3D Plug-in Results

Space Syntax and the Social Logic of Interior Spaces

The configurational layout design of office buildings has a significant impact on the productivity, well-being, and satisfaction of users (T. Arnold, Hascher, Jeska, & Klauck, 2002). Improving our understanding of configurational relations between office spaces using the Space Syntax tool can provide insight into better design solutions aiming to improve both the functionality and social dimensions of the office environment (Thomas Arnold, 2011). By employing Space Syntax methodology, designers can utilize a single connectivity graph, which serves as an abstract representation of the spatial organization. This graph can be interpreted in a variety of geometric configurations that all share the same connectedness pattern but vary in size and shape. This pattern recognition, however, is built upon the two main well-documented presuppositions of Space Syntax: first, spaces are not mere background to human activities but rather an intrinsic aspect of them, and second, spaces can only be fully understood when considering their relation with all other spaces in a given network (spaces cannot be explored in isolation) (Bill Hillier, 2007; Bill Hillier & Hanson, 1984; Karimi, 2012). The current study employs a set of Space Syntax measures, including depth (visualized through justified graphs), entropy, integration, control, choice, and difference factor (Hanson, 2003; Bill Hillier & Hanson, 1984; Nourian et al., 2013; Zabihi & Mirzaei, 2023).

Considering the space as the container of social dynamics is among the strong drivers of this study. In this regard, the Space Syntax tool was selected as it offers a tangible and bottom-up reading of spatial configuration. Accordingly, the study aimed to overlay the survey with the spatial configuration of each office space. The Space Syntax analysis was conducted for each office using the Grasshopper application in Rhinoceros 3D as explained in Chapter 3. The study employed the six Space Syntax measures of Depth, Difference factor, Integration, Entropy, Control, and Choice. Each of these measures is shown to be associated with different characteristics of the movement, presence, interaction, or what Bill Hillier and Hanson (1984) call the "social logic of space". These measures were then separated (and normalized to account for different space sizes) according to their space typology. The numbers were added to the table representing the outcome of the survey for each case study. The following sub-headings represent the measurement, meaning, and interpretation of the results associated with each of the aforementioned Space Syntax measures. The workflow of these analyses is shown in Figure 25.

In order to provide a better comparative perspective, the analysis was performed for each office, and the results were separated for different types of spaces (where applicable). Measures like the difference factor are representative of the whole network and are not associated with individual spaces. The below spaces are the most common types of spaces found among all offices, although not all offices have all listed spaces (Table 14). An instance of the analysis is shown in Figure 26; all 35 cases are presented in Appendix B.

Table 14

space types explored in the Space Syntax analysis.

Entrance	E
Reception & Waiting Area	R&W
General Manager	GM
Managers	MA
Workstations	WS
Offices	O
Meeting rooms	ME
Service Area	SA
Common spaces	CS

Accordingly, the outcome of the survey and the Space Syntax analysis were normalized and organized into 35 cases. The statistical analysis was performed using

IBM SPSS. The significance threshold for the analysis was set to 0.05. The following sections of the thesis explore the correlations between Space Syntax measures and the outcome of the survey; this includes the two main dependent variables and the four composite variables representing the four major categories.

Figure 25

The process of investigating and overlaying the results of the survey and space syntax analysis across the 35 case studies.

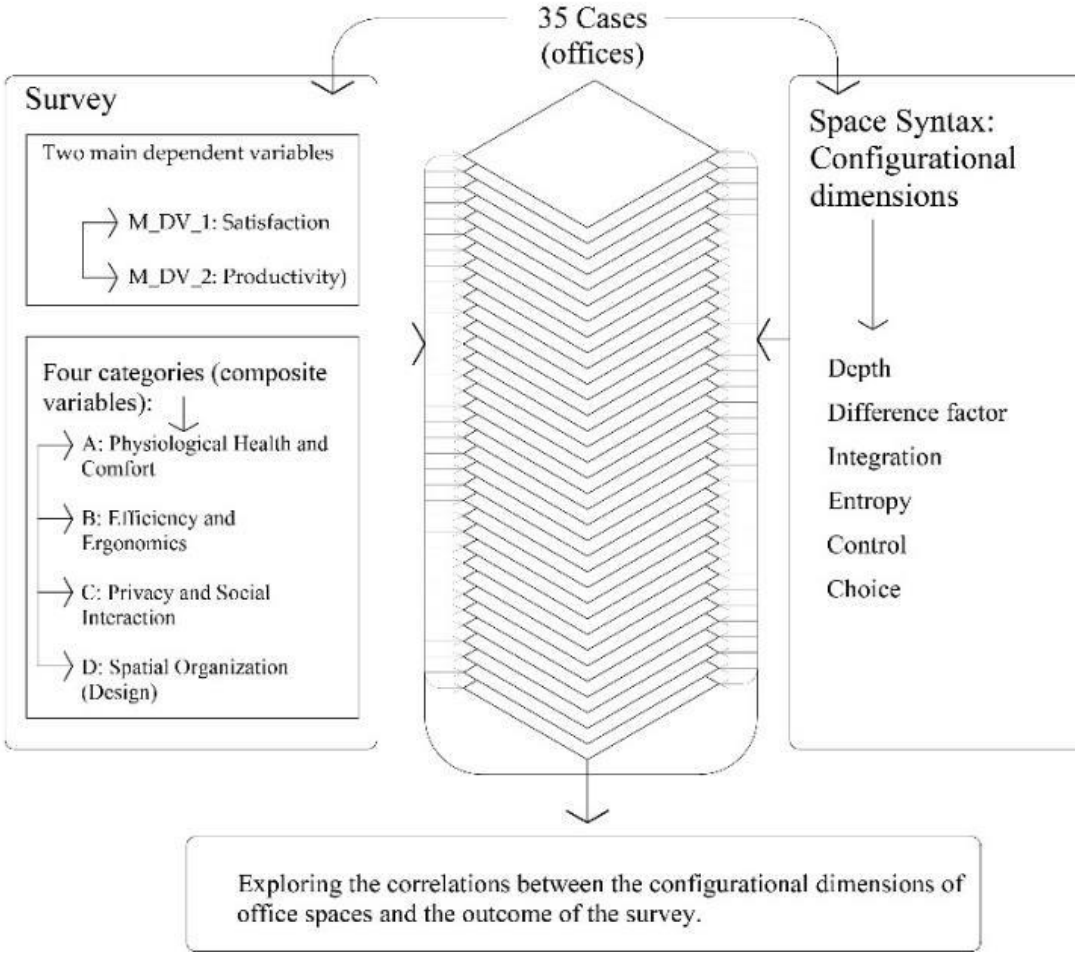
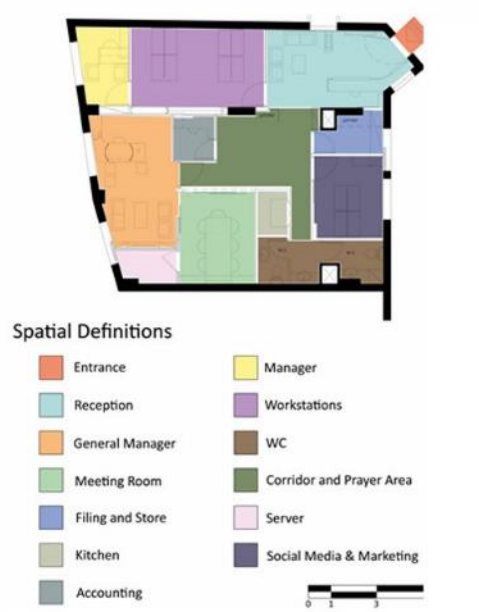
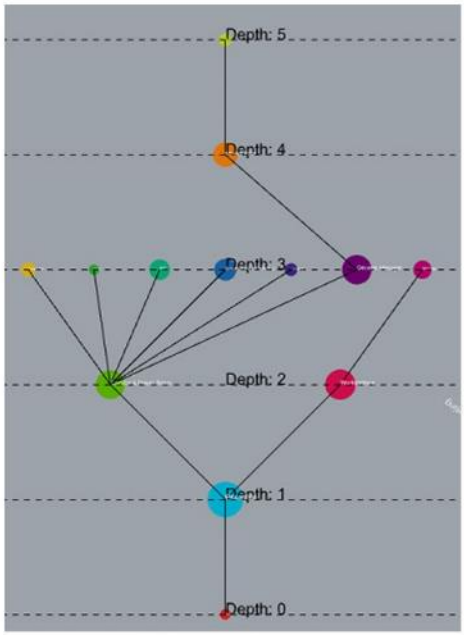


Figure 26

An example of the space syntax analysis outcome (Office #3) including Depth, difference factor, integration, entropy, control, and choice.

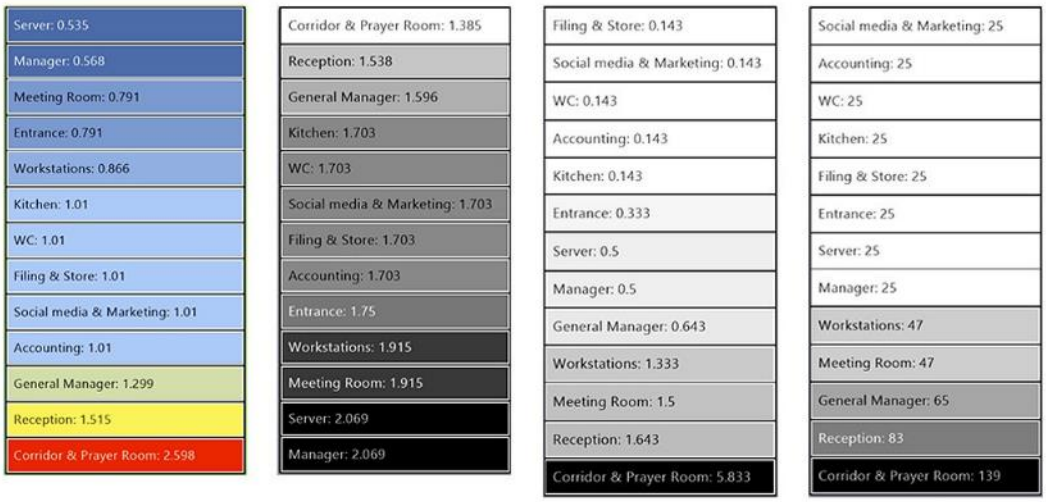


Spatial Definitions



View Depth

Difference factor:



Integration Entropy Control Choice

Depth

The mean depth is derived by assigning a depth value to each space based on how many spaces separate it from the original space, adding these values together, and dividing by the number of spaces in the system less one (the initial space) (Bill Hillier & Hanson, 1984). Figure 26 shows the depth graph represented based on the building entrance. Within the example shown in Figure 26, the depth graph is organized with the base of the network at the entrance. The depth in this case is the foundation on which other measures are constructed. In the example shown in Figure 26, the reception, which is the most visited and common space in the office layout, is at depth 1. On the other hand, the manager and general manager offices are at depth 5; these spaces are more isolated and more difficult to reach from the entrance.

Difference factor

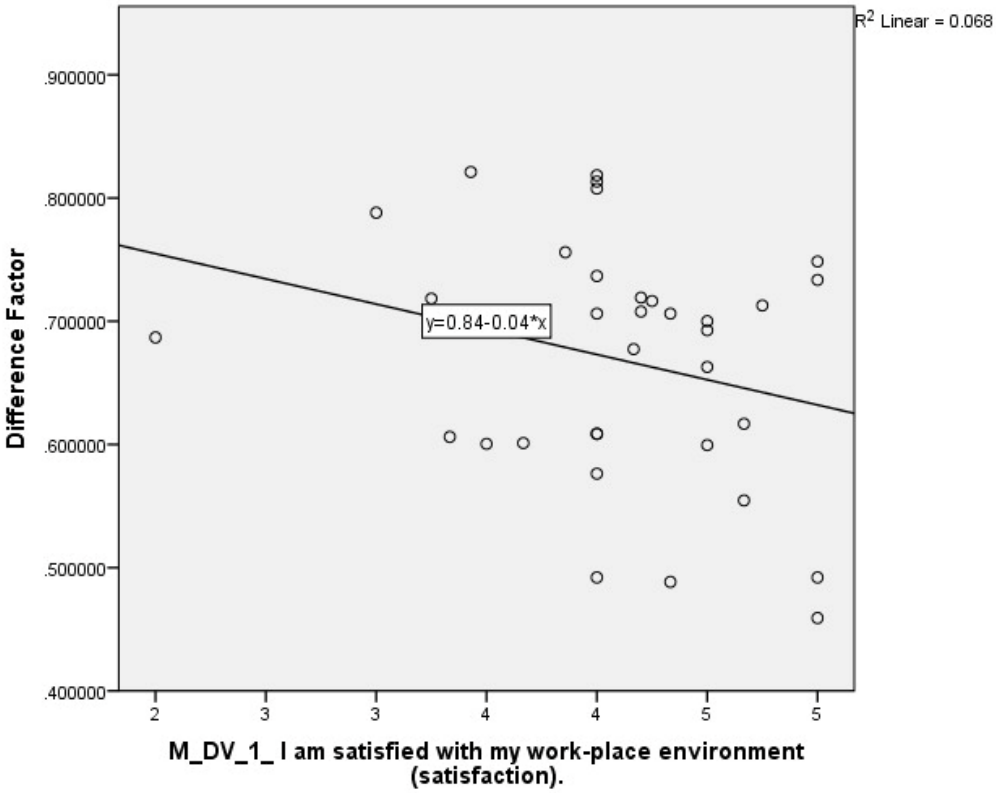
Originally developed by B Hillier, Hanson, and Graham (1987), the difference factor measures variations in the overall centrality of a network and is utilized to explore and compare interior spatial configurations. It is a measure of the articulation of the whole network (for calculations see Nourian et al., 2013). The base difference factor quantifies the variation in minimum, maximum, and mean integration values within the complex. It provides an indication of the potential for differentiation within the complex, which may or may not be utilized by different functions (B Hillier et al., 1987). The difference factor is a measure of homogeneity in integration value (Dawes, Ostwald, & Lee, 2021). A high difference factor indicates that the differences between the depth of various types of spaces (common versus less common) are not high (Bandyopadhyay & Merchant, 2006). The measure is useful when comparing networks of different sizes (see Bandyopadhyay & Merchant, 2006; Dawes et al., 2021). The difference factor is highly influenced by the structure and connections of the transitional spaces in a network.

In this case, the study was not able to isolate a statistically significant relationship between the difference factor and both dependent variables. Although a general negative association can be seen (Figure 27), the outliers prevent the analysis from indicating a strong correlation. As shown in Figure 27, some of the cases have scored really high on satisfaction, but are very low in difference factors. Based on these results, the complexity of the spatial arrangement does not seem to have a direct significant effect on satisfaction. That said, if controlled for the outliers in the

data set (four cases), a significant negative correlation between the two can be drawn, indicating that more homogenous spatial arrangements might negatively influence satisfaction and productivity. These distinctions might appear in a variety of ways, such as disparities in connectedness, centrality, visual permeability, or ease of mobility within the area.

Figure 27

scatterplot of difference factor in relation with the main dependent variable.



This is more evident when repeating the analysis in relation to the four categories. The difference factor shows a clear and significant relationship with the "Efficiency and Ergonomics" and with "Physiological Health and Comfort" categories. It can be inferred from these results that more homogenous building layouts have a negative impact on people's perception of efficiency and comfort (See Table 15).

Table 15

The correlation coefficient between the four categories (composite variables) and the difference factor.

Correlations					
		A: Physiological Health and Comfort	B: Efficiency and Ergonomics	C: Privacy and Social Interaction	D: Spatial Organization (Design)
Difference Factor	Pearson Correlation	-.432*	-.484**	-.323	-.274
	Sig. (2-tailed)	.011	.004	.062	.117
*. Correlation is significant at the 0.05 level (2-tailed).					
**. Correlation is significant at the 0.01 level (2-tailed).					

Integration

The Space Syntax integration value is a metric that evaluates a space's degree of closeness, centrality, or connectivity within a spatial graph representative of connection among architectural – or larger urban – spaces (Bill Hillier & Hanson, 1984). It determines how easily and directly a location can be visited or the degree to which it is accessible from other areas of the same environment. The integration value reveals the functional and social characteristics of interior environments (Bill Hillier & Tzortzi, 2006). An area with a greater integration value is more centrally positioned and well-connected within the overall plan. Such areas are more likely to see increased foot traffic, interactions, and accessibility. They can function as focal points or hubs, drawing people in and encouraging social interactions.

For the current study, the integration value was measured for all individual spaces across 35 case studies. First, the correlations among Space Syntax measures of integration for different space types were explored (Table 16). This analysis explores the common spatial patterns among all case studies that might be associated with configurational attributes. The strongest positive correlation was detected between office spaces and the manager room, both of which seem to be closely associated by design. Managers need to stay close and in communication with the designers in the office. The second positive correlation can be detected between meeting rooms and offices. It can be inferred from these results that among the 35 case studies, the centrality of the office spaces is associated with meeting rooms and manager rooms. Moreover, the entrances show significant correlation with manager rooms and workstations.

Table 16

The correlation coefficient among integration value of different spatial types across 35 offices.

Correlations

		Int_Entrance	Int_Reception & Waiting Area	Int_General Manager	Int_Manager	Int_Workstations	Int_Offices	Int_Meeting rooms	Int_Service areas	Int_Common spaces
Int_Entrance	Pearson Correlation	1	0.214	0.23	.400*	.345*	0.383	0.162	-0.071	-0.143
	Sig. (2-tailed)		0.239	0.619	0.017	0.042	0.079	0.384	0.685	0.495
Int_Reception & Waiting Area	Pearson Correlation	0.214	1	0.269	0.159	0.256	0.253	0.301	0.121	0.298
	Sig. (2-tailed)	0.239		0.607	0.384	0.156	0.281	0.12	0.508	0.157
Int_General Manager	Pearson Correlation	0.23	0.269	1	0.031	0.074	0.53	0.028	-0.152	0.721
	Sig. (2-tailed)	0.619	0.607		0.947	0.876	0.279	0.953	0.745	0.106
Int_Manager	Pearson Correlation	.400*	0.159	0.031	1	0.142	.603**	0.301	0.131	0.282
	Sig. (2-tailed)	0.017	0.384	0.947		0.414	0.003	0.1	0.455	0.172
Int_Workstations	Pearson Correlation	.345*	0.256	0.074	0.142	1	0.098	0.329	-0.103	0.082
	Sig. (2-tailed)	0.042	0.156	0.876	0.414		0.663	0.071	0.557	0.698
Int_Offices	Pearson Correlation	0.383	0.253	0.53	.603**	0.098	1	.473*	0.28	0.316
	Sig. (2-tailed)	0.079	0.281	0.279	0.003	0.663		0.03	0.206	0.217
Int_Meeting rooms	Pearson Correlation	0.162	0.301	0.028	0.301	0.329	.473*	1	0.247	0.292
	Sig. (2-tailed)	0.384	0.12	0.953	0.1	0.071	0.03		0.181	0.176
Int_Service areas	Pearson Correlation	-0.071	0.121	-0.152	0.131	-0.103	0.28	0.247	1	.568**
	Sig. (2-tailed)	0.685	0.508	0.745	0.455	0.557	0.206	0.181		0.003

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The study was not able to isolate a significant correlation between the integration value of spaces and both dependent variables. It could be argued that the integration value, which represents the closeness/centrality of spaces in a network, is not a significant predictor of satisfaction and productivity. The physical qualities of the environment seem to take precedence over closeness.

Entropy

Entropy quantifies the arrangement of places in relation to the most central space in the network rather than the actual distances between them (B Hillier et al., 1987; Turner, 2001). The entropy value is low when several locations are near a space, resulting in unequal depths (for instance, many rooms directly opening to a distribution hall). When the depths are more uniformly distributed, the entropy value increases. This metric accurately reflects culturally important changes in spatial arrangement topology. Accordingly, entropy can be interpreted as a measure of order in a spatial network (Salah El Samaty, Ziyad Feidi, & Mohamed Refaat, 2023).

In this regard, the entropy of all subspaced was calculated. There seems to be an overall negative correlation between entropy and both dependent variables. The two notable significant correlations are between M_DV_2 (productivity) and both manager rooms and workstations (Table 17).

Table 17

The correlation coefficients between the space syntax entropy measures and the two main dependent variables across the 35 case studies.

		Ent_Entrance	Ent_Reception & Waiting Area	Ent_General Manager	Ent_Manager	Ent_Workstations	Ent_Offices	Ent_Meeting rooms	Ent_Service areas	Ent_Common spaces
M_DV_1_ I am satisfied with my work-place environment (satisfaction).	Pearson Correlation	-.264	-.287	-.235	-.299	-.278	-.244	-.253	-.212	-.222
	Sig. (2-tailed)	.126	.111	.612	.081	.106	.275	.169	.221	.286
M_DV_2_My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity).	Pearson Correlation	-.242	-.319	-.362	-.359*	-.353*	-.375	-.226	-.257	-.310
	Sig. (2-tailed)	.161	.075	.424	.034	.037	.085	.221	.136	.131

*. Correlation is significant at the 0.05 level (2-tailed).

The analysis of the entropy metric can be further extended into the four main categories addressed by this thesis (A: Physiological Health and Comfort, B: Efficiency and Ergonomic, C: Privacy and Social Interaction, and D: Spatial

Organization). In fact, these are the strongest correlations that the study was able to identify (Table 18). It is evident that user Physiological Health and Comfort has a significant negative correlation with the entropy value. This is consistent with the outcome regarding the two main dependent variables. Notable and statistically significant instances of this negative correlation can be observed with respect to "reception and waiting areas", "workstations", and "common spaces". This shows the critical importance of spatial configuration within the office space and its effect on all dimensions of well-being and quality of work life.

Table 18

The correlation coefficient between the four categories (composite variables) and entropy value of different spatial types across 35 cases.

Correlations										
		Ent_Entrance	Ent_Reception & Waiting Area	Ent_General Manager	Ent_Manager	Ent_Workstations	Ent_Offices	Ent_Meeting rooms	Ent_Service areas	Ent_Common spaces
A: Physiological Health and Comfort	Pearson Correlation	-.412*	-.466**	-.368	-.380*	-.415*	-.409	-.398*	-.391*	-.405*
	Sig. (2-tailed)	.014	.007	.417	.024	.013	.059	.027	.020	.045
B: Efficiency and Ergonomics	Pearson Correlation	-.441**	-.427*	-.208	-.311	-.317	-.388	-.353	-.332	-.216
	Sig. (2-tailed)	.008	.015	.655	.069	.063	.075	.052	.051	.300
C: Privacy and Social Interaction	Pearson Correlation	-.221	-.275	-.694	-.271	-.212	-.336	-.179	-.212	-.276
	Sig. (2-tailed)	.203	.128	.083	.115	.222	.126	.337	.221	.181
D: Spatial Organization (Design)	Pearson Correlation	-.323	-.404*	-.844*	-.359*	-.424*	-.493*	-.328	-.300	-.425*
	Sig. (2-tailed)	.059	.022	.017	.034	.011	.020	.072	.080	.034
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

Control

Control is a local measure that explores the degree to which each space serves as a potential destination to its neighboring spaces. Every space is connected to a specific number of immediate neighbors (k) (Sharmin & Kamruzzaman, 2018; Zhang & Wang, 2021). Thus, each space distributes a value of 1/k to each of its neighboring spaces, and these values are summed to determine the control values of those

receiving spaces. Spaces with control values exceeding 1 exhibit strong control, whereas those below 1 are considered weak control spaces. For instance, corridors and distribution halls often show high degrees of control measure as they have numerous immediate neighbors. Control has been shown to be negatively associated with pedestrian movement (Sharmin & Kamruzzaman, 2018).

The mean value of the control is presented in Table 19. As suggested by the aforementioned literature, spaces such as "common spaces" (with a mean value of 2.45) and "reception" (with a mean value of 2.36) show high control (Table 19). This is natural and expected as both space types require high connectivity with other spaces in the network. The lowest ranked spaces regarding control are the 'general manager", "offices", and "manager" spaces. These spaces often have only one connection and are often not directly connected to main common areas.

Table 19

The descriptive statistics of the space syntax control measures across the 35 case studies.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Con_Entrance	35	.091	2.20	.46	.47
Con_Reception &; Waiting Area	32	.09	7.33	2.36	1.43
Con_General Manager	7	.11	.64	.29	.18
Con_Manager	35	.13	1.33	.44	.31
Con_Workstations	35	.13	4.36	1.31	1.06
Con_Offices	22	.13	.98	.38	.27
Con_Meeting rooms	31	.06	1.67	.64	.52
Con_Service areas	35	.17	1.01	.50	.28
Con_Common spaces	25	.92	5.83	2.45	1.16

Furthermore, the correlation coefficient between the control measure and the two main dependent variables was explored. The results presented in Table 20 show a significant positive correlation between the control measure of reception spaces and both dependent variables. It can be argued that satisfaction and productivity may be improved in offices with better-defined reception and waiting areas. This seems to be associated with the ability of these spaces to reduce/contain external noise and distractions. This is due to the fact that having well-connected waiting areas and reception areas creates a buffer zone between internal workflow activities and external activities.

Table 20

The correlation coefficients between the space syntax control measures and the two main dependent variables across the 35 case studies.

		Con_Entrance	Con_Reception & Waiting Area	Con_General Manager	Con_Manager	Con_Workstations	Con_Offices	Con_Meeting rooms	Con_Service areas	Con_Common spaces
M_DV_1_ I am satisfied with my work-place environment (satisfaction).	Pearson Correlation	.119	.362*	-.711	-.003	-.009	.098	-.134	-.095	-.312
	Sig. (2-tailed)	.496	.042	.073	.986	.957	.665	.473	.586	.128
M_DV_2_My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity).	Pearson Correlation	.055	.371*	-.568	-.019	-.138	.008	-.179	-.040	-.273
	Sig. (2-tailed)	.753	.037	.184	.912	.430	.971	.336	.821	.186

*. Correlation is significant at the 0.05 level (2-tailed).

Choice

Choice is a measure of betweenness; it explores spaces and their capacity as vessels of movement. Accordingly, considering all possible travel paths in a network, choice measures how often each space is used in the most optimum path among all origin- destination pairs. Spaces with high choice degrees are often essential components of the network and they are highly associated with the aggregate number of people using spaces (Bill Hillier, 2007; Sharmin & Kamruzzaman, 2018).

This study was not able to isolate any significant correlations between the choice measure and the two main dependent variables. However, regarding the four main categories of the study, many interesting outcomes can be observed (Table 21). The most notable instances are the significant negative correlations between "Physiological Health and Comfort" and the choice value for meeting rooms, manager rooms, and service areas. This indicates that in offices where these spaces have a more in-between nature, the users have reported lower degrees of Physiological Health and Comfort. Another notable instance is the negative correlation between the choice value of workstations and Spatial Organization. It can be argued that office users do not feel comfortable doing long work sessions (in a workstation) in a place with high choice. Table 22 shows the findings relevant to

correlations between the space syntax measures and the two main dependent variables.

Table 21

The correlation coefficient between the four categories (composite variables) and choice (betweenness) value of different spatial types across 35 cases.

Correlations

		Cho_Entrance	Cho_Reception & Waiting Area	Cho_General Manager	Cho_Manager	Cho_Workstations	Cho_Offices	Cho_Meeting rooms	Cho_Service areas	Cho_Common spaces
A: Physiological Health and Comfort	Pearson Correlation	-.188	-.319	-.105	-.340*	-.301	-.109	-.514**	-.338*	-.263
	Sig. (2-tailed)	.280	.075	.823	.046	.079	.630	.003	.047	.205
B: Efficiency and Ergonomics	Pearson Correlation	-.074	-.267	-.325	-.223	-.310	-.032	-.328	-.307	-.258
	Sig. (2-tailed)	.672	.140	.477	.198	.070	.888	.071	.073	.214
C: Privacy and Social Interaction	Pearson Correlation	-.108	-.209	-.563	-.257	-.280	-.142	-.346	-.284	-.249
	Sig. (2-tailed)	.538	.251	.188	.135	.103	.528	.056	.098	.231
D: Spatial Organization (Design)	Pearson Correlation	-.118	-.340	-.587	-.295	-.374*	-.071	-.414*	-.365*	-.372
	Sig. (2-tailed)	.499	.057	.166	.085	.027	.755	.021	.031	.067

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 22

Table of findings relevant to correlations between the space syntax measures and the two main dependent variables.

Measures	Correlations
Integration	The strongest positive correlation among the integration value of different spatial types across 35 offices was detected between office spaces and the manager room, both of which seem to be closely associated by design. The second positive correlation can be detected between meeting rooms and offices. Moreover, entrances show significant correlation with manager rooms and workstations.
Entropy	The entropy shows an overall negative correlation with both dependent variables. The two notable significant correlations are between productivity and both manager rooms and workstations.
Control	The results show a significant positive correlation between the control measure of reception spaces and both dependent variables. It can be argued that satisfaction and productivity may be improved in offices with better-defined reception and waiting areas.

CHAPTER V
Discussion

The move toward social sustainability has a strong spatial dimension that adds to the mere consideration of environmental sustainability. The space is the container of its social dynamics, and by extension a contributor to social sustainability. Social sustainability refers to the concept of creating and maintaining a society that promotes social well-being, equity, and inclusivity over the long term (McKenzie, 2004). It entails creating communities and spaces that improve people's quality of life, build social cohesiveness, and address the needs and ambitions of individuals and groups. Although these concepts can be addressed at large, this thesis argues that the very small reflections of space on people's daily life and work is a bottom-up and essential component of moving towards socially sustainable settings. Space in this regard embodies a social logic where the society shapes the space over time, and the space shapes some social constructs (Bill Hillier, 2007; Bill Hillier & Hanson, 1984). The dialogue between space at the very fundamental, need-based level and people has a profound impact on the social life that it houses. Accordingly, when it comes to interior spaces, several qualities can contribute to improving social sustainability. In this thesis, the idea of social suitability has been approached from the narrow window of interior space quality. Furthermore, quality of life and quality of work life have been explored relative to their profound impact on the well-being of people working in office spaces. Spaces that encourage social interaction and connection can enhance social sustainability by increasing the possibility of addressing occupant needs via mutual communication. In that sense, and within the scope of the following discussion, the study aims to address the research question and the two hypotheses set forth.

Design elements such as communal areas, seating arrangements that promote conversation, and shared amenities or facilities foster a sense of community and facilitate social bonds among individuals. Incorporating spaces for collaborative work, communal dining areas, or informal gathering spots can promote social interaction and create opportunities for people to engage with one another. While fostering social interaction is important, it is equally essential to provide areas that offer privacy and personal space. Interior spaces should strike a balance between shared spaces and quiet retreats where individuals can relax, focus, or have personal

conversations which can lead to better performance and higher satisfaction (S. Ornstein, 1989; S. W. Ornstein, 1999). Incorporating designated quiet zones, private meeting rooms, or cozy reading corners within a larger space allows people to have moments of solitude and personal reflection. Furthermore, safe and secure interior spaces are critical for social sustainability. This includes things like sufficient lighting, clear signage, and well-designed circulation patterns to make individuals feel safe and able to navigate the environment without fear. Adequate methods to prevent accidents, deal with emergencies, and control crowd movement contribute to the overall well-being and comfort of all space users. The general well-being and mood of individuals can be improved by having access to natural light, views of nature, indoor plants, and natural materials. These factors have been demonstrated to lower the level of stress, increase cognitive performance, and build a sense of connection with the environment, resulting in a healthier and more sustainable social experience.

In aiming for this, the study explored the literature and categorized the parameters that might impact wellbeing, quality of life, and quality of work life of office workers into four distinct categories: Physiological Health and Comfort, Efficiency and Ergonomics, Privacy and Social Interaction, and Spatial Organization (Design).

The flow of ideas between employees and their ability to work together effectively are likely to be improved by workspace designs that promote collaboration and interaction. Such designs can potentially facilitate innovative solutions and the integration of different teams across an organization. A higher level of connectivity between individuals increases the likelihood of job engagement and commitment. In that sense, the well-being of space users can be enhanced through workspaces that feature proper lighting, that present a comfortable setting, and that cater to user health (Voordt & Jensen, 2023). This can be achieved by way of carefully addressing aspects like natural lighting, air quality, ergonomic furniture, and access to the outdoors. Employee health and level of comfort can improve productivity and engagement (Voordt & Jensen, 2023). A sense of belonging to the organization can be fostered by way of workspace designs that address diversity and inclusion. This study investigated quality of work life and quality of life in light of these variables to present the argument that they are integral to the notion of social sustainability in office workspaces.

The results and insight of Vischer and others (Jacqueline Vischer, 1989, 1996, 2005, 2007, 2008a, 2008b, 2012, 2018; Jacqueline Vischer & Wifi, 2017) were harnessed within this study in the context of workplace design and social sustainability. The survey employed within this study represents an enrichment to the Building-In-Use (BIU) assessment tool (Jacqueline Vischer, 1996, 2018) by way of synthesizing an additional category that addresses the spatial organization and design of workplaces. Within this construct, tangible space attributes are viewed to possess a direct influence on promoting or inhibiting the social characteristics of the interactions taking place in the space. A balance between private personal spaces and communal spaces that are essential to forming a collective community in the workspace increases the likelihood of employee connectedness and organizational belonging. Examples of communal places include dining and socializing spaces, shared collaboration spaces, and the spaces dedicated to exercises aimed at team-building. Performance and satisfaction within the workplace environment are highly impacted by spatial organization and office layout (Brunia et al., 2016; Candido et al., 2019). A summary of the four categories covered by this study and a collection of subitems ranked according to statistical significance are presented in Table 23.

Table 23

Categories in order of observed statistical significance (left-to-right) and most significant items in each category (top-down) as reported via survey.

CATEGORIES IN ORDER OF SIGNIFICANCE	#1: (HIGHEST) C_DV: PRIVACY AND SOCIAL INTERACTION	#2: B_DV: EFFICIENCY AND ERGONOMICS	#3: A_DV: PHYSIOLOGICAL HEALTH AND COMFORT	#4: D_DV: SPATIAL ORGANIZATION (DESIGN)
#1 (HIGHEST RANKED ITEM IN THE CATEGORY)	C_Q4_ Team proximity	B_Q2_ Furniture ergonomics	A_Q3_ Unpleasant odors	D_Q5_ Access to services and amenities
#2	C_Q1_ Safety and building security	B_Q1_ Size of office/workstation	A_Q1_ General cleanliness and hygiene	D_Q6_ Access to common areas
#3	C_Q2_ Density and over-crowdedness	B_Q3_ Flexibility and personalization	A_Q7_ Artificial lighting	D_Q3_ Access to management
#4	C_Q5_ Visual and acoustic privacy	B_Q4_ Work surfaces area	A_Q2_ Thermal comfort	D_Q4_ Access to information and archives

Catering to privacy and accommodating individual space needs were shown within this study to be important to the overall employee experience in the

workplace. Out of the results obtained within this study, the strongest correlation established was between employee satisfaction and the Privacy and Social Interaction category. This is most highlighted within answers associated to acoustic privacy (also see Haynes et al., 2017; Rashid & Zimring, 2008) and the amenability of the space to personalization (Nappi, de Campos Ribeiro, & Cochard, 2020). In that sense, the results derived from this study imply that the quality of work life can be positively impacted by workplaces that demonstrate a high level of flexibility (Sirgy et al., 2008). While there is a general trend within the results obtained towards a level of satisfaction with preexisting workplace arrangements, the study reveals a number of items for which some enhancement is necessary. Such items include views to the exterior, workspace flexibility, and employee privacy. As suggested by relevant literature, aspects including the level of artificial lighting, hygiene and cleanliness, and the presence of undesirable odors significantly impact employee comfort and physiological health in the workplace (Jung & El Samanoudy, 2023; T. S. Larsen et al., 2020; Li & Tsang, 2008; Mujan et al., 2019; Wong et al., 2008). These results emphasize the importance of carefully considering these aspects in the pursuit of enhancing employee health and productivity in the workplace.

The first part of this discussion aims to address the first hypothesis (H1). Drawing from the outcome of the survey, it is evident that strong evidence exists in favor of the hypothesis. The findings (See Tables 4-13 and 23) suggest a strong correlation between overall employee satisfaction and productivity in the workplace and detailed employee functional comfort scores under each of the four categories considered. The statistical significance of the final regression model suggests that hypothesis 1 can be held with high confidence.

The Configurational Dimensions of Interior Spaces

One of the nuances of this study was embedded in its methodical approach. The bottom-up configurational dimensions of office spaces were integrated and cross-referenced by the outcome of the survey. The Space Syntax analysis conducted aimed to provide tangible spatial and design-oriented insight into the office work environment. The results of the survey and the Space Syntax analysis were studied for all 35 cases. Accordingly, the results were interpreted in a comparative manner in search of potential patterns connecting the results of the survey (as primarily represented by the two main dependent variables of satisfaction and productivity and

the four categories of Physiological Health and Comfort, Efficiency and Ergonomics, Privacy and Social Interaction, and Spatial Organization). A comparative analysis between case studies was conducted to draw more detailed results.

The first significant variable that was identified was the difference factor. In relation to all other variables, a negative correlation was observed. First, the nature of the difference factor must be concretely dissected. Consider an open-plan office with cubical workstations laid out in a grid arrangement. Each workstation has direct access to its neighbors, resulting in a highly integrated arrangement. The average depth of this space is modest since every workstation is close to every other workstation. The mean depth of the focus space will be much lower than the mean depth of its nearby spaces when calculating the difference factor, resulting in a positive difference factor. Thus, as the difference factor is a measure of homogeneity, an argument can be made that spaces that lack sufficient degrees of complexity (i.e. those that are too repetitive) might negatively impact the quality of work life, and consequently, the quality of life (also see Colenberg, Jylhä, & Arkesteijn, 2021; Engineer et al., 2021; Steen & Markhede, 2010). QWL and QoL are major long-term contributors of socially sustainable spaces. These negative correlations were significantly reflected on the composite variables representing Physiological Health and Comfort and Efficiency and Ergonomics.

In terms of closeness and centrality, the study was not able to isolate any significant correlations between the outcome of the survey and the integration value. However, the significant internal correlation among the integration of different spaces provides an opportunity to explore recurring patterns in office spaces in Jordan. A strong positive correlation was detected between the integration of office spaces and manager rooms, meaning that they often are closely related to each other. The selection of spaces for mangers may be such that closer supervision of the designers in the office is facilitated. Service areas are also shown to be closely related to common spaces in most offices.

According to the findings, the entropy of subspaces has a negative connection with both dependent variables. A negative correlation suggests that when entropy rises, the values of the dependent variables tend to fall. The nature of these relationships is not specified, but it appears that there is a statistically significant association between the level of connectivity of workstations and management rooms with productivity. Literature suggests that when workstations are overly connected,

productivity levels may suffer due to excessive noise, external distractions and over-crowding (e.g. Evans & Johnson, 2000; Haynes et al., 2017; Rashid & Zimring, 2008; Roskams et al., 2019; Sundstrom et al., 1980; Sundstrom et al., 1982). It is important to note that further analysis or contextual understanding would be required to determine the underlying reasons for this negative impact.

In an office building, for instance, entropy can be reflective of the movement patterns of people. A high entropy value may indicate that people move equally between different rooms from a given starting position, suggesting a more random distribution of movement. Conversely, if there is a predominant flow of people towards specific areas or floors, this may be reflected by a lower entropy value, indicating a more organized spatial configuration.

Accordingly, entropy provides a quantitative measure to assess the level of order or disorder in spatial layouts. It helps researchers and designers understand how spatial configurations influence movement patterns and accessibility, which can have implications for urban planning, architecture, and wayfinding systems.

The study further explored the measure of control as a local measure that explores the relationship between spaces and their neighboring spaces (Sharmin & Kamruzzaman, 2018; Zhang & Wang, 2021). As expected, common spaces, reception and waiting areas showed the highest degrees of control. The results demonstrate a substantial positive connection between the reception space control measure and both dependent variables. It might be suggested that satisfaction and productivity may increase in offices with better-defined reception and waiting rooms. This appears to be related to the ability of these areas to reduce/contain external noise and distractions. It can be argued that this is a consequence of the buffer zone well-connected waiting and reception areas provide between internal and external workflow processes.

The measurement of choice was also investigated in its potential relationship with the survey outcome. In an office setting, the degree of freedom afforded to individuals in terms of choosing paths and destinations within the spatial arrangement is referred to as the space syntactic choice measure. It is concerned with the concept of spatial accessibility, as well as the ease of movement and navigation inside the office environment. The space syntax choice measure has the potential to impact both productivity and well-being.

Within this study, one of the most notable instances demonstrating the effect of choice is the negative correlation between "Physiological Health and Comfort" and the choice value associated with meeting rooms, manager rooms, and service areas. This suggests that space users reported lower levels of Physiological Health and Comfort in offices demonstrating a higher degree of in-betweenness. Another significant example is the negative link between workstation space betweenness and Spatial Organization. It may be argued that office users do not feel comfortable completing long work sessions (in a workstation) in a space with a high choice measure. It is important to note that the outcome of this study might be contextual; human behavior often demonstrates some degree of randomness and external influences relative to specific context at hand (Bafna & Ramash, 2007). Nevertheless, the significant correlations that were detected across 35 case studies imply some robust patterns between the configurational dimensions of the office layout, satisfaction, and productivity. In fact, including the significant Space Syntax results into the regression model shows a significant improvement in predictive ability. When including some of the aforementioned Space Syntax variables, more than 70% of the variability surrounding both dependent variables can be addressed (Table 24). This result, along with the previous regression models and the extended literature review, all support the validity and strength of the original hypotheses of the study. Accordingly, it can be argued that the four categories that were designed to address the quality of interior space and the configurational dimensions of office layout have a profound impact on QoL, QWL, and, by extension, the possibility of moving toward a socially sustainable work environment. It must be noted that these hypotheses are formed within the limited scope of the study; the concept of social sustainability is approached from a spatial perspective within which the space is considered the container of and an influencer on social dynamics.

Based on the foregoing, the statistical significance of the relationship between the configurational attributes of office spaces and the outcome of the survey suggests that strong evidence exists in favor of hypothesis 2 (H2) (See Tables 15-22 and 24). Therefore, at least for a number of combinations of space syntax metrics and zones, it can be argued that the layout and spatial attributes of workplace spaces represented by Space Syntax metrics are correlated with overall employee satisfaction and productivity along with employee functional comfort scores under each of the four categories considered.

Table 24

the regression model including some of the space syntax variables that were shown to be significant.

Model Summary				
Models	R	R Square	Adjusted R Square	Std. Error of the Estimate
1. Dependent Variable: M_DV_1_ I am satisfied with my workplace environment (satisfaction).	.856[a]	.733	.691	.399
a. Predictors: (Constant), Con_Reception & Waiting Area, A: Physiological Health and Comfort, B: Efficiency and Ergonomics, D: Spatial Organization (Design), C: Privacy and Social Interaction				

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2. Dependent Variable: M_DV_2_My current workplace design helps me conduct my duties effectively, efficiently, and with a low level of stress (productivity).	.863[b]	.744	.700	.304
b. Predictors: (Constant), Ent_Workstations, C: Privacy and Social Interaction, B: Efficiency and Ergonomics, D: Spatial Organization (Design), A: Physiological Health and Comfort, Ent_Manager				

CHAPTER VI
Conclusion and Recommendations

Conclusion

This study addresses the vast concept of social sustainability from a limited, well-defined angle. This thesis attempted to explore a narrow scope through which spatial attributes render possibilities that might promote social sustainability in the workplace.

Multiple statistically significant correlations between overall employee satisfaction and productivity and detailed comfort scores were detected. While this is not true for all Space Syntax metrics and zones, a number of statistically significant correlations were detected between some Space Syntax metrics and detailed functional comfort scores along with overall employee satisfaction and productivity. This evidence strongly supports both research hypotheses (H1 and H2) adopted within this study. Considering the scope and limitations of the study, the strong evidence provided by the analysis can supply valuable insight for designing office spaces with social sustainability in mind. The study, at its core, specifically focuses on the concept of social sustainability, approaching it from a spatial perspective. In this context, the study considers space as both a container and an influencer of social dynamics and emotions, particularly in relation to the overall progression towards sustainability.

While attention to social sustainability is picking up in the research community, this aspect of sustainability still very much lags behind the more commonly studied environmental and economic aspects. The overarching aim of this study was to integrate social sustainability within the workplace interior design practice by way of putting forth design guidance on characteristics that maximize functional comfort and social sustainability in the workplace. Table 22 was put together with the goal of presenting to the reader the most impactful aspects in relation to employee satisfaction and productivity, ranked by order of significance. The results obtained show that “Privacy and Social Interaction” and “Efficiency and Ergonomics”, in that order, are the two most significant categories in terms of establishing socially sustainable workplaces in Jordan. Subitems within each category can be harnessed to establish design guidelines with a higher level of detail – for instance, the proximity of team members to each other within the workplace

setting and the level of privacy and personal safety were shown to be the aspects with the most significant contribution under the umbrella of the “Privacy and Social Interaction” category. In light of these results, it is clear that establishing a reasonable equilibrium between individual needs and community building is of paramount importance.

This study and its findings provide useful insight for practical design teams and academics seeking to integrate social sustainability in the design process and further explore this subject. The results are presented in a manner that allows adoption in future studies within numerous contexts targeting a range of indoor spaces.

Social sustainability and employee well-being can be significantly enhanced by deliberately considering the design characteristics of workspaces. Nonetheless, it is worthy of note that the scope of this study was restricted to workplaces that are located in Jordan; careful assessment must be conducted before attempting to generalizing these results to workplaces in other geographies. This aspect admits room for further investigation in order to robustly establish the relationship between the subitems considered and the overall quality of the workplace environment in different geographies with the aim of designing socially sustainable workplaces.

In light of this study, it is evident that workplace design should place emphasis on producing spaces that cater to the health, well-being, and satisfaction of employees in addition to ensuring an adequate level of functionality. This is of paramount importance to ensuring an adequate level of social sustainability within the workplace, which is critical to maximizing the level of sustainability within the context of the wider society.

One of the methodological nuances of this study is the combination of Space Syntax analysis and survey results. The strong literature background of Space Syntax supports the usability of its measures in creating a bottom-up insight into the configurational design of interior spaces. The outcome of the study supports and compliments this literature. In this regard, analyses were conducted and cross-referenced across 35 case studies in Jordan. While this study acknowledges that human movements, interactions, and presence demonstrate random behavior at individual level, many significant correlations were identified between Space Syntax analysis results and the outcome of the survey.

For instance, it can be concluded that spaces with higher degrees of homogeneity create a less pleasant work environment. This is reflected in both satisfactions with the work environment and with the level of productivity. This outcome is reflected in the negative correlation between the Space Syntax difference factor and survey results.

Further, the study shows that subspace entropy has a negative relationship with the dependent variables, particularly productivity. Entropy values of workstations and manager rooms appear to have a substantial impact on productivity. Furthermore, common spaces, reception areas, and waiting areas were shown to be associated with the performance in the offices. These spaces, provide a buffer that contains movements and external distractions, and supply a designated area for social interaction and communication.

Recommendations

As is the case with any study, the limitations must be carefully considered in order to properly understand, apply, and extend on the obtained findings. One limitation associated with this study is the fact that it is strictly focused on traditional workplace arrangements, without assessing remote work arrangements which gained prominence after the global COVID-19 pandemic. This is an opportunity for future investigation; future efforts may explore the notion of social sustainability within the context of home and remote workplace environments. Another limitation applicable to this study is its strict focus on professional interior design and architecture practitioners; future studies may conduct similar assessments to explore whether different trends emerge for workforce groups of different backgrounds (e.g. those not involved in the design practice). As mentioned previously, this study targeted workplaces located in Jordan only, so further research aiming to explore the influence of cultural and contextual aspects on the relationship between spatial attributes and the notion of workplace social sustainability in other international settings are needed to formulate a globally applicable understanding. These limitations emphasize the constraints on generalizing this study with respect to context-specific differences relative to professional, cultural, environmental, social, and psychological considerations.

It is worth noting that the precise design and configuration of the office space, as well as company culture and individual preferences, can all enhance the

influence of configurational measures on productivity and well-being. A thorough examination of these aspects is essential for developing an office atmosphere that promotes productivity and employee well-being.

An office with a well-designed layout that offers multiple path choices and clear connections between different areas can enhance productivity. Ideally, employees can move about the office more effectively since they have easy access to multiple workstations, conference rooms, and resources. Furthermore, a physical plan that encourages employee engagement and unexpected encounters can boost cooperation, information sharing, and idea generation. A setting that allows for simple communication and spontaneous encounters can improve teamwork and productivity. On the other hand, open and collaborative spaces must be balanced with areas that provide seclusion and a calm setting for concentrated work. Providing rooms with limited accessibility and that are separated from high-traffic areas might help people focus on jobs that demand intense concentration, thereby boosting productivity.

Highly homogenous spaces were shown to be negatively correlated with “Efficiency and Ergonomics” and with “Physiological Health and Comfort”. Consequently, designing repetitive workstations (e.g. monotonous cubical settings) is recommended to be avoided.

Reception and common areas are recommended to be designed with a higher level of control. This can provide a buffer between the inside workflow of the offices and external distractions. Having well-defined and well-connected common and reception areas creates designated spaces in which social interactions can take place.

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Appendices

Appendix A

Ethical Committee Approval

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

22.06.2022

Dear Shrouq Altamimi

Your application titled **"Socially Sustainable Workplace Interior Design: A Study on Interior Design and Architecture Offices in the Post COVID-19 Pandemic Era"** with the application number NEU/AS/2022/162 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of theScientificResearchEthicsCommittee

Direnc Kanol

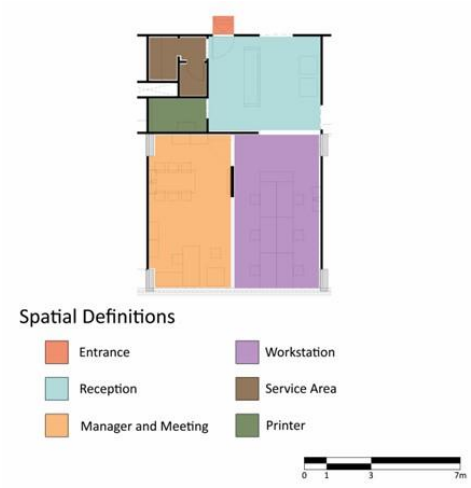
Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.

Appendix B

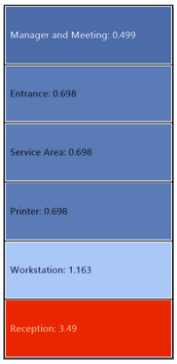
Space Syntax Analysis Results

Office (1)

Office (1) - Plan

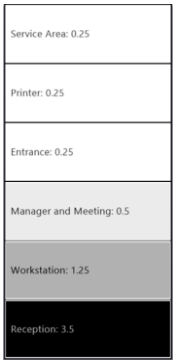


Office (1) - Spatial Definitions



Office (1) - Integration

Office (1) - Entropy



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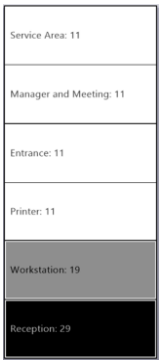
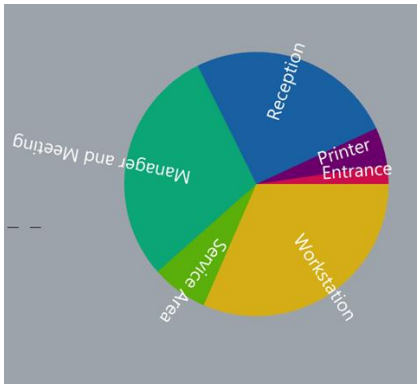
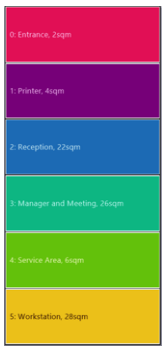


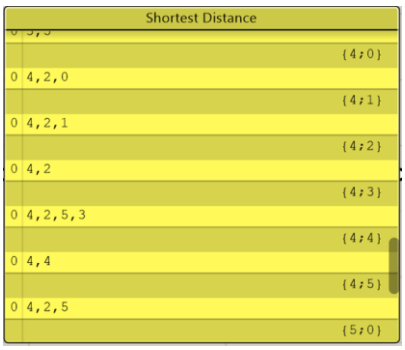
Office (1) - Choice



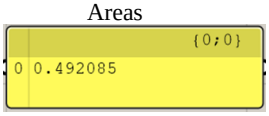
Office (1) - Zones Pie Chart



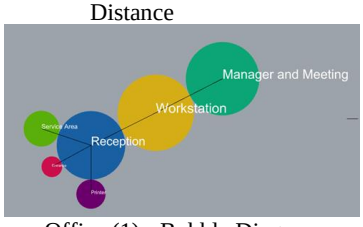
Office (1) - Areas



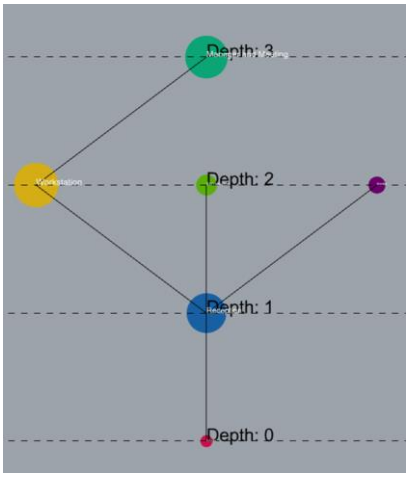
Office (1) - Example of Shortest Distance



Office (1) - Difference factor

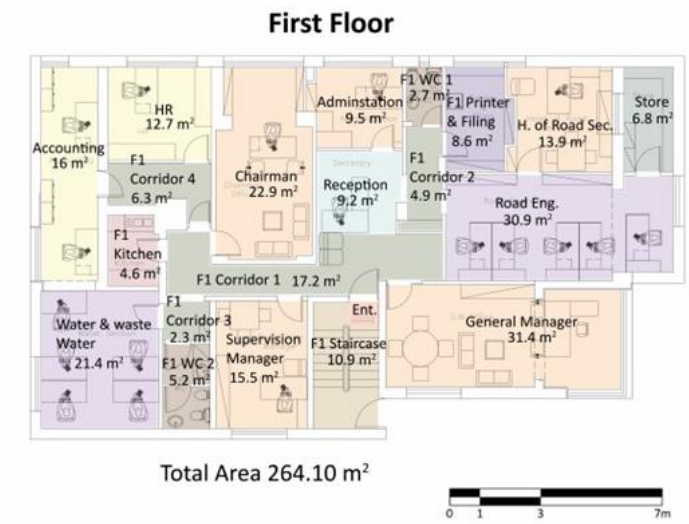


Office (1) - Bubble Diagram

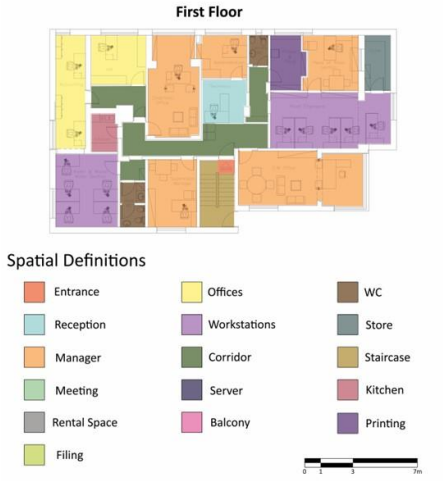


Office (1) - View Depth

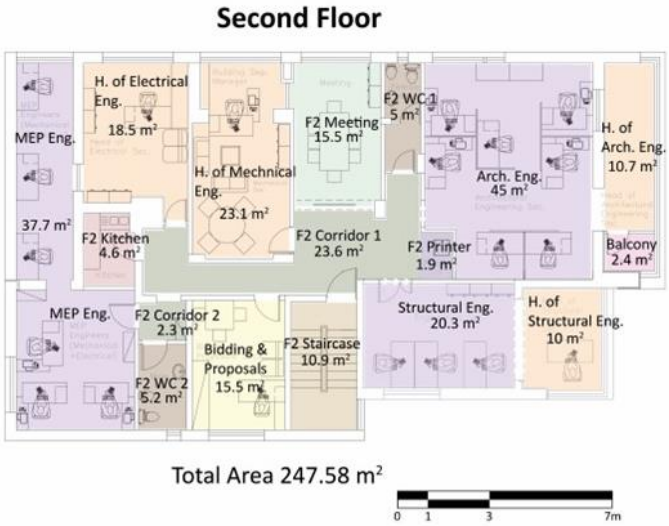
Office (2)



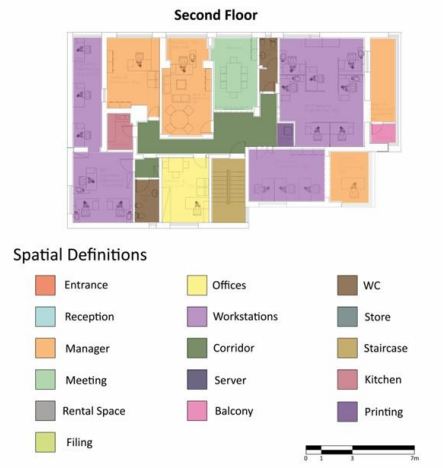
Office (2) - First Floor Plan



Office (2) - First Floor Spatial Definitions



Office (2) – Second Floor Plan



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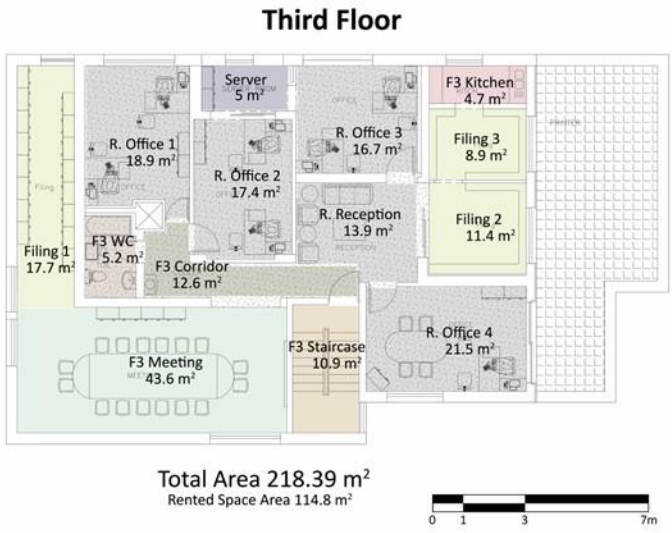
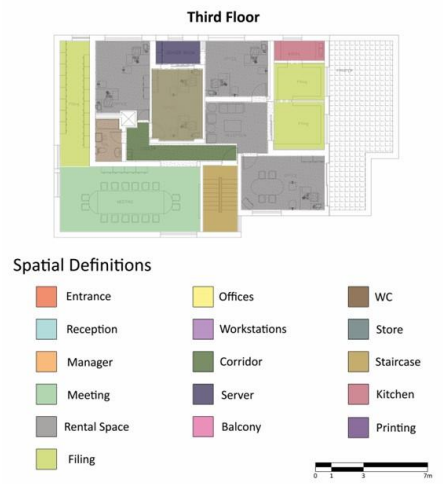


Office (2) - Third Floor Plan



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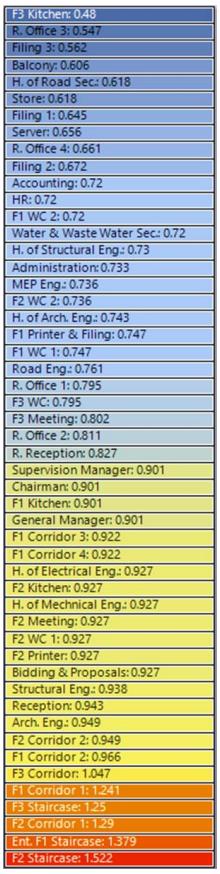

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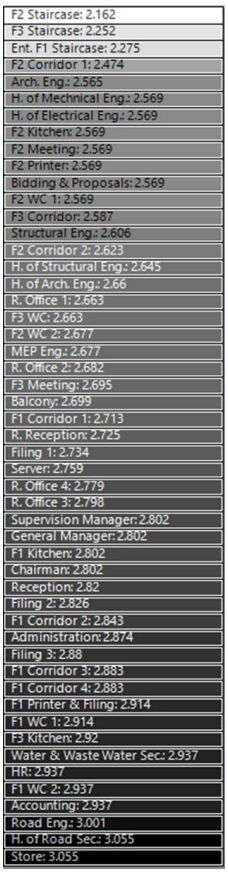
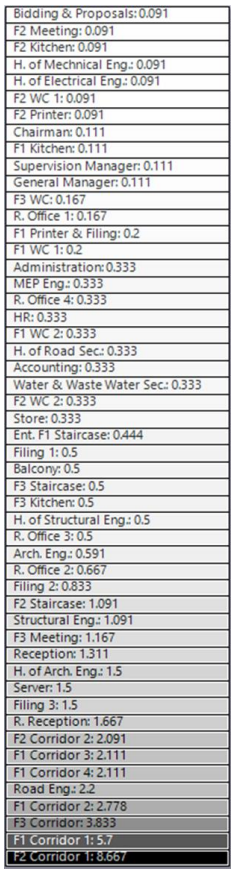


Office (2) - Entropy



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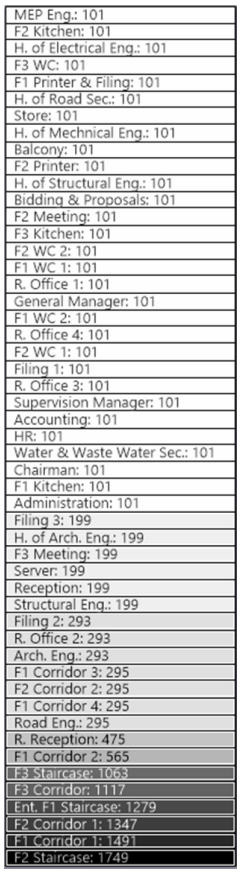
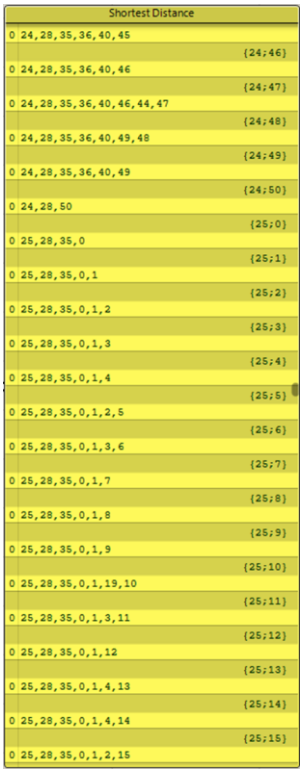
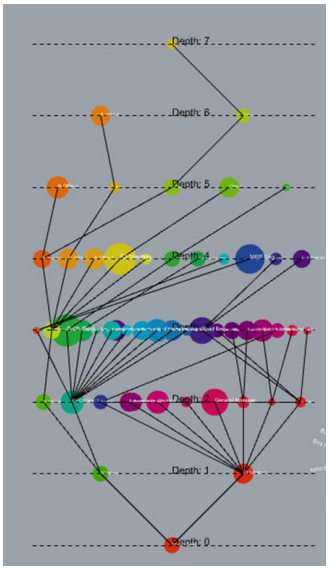


Office (2) - Choice

Office (2) - Areas

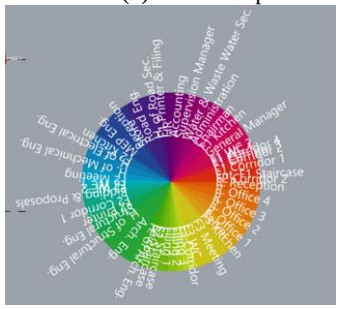


Office (2) - Example of Shortest Distance



Office (2) - View Depth

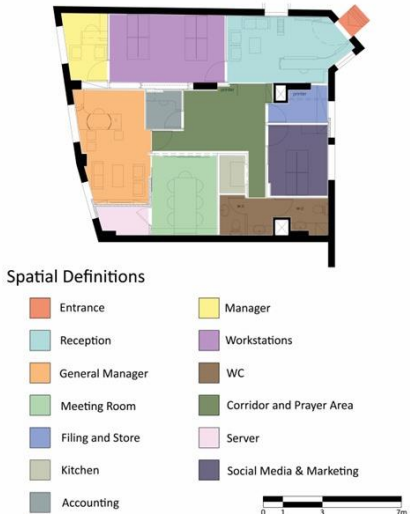
Office (2) - Difference factor



Office (2) - Zones Pie Chart

Office (3)

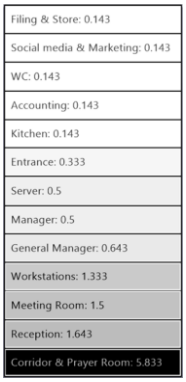
Office (3) - Plan



Office (3) - Spatial Definitions

Office (3) - Integration

Office (3) - Entropy



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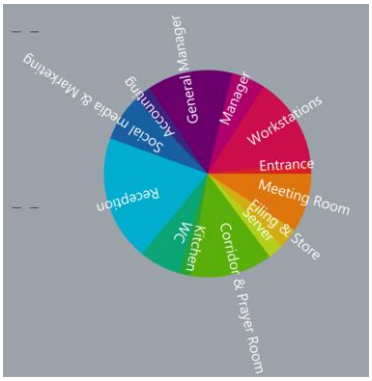

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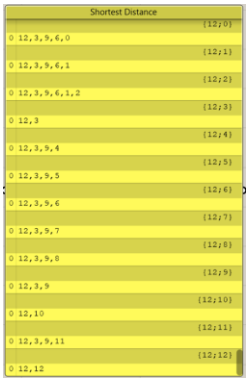
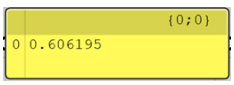
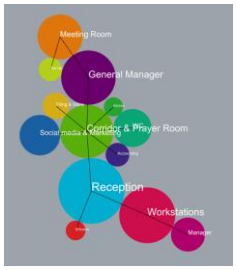
Office (3) - Areas



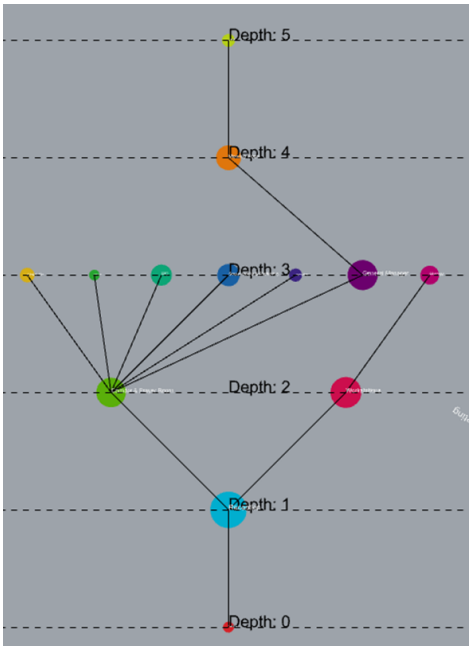
Office (3) - Example of Shortest Distance



Office (3) - Difference factor

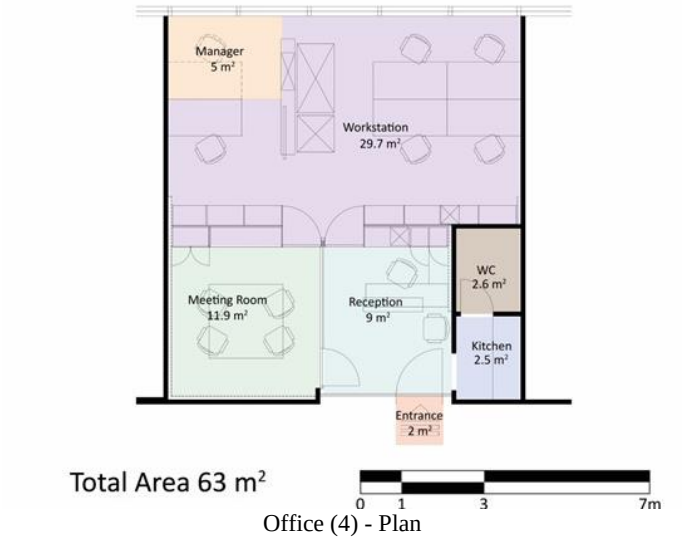


Office (3) - Bubble Diagram

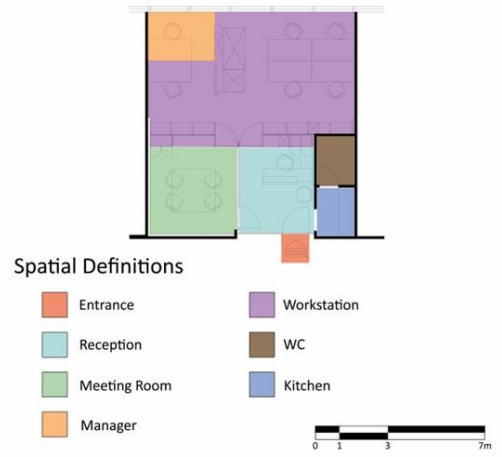


Office (3) - View Depth

Office (4)



Office (4) - Plan

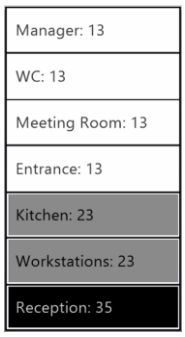


Office (4) - Spatial Definitions

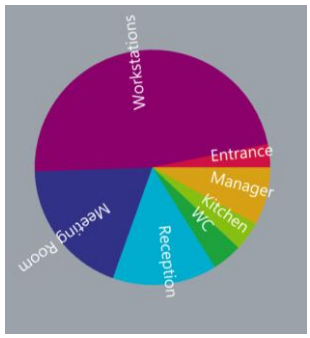
Office (4) - Integration

Office (4) - Entropy

Office (4) - Control

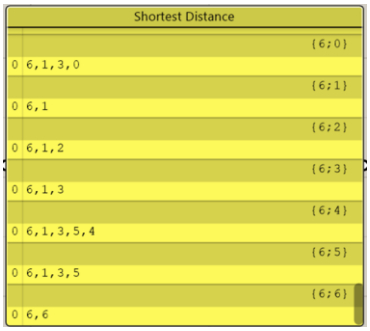


Office (4) - Choice

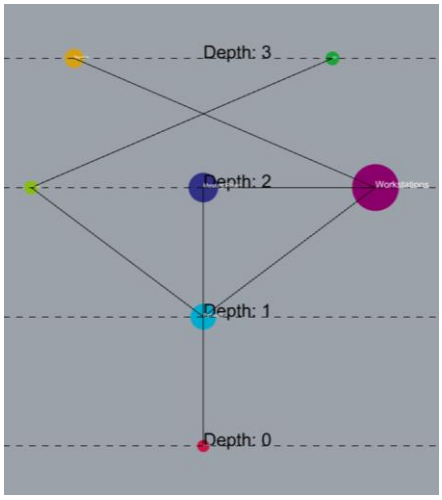


Office (4) - Zones Pie Chart

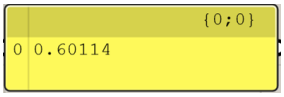
Office (4) - Areas



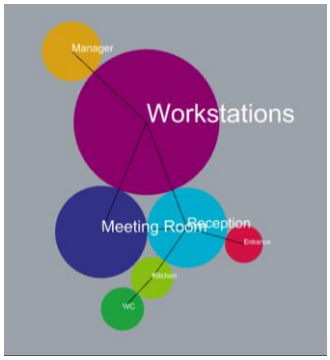
Office (4) - Example of Shortest Distance



Office (4) - View Depth



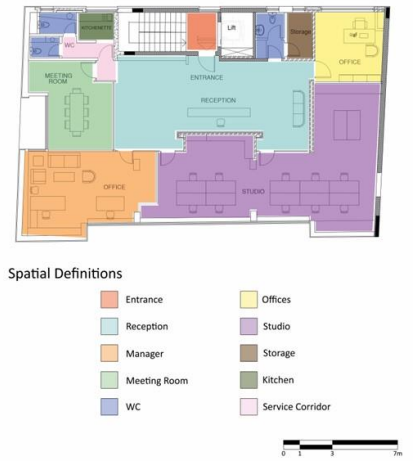
Office (4) - Difference factor



Office (4) - Bubble Diagram

Office (5)

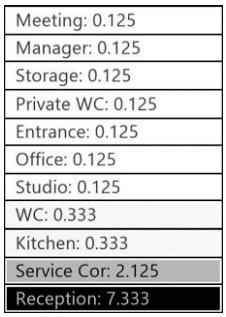
Office (5) - Plan



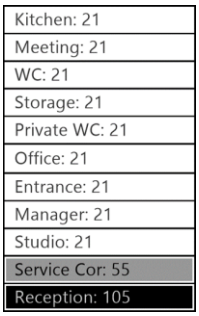
Office (5) - Spatial Definitions

Office (5) - Integration

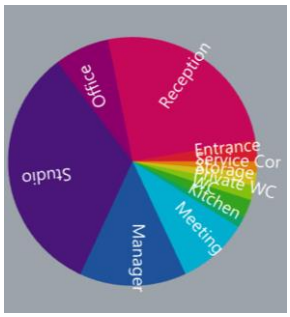
Office (5) - Entropy



Office (5) - Control

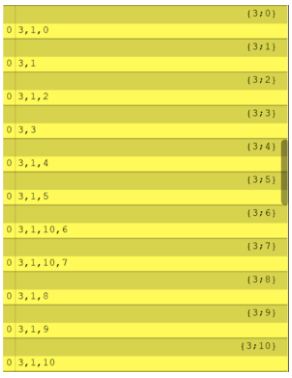


Office (5) - Choice

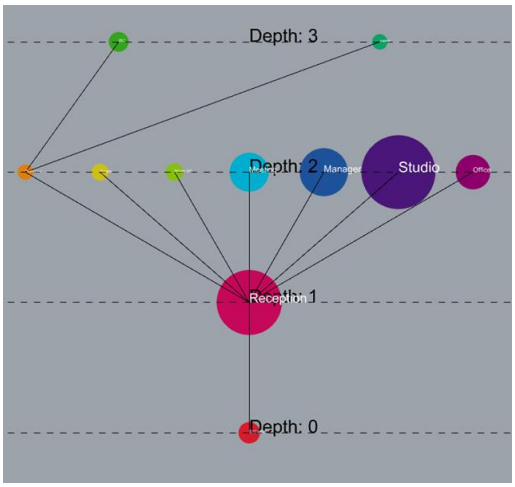


Office (5) - Zones Pie Chart

Office (5) - Areas

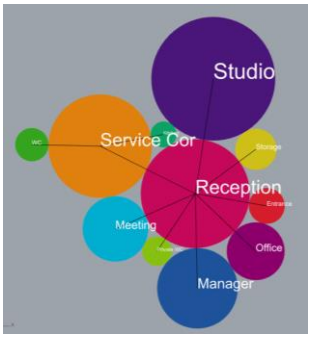


Office (5) - Example of Shortest Distance



Office (5) - View Depth

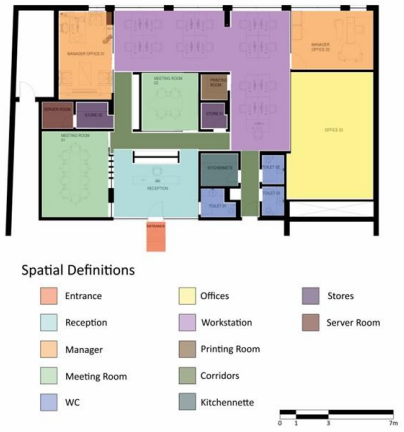
Office (5) - Difference factor



Office (5) - Bubble Diagram

Office (6)

Office (6) - Plan



Office (6) - Spatial Definitions

PR WC: 0.77
Kitchen: 0.77
Entrance: 0.836
PU WC: 0.836
Office: 1.084
Manager 2: 1.084
Print: 1.084
Meeting 2: 1.171
Store 1: 1.171
Store 2: 1.171
Manager 1: 1.22
Corridor 2: 1.273
Meeting 1: 1.33
Reception: 1.464
Workstation 1: 1.722
Workstation 2: 2.439
Corridor 1: 2.927

Office (6) - Integration

Corridor 1: 1.405
Workstation 2: 1.405
Workstation 1: 1.419
Office: 1.635
Print: 1.635
Manager 2: 1.635
Store 2: 1.661
Meeting 2: 1.661
Store 1: 1.661
Meeting 1: 1.729
Manager 1: 1.787
Corridor 2: 1.854
Reception: 1.876
PR WC: 2.016
Kitchen: 2.016
Entrance: 2.067
PU WC: 2.067

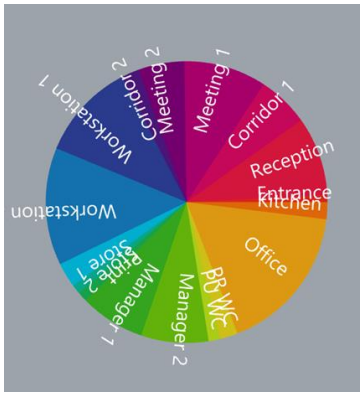
Office (6) - Entropy

Meeting 2: 0.125
Store 2: 0.125
Store 1: 0.125
Print: 0.167
Office: 0.167
Manager 2: 0.167
Entrance: 0.25
PU WC: 0.25
PR WC: 0.333
Kitchen: 0.333
Meeting 1: 0.375
Manager 1: 0.458
Workstation 1: 0.792
Corridor 2: 2.167
Reception: 2.625
Workstation 2: 3.792
Corridor 1: 4.75

Office (6) - Control

Store 1: 33
Meeting 2: 33
PU WC: 33
Store 2: 33
Entrance: 33
Meeting 1: 33
Manager 2: 35
PR WC: 35
Kitchen: 35
Office: 35
Print: 35
Workstation 1: 47
Manager 1: 47
Reception: 91
Corridor 2: 97
Workstation 2: 191
Corridor 1: 203

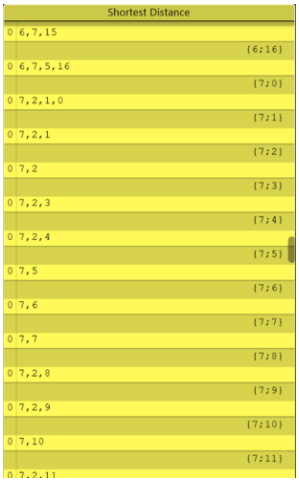
Office (6) - Choice



Office (6) - Zones Pie Chart

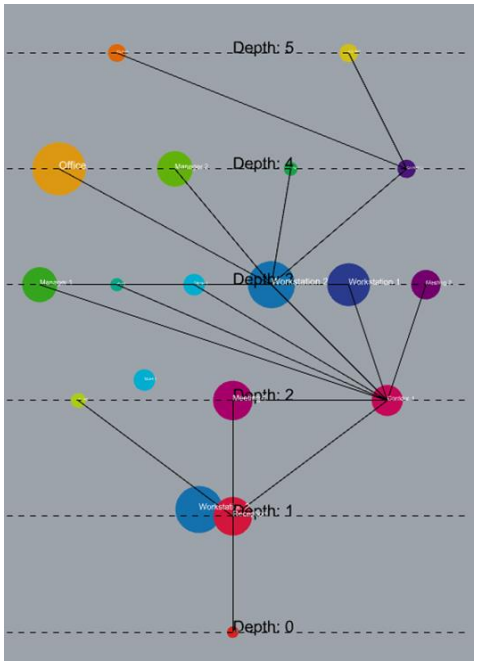
0: Entrance, 2sqm
1: Reception, 26sqm
2: Corridor 1, 16sqm
3: Meeting 1, 26sqm
4: Meeting 2, 14sqm
5: Corridor 2, 6sqm
6: Workstation 1, 32sqm
7: Workstation 2, 38sqm
8: Store 1, 8sqm
9: Store 2, 2sqm
10: Print, 4sqm
11: Manager 1, 20sqm
12: Manager 2, 22sqm
13: PU WC, 4sqm
14: PR WC, 6sqm
15: Office, 48sqm
16: Kitchen, 6sqm

Office (6) - Areas



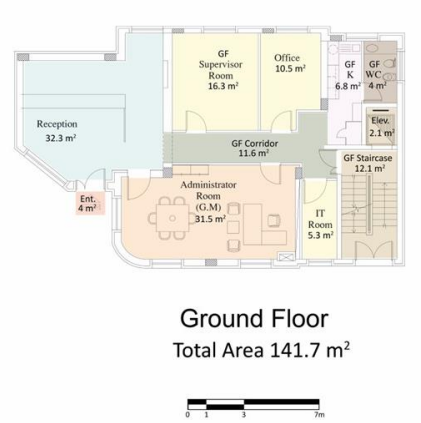
Office (6) - Example of Shortest Distance

Office (6) - Difference factor

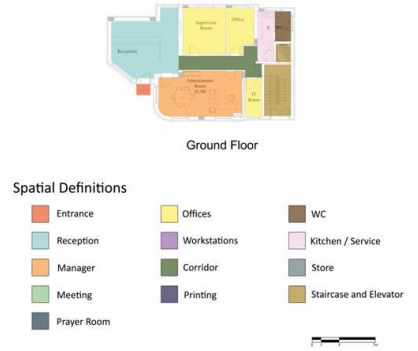


Office (6) - View Depth

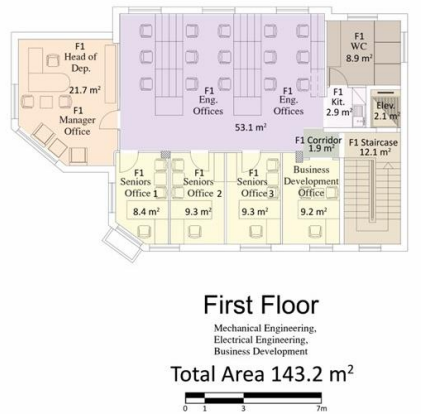
Office (7)



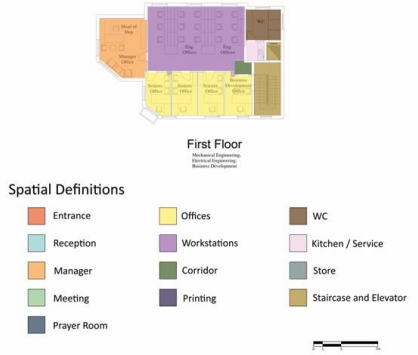
Office (7) - Ground Floor Plan



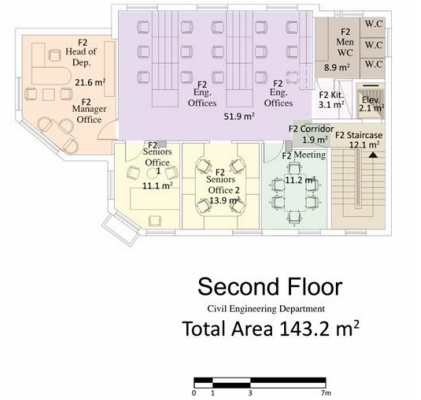
Office (7) - Ground Floor Spatial Definitions



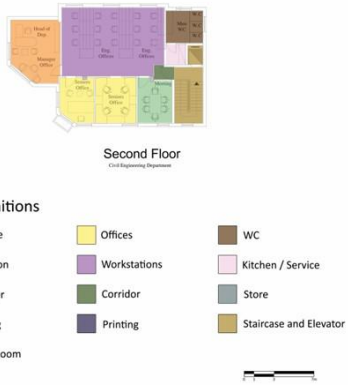
Office (7) – First Floor Plan



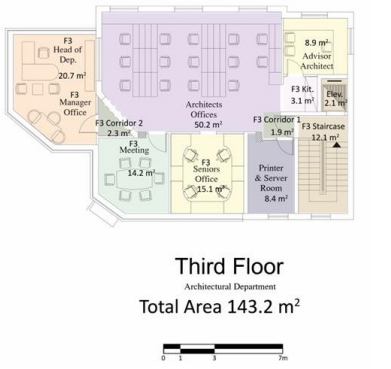
Office (7) - First Floor Spatial Definitions

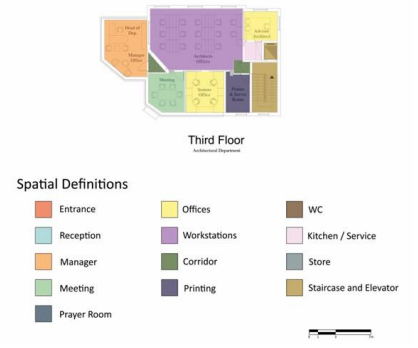


Office (7) - Second Floor Plan

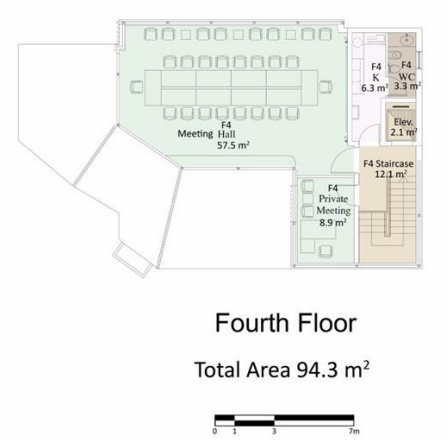


Office (7) – Second Floor Spatial Definitions

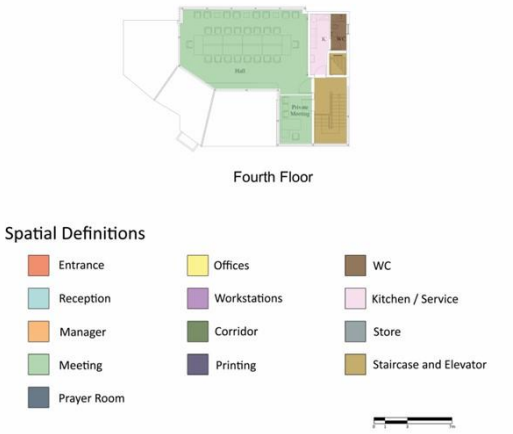




Office (7) – Third Floor Plan



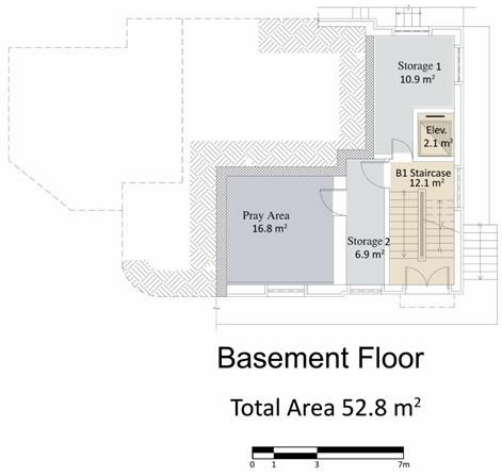
Office (7) - Third Floor Spatial Definitions



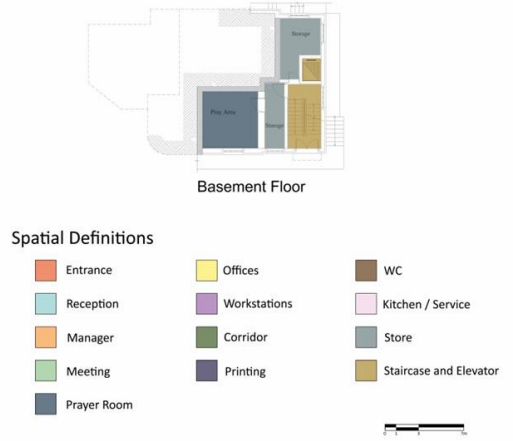
Office (7) – Fourth Floor Plan

Office (7) - Fourth Floor Spatial Definitions

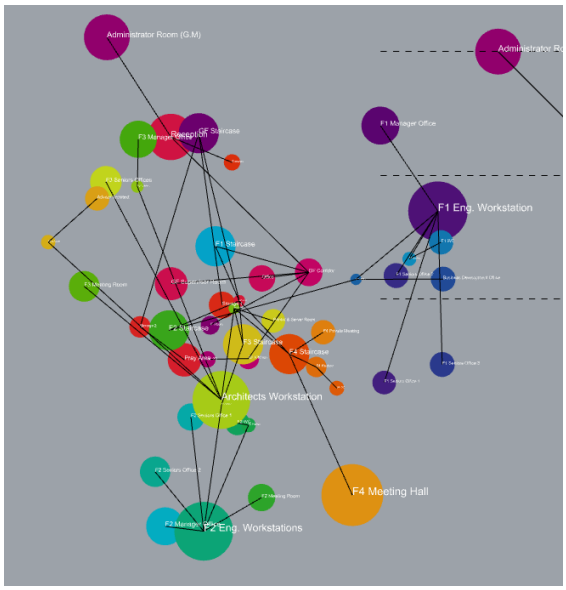
Office (7) – Basement Floor Plan



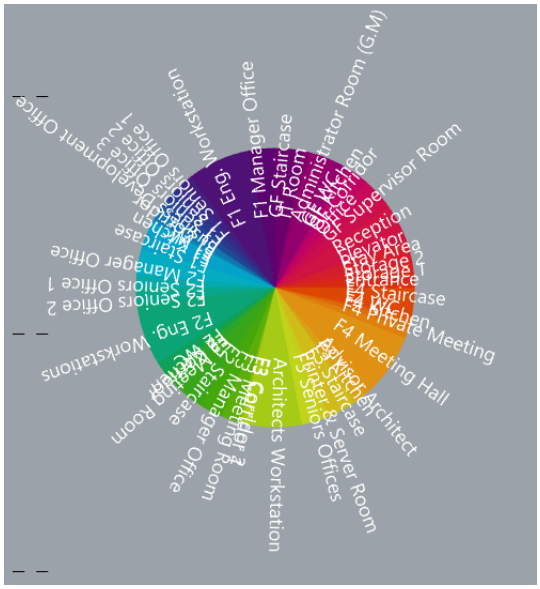
Office (7) - Basement Floor Spatial Definitions



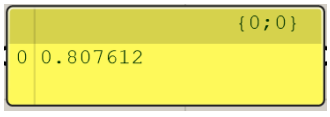
Office (7) - Bubble Diagram

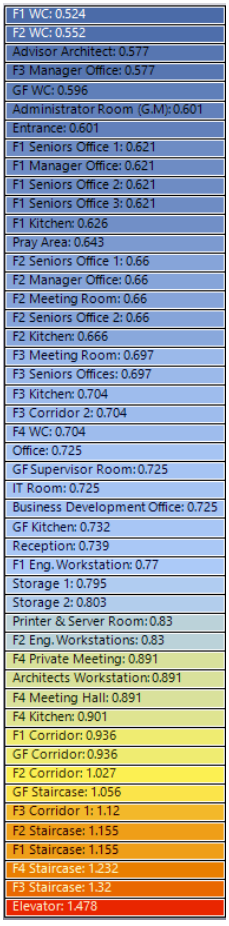


Office (7) - Zones Pie Chart

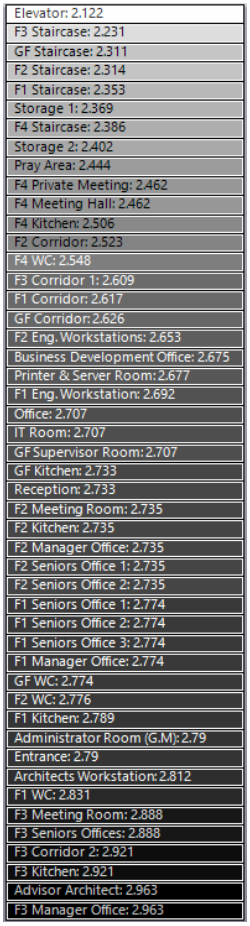


Office (7) - Difference factor

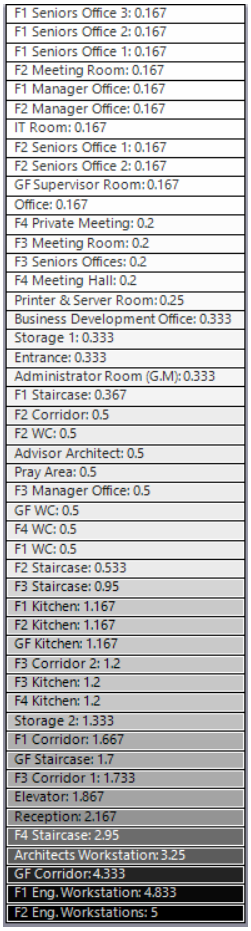




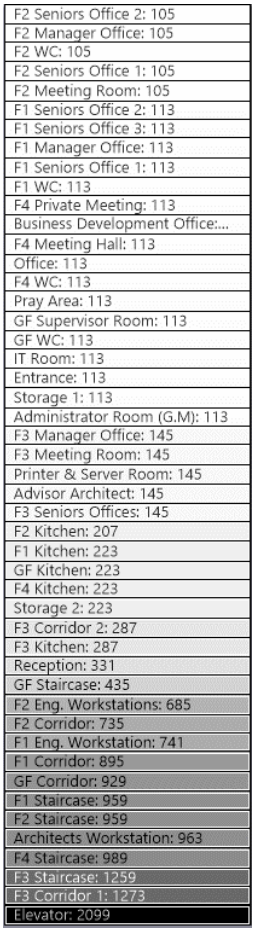
Office (7) - Integration



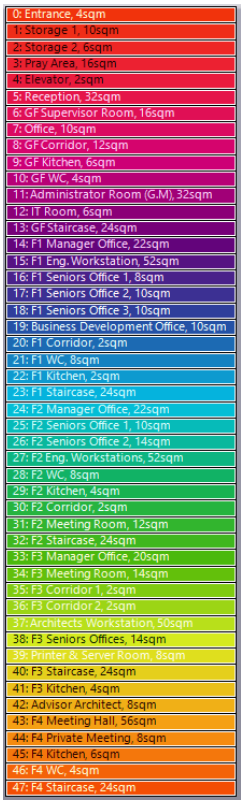
Office (7) - Entropy



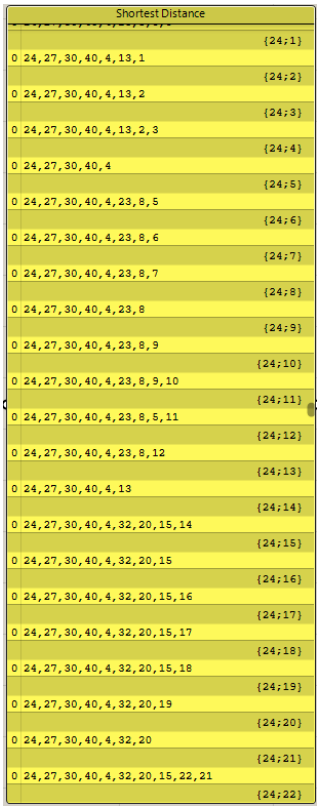
Office (7) - Control



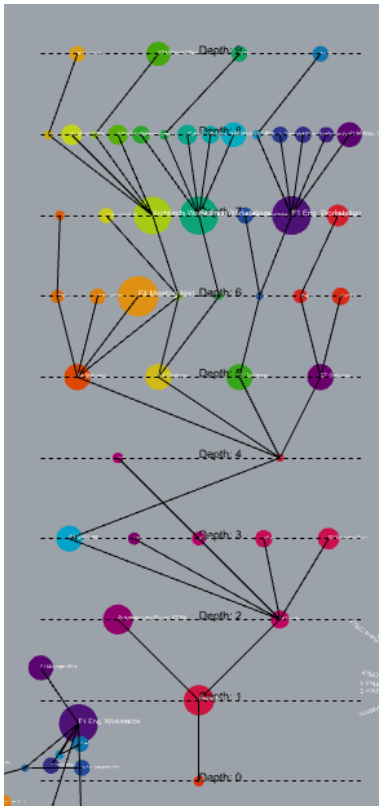
Office (7) - Choice



Office (7) - Areas

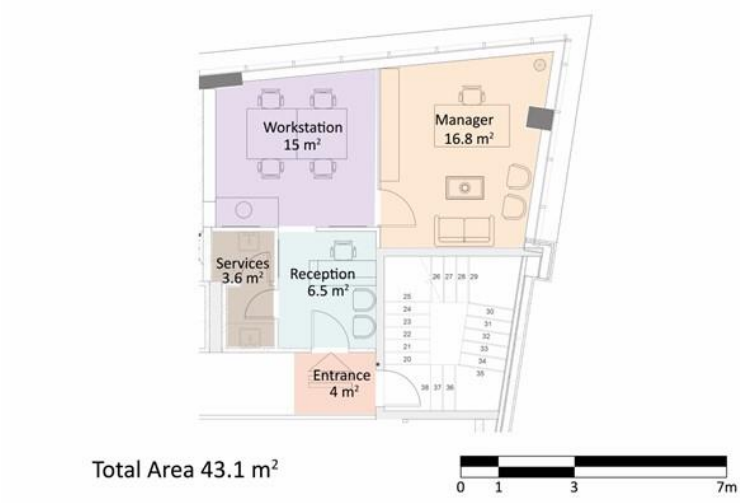


Office (7) - Example of Shortest Distance

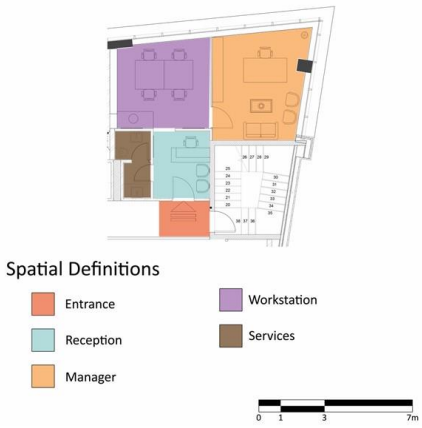


Office (7) - View Depth

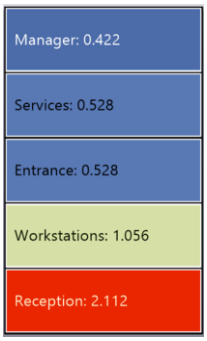
Office (8)



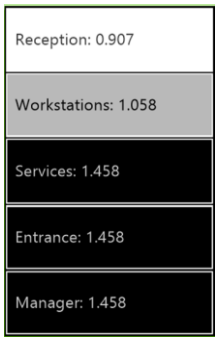
Office (8) - Plan



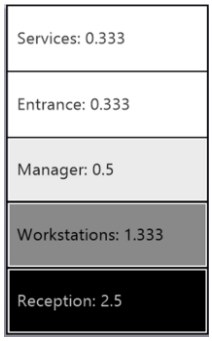
Office (8) - Spatial Definitions



Office (8) - Integration

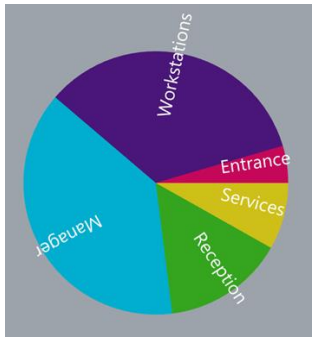


Office (8) - Entropy

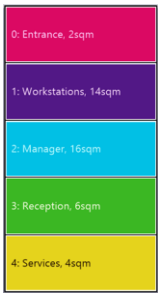


Office (8) - Control

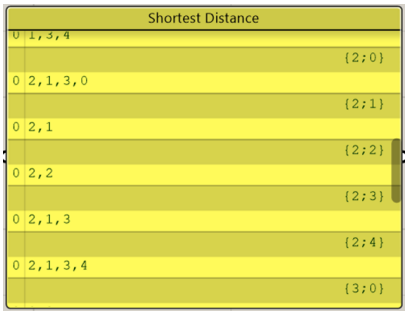
Office (8) - Choice



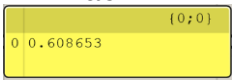
Office (8) - Zones Pie Chart



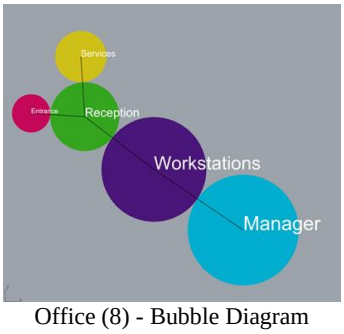
Office (8) - Areas



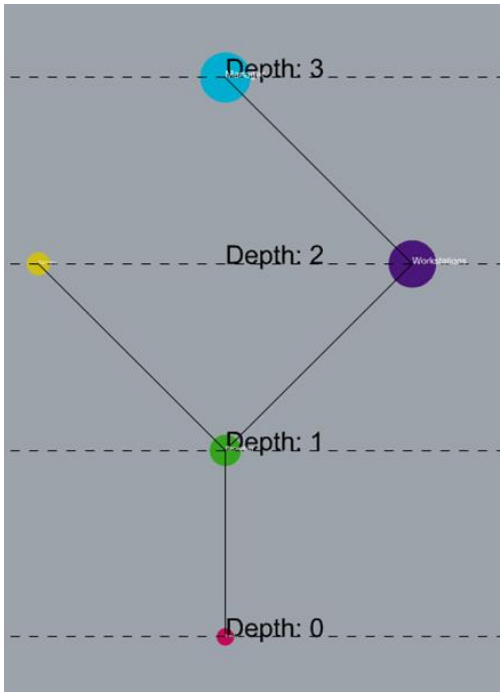
Office (8) - Example of Shortest Distance



Office (8) - Difference factor



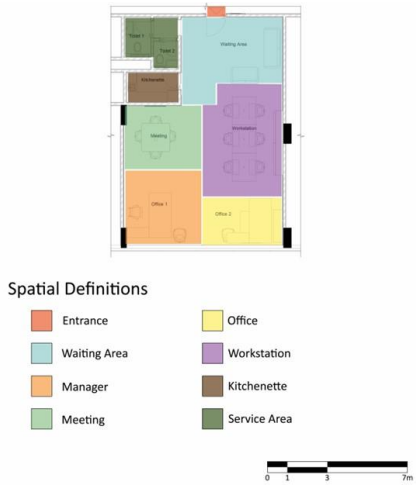
Office (8) - Bubble Diagram



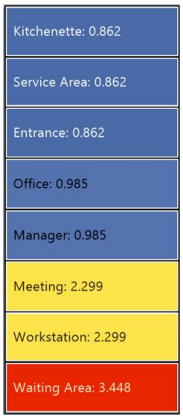
Office (8) - View Depth

Office (9)

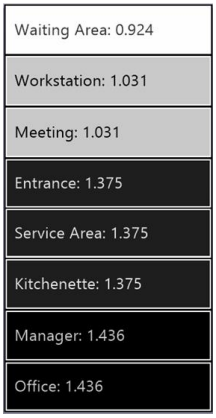
Office (9) - Plan



Office (9) - Spatial Definitions



Office (9) - Integration



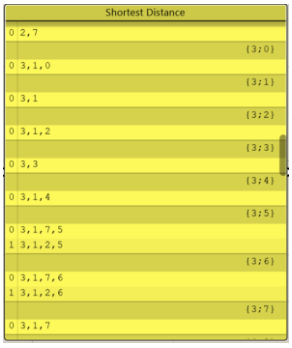
Office (9) - Entropy

Office (9) - Control

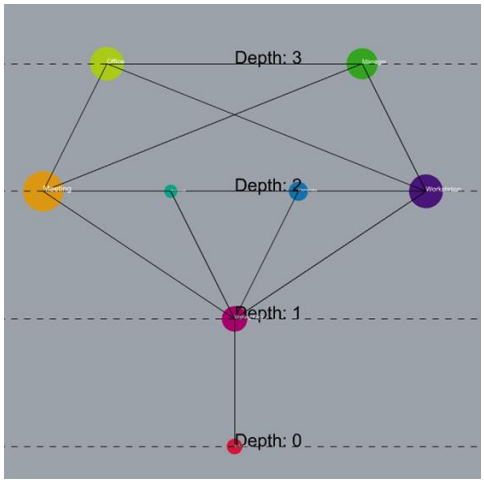
Office (9) - Choice

Office (9) - Zones Pie Chart

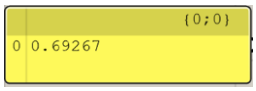
Office (9) - Areas



Office (9) - Example of Shortest Distance



Office (9) - View Depth

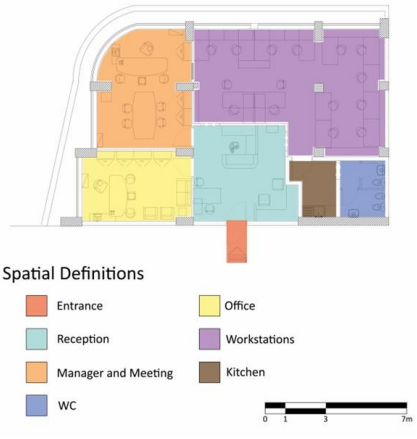


Office (9) - Difference factor

Office (9) - Bubble Diagram

Office (10)

Office (10) - Plan



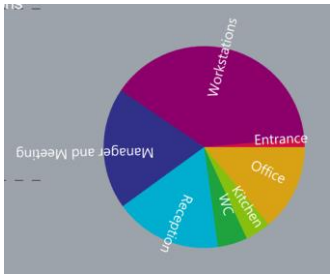
Office (10) - Spatial Definitions

Office (10) - Integration

Office (10) - Entropy

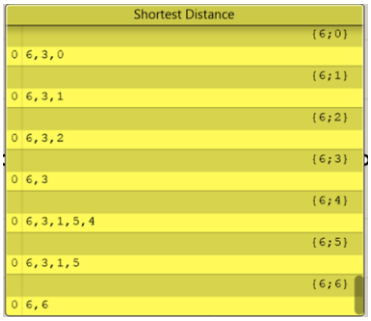
Office (10) - Control

Office (10) - Choice



Office (10) - Zones Pie Chart

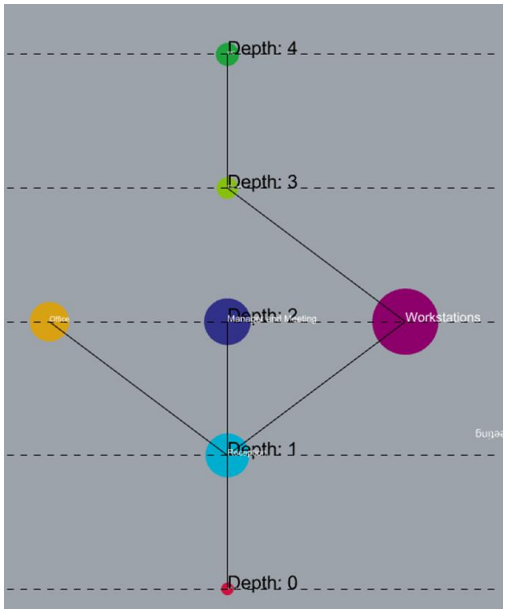
Office (10) - Areas



Office (10) - Example of Shortest Distance

Office (10) - Difference factor

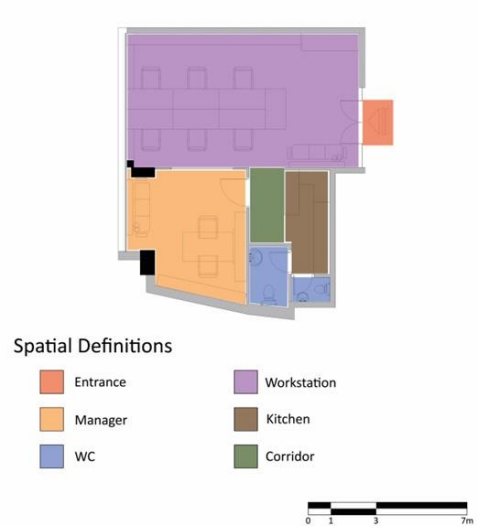
Office (10) - Bubble Diagram



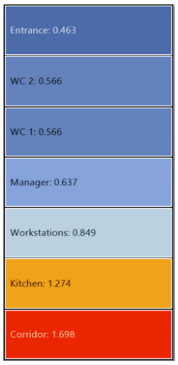
Office (10) - View Depth

Office (11)

Office (11) - Plan

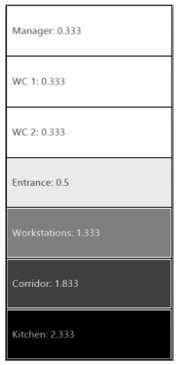


Office (11) - Spatial Definitions



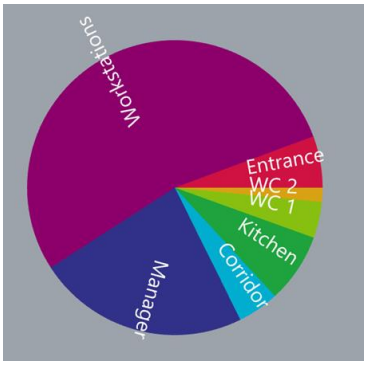
Office (11) - Integration

Office (11) - Entropy



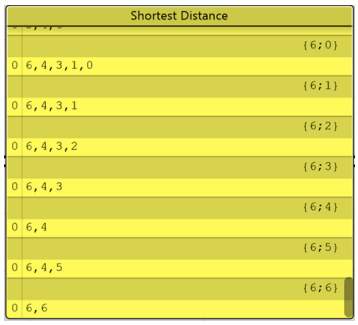
Office (11) - Control

Office (11) - Choice

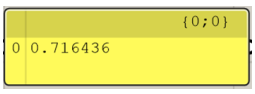


Office (11) - Zones Pie Chart

Office (11) - Areas

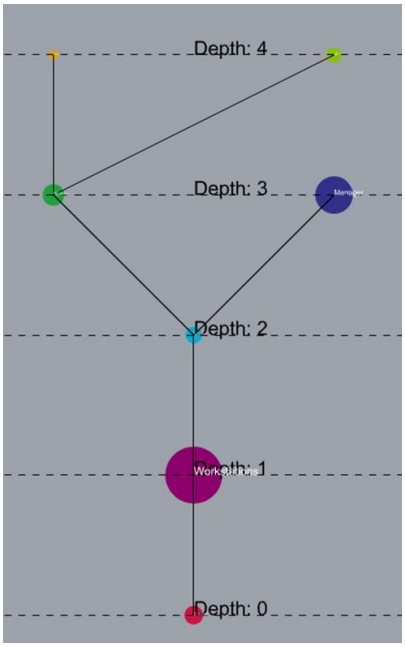


Office (11) - Example of Shortest Distance



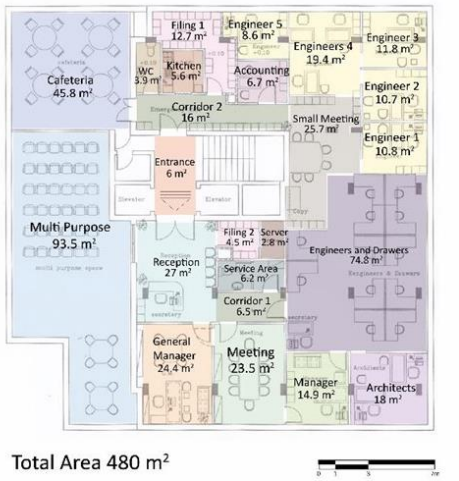
Office (11) - Difference factor

Office (11) - Bubble Diagram

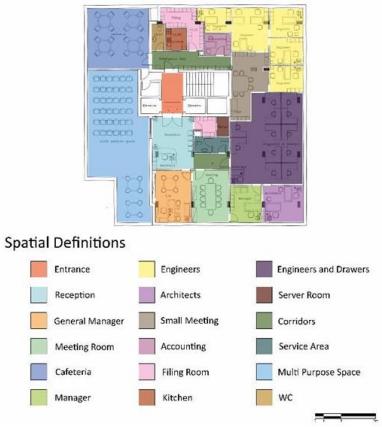


Office (11) - View Depth

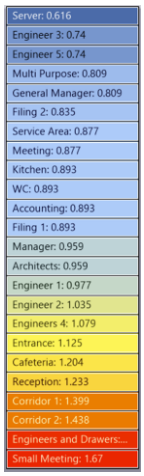
Office (12)



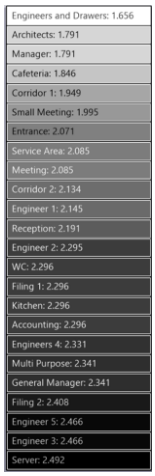
Office (12) - Plan



Office (12) - Spatial Definitions

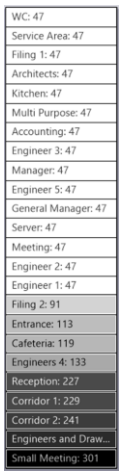


Office (12) - Integration

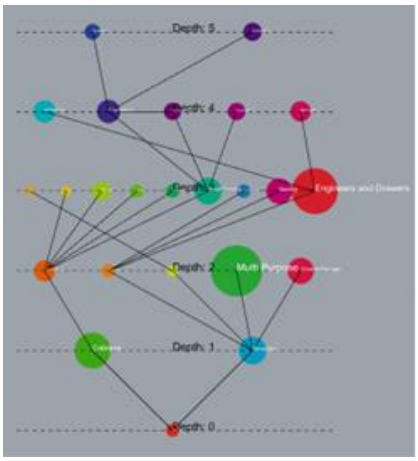


Office (12) - Entropy

Office (12) - Control

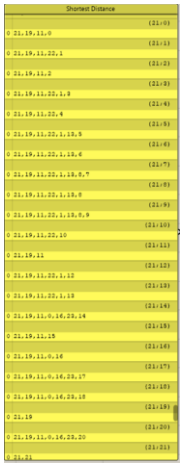


Office (12) - Choice

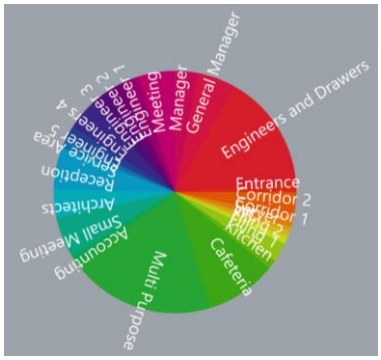


Office (12) - View Depth

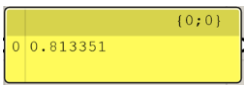
Office (12) - Areas



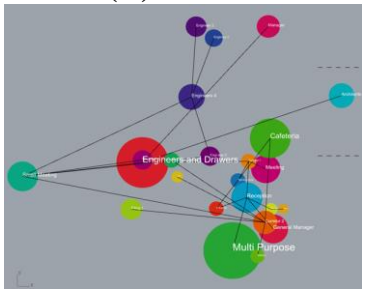
Office (12) - Example of Shortest Distance



Office (12) - Zones Pie Chart

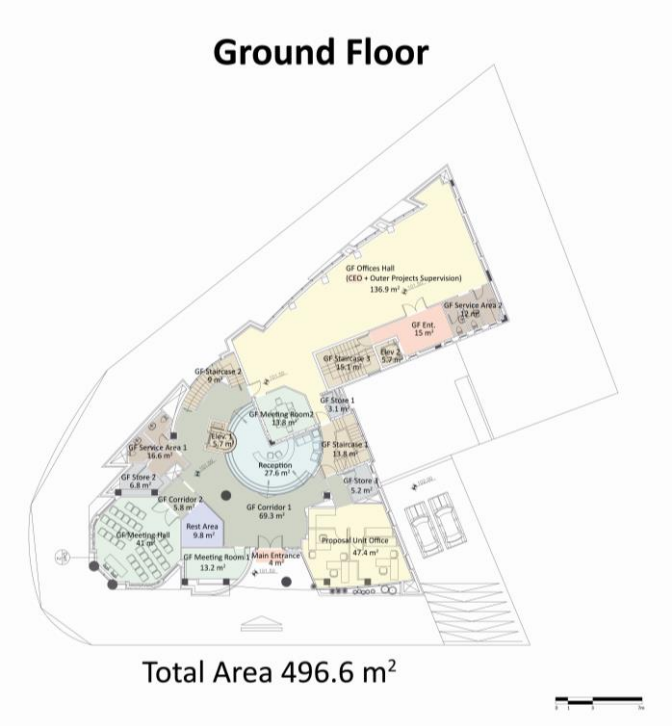


Office (12) - Difference factor

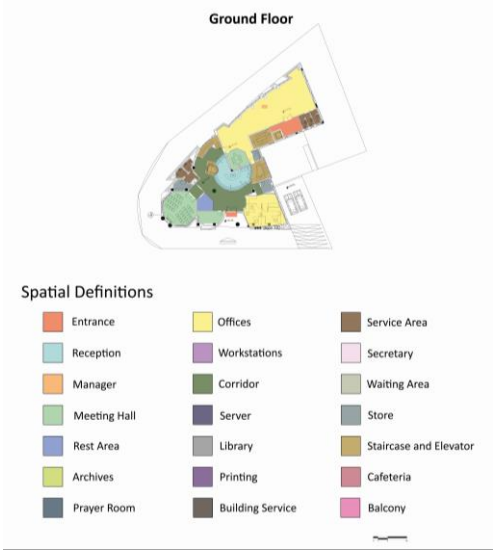


Office (12) - Bubble Diagram

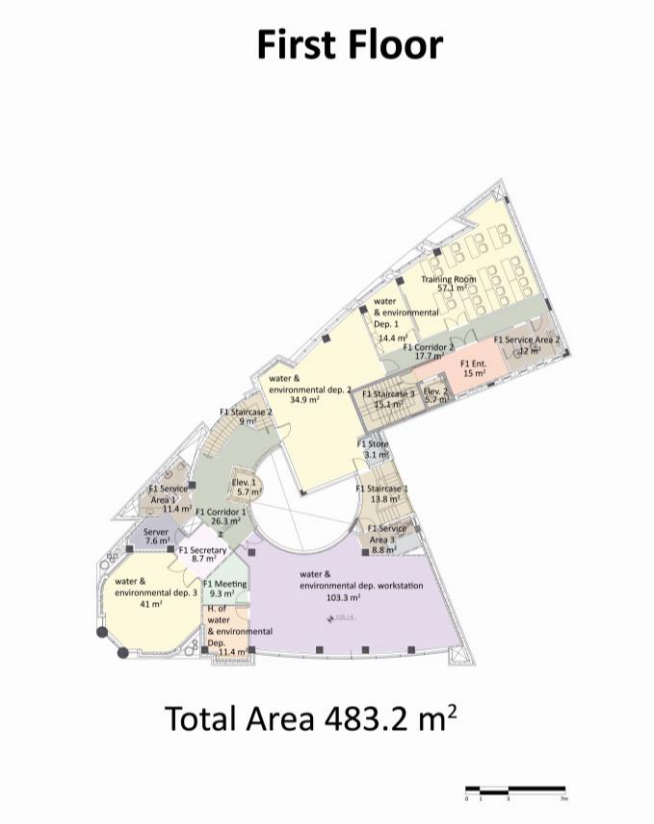
Office (13)



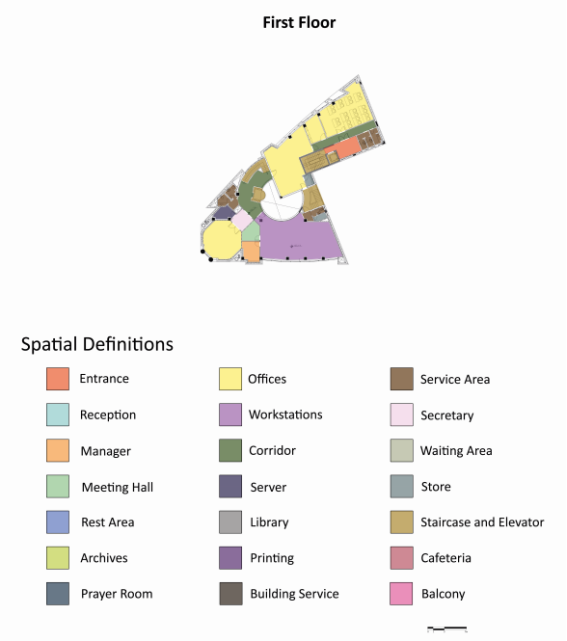
Office (13) - Ground Floor Plan



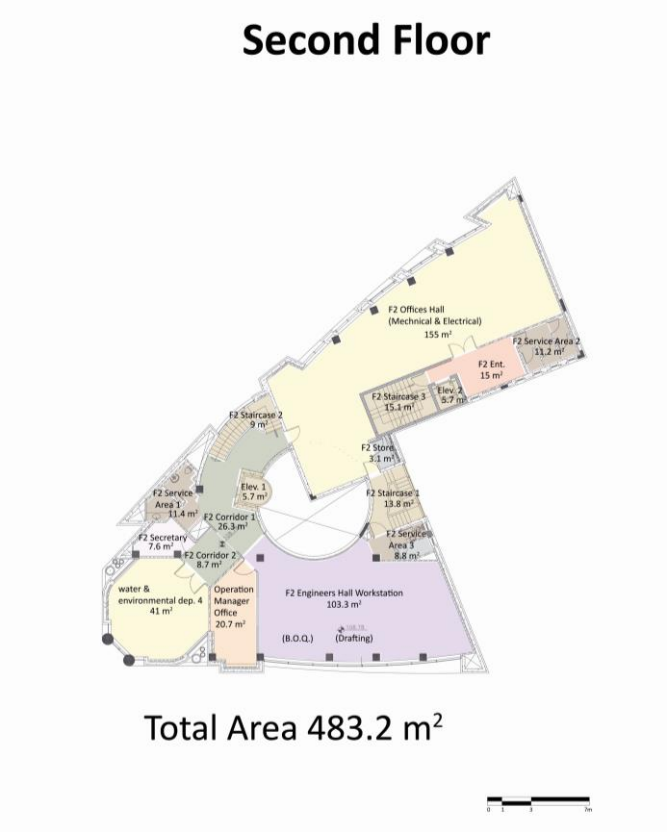
Office (13) - Ground Floor Spatial Definitions



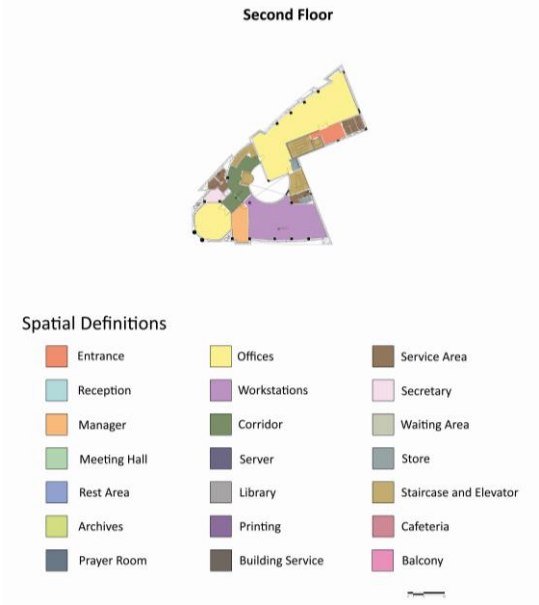
Office (13) – First Floor Plan



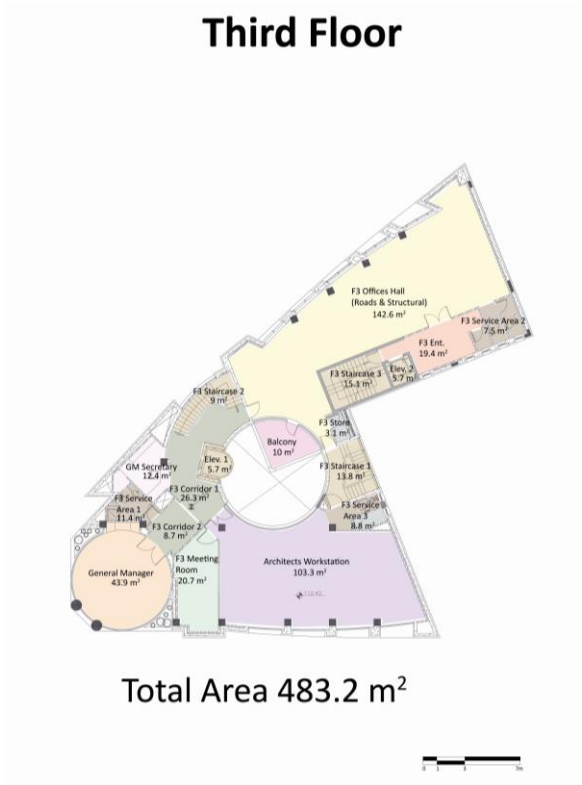
Office (13) - First Floor Spatial Definitions



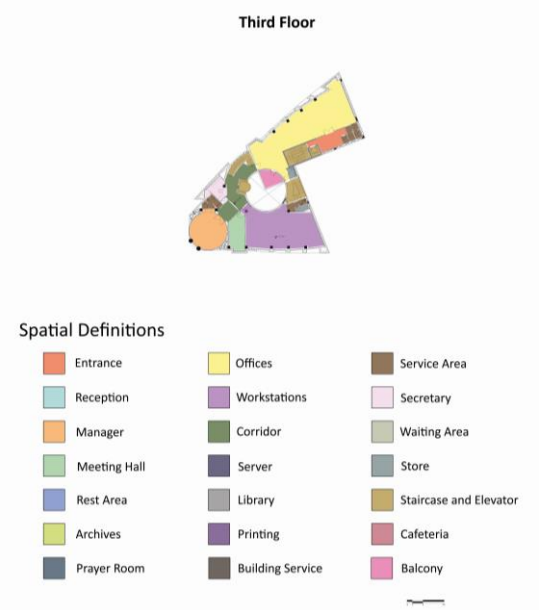
Office (13) - Second Floor Plan



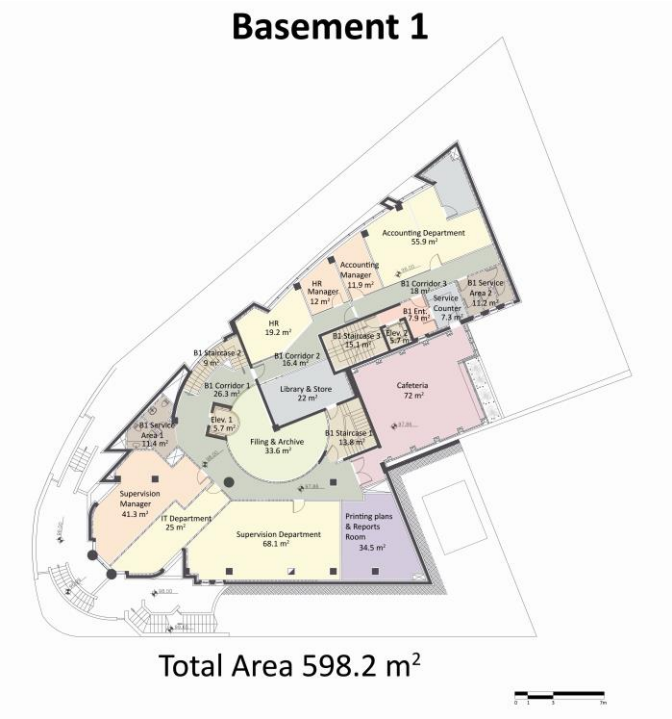
Office (13) – Second Floor Spatial Definitions



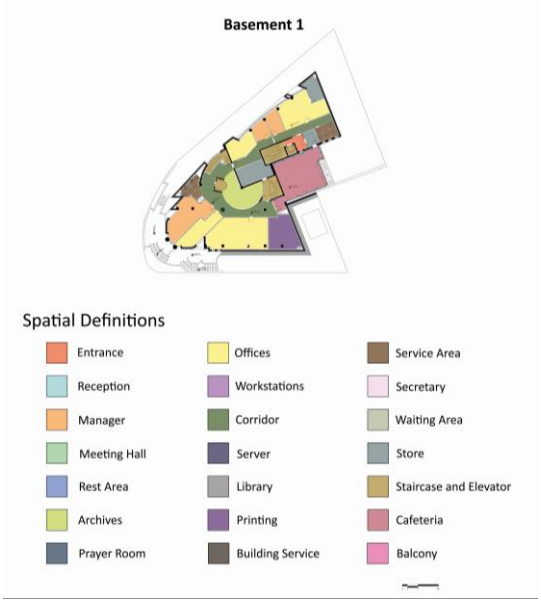
Office (13) – Third Floor Plan



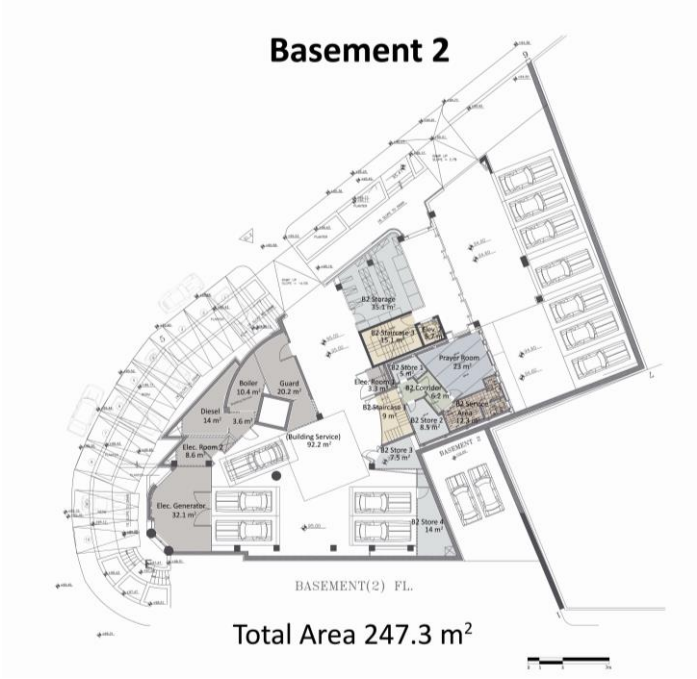
Office (13) - Third Floor Spatial Definitions



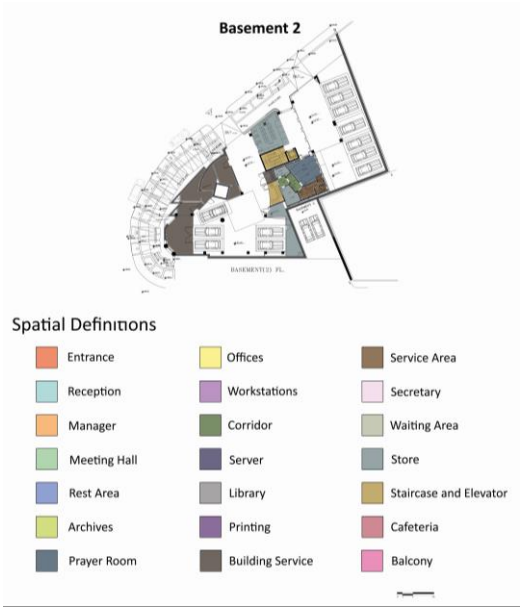
Office (13) – Basement 1 Floor Plan



Office (13) - Basement 1 Floor Spatial Definitions



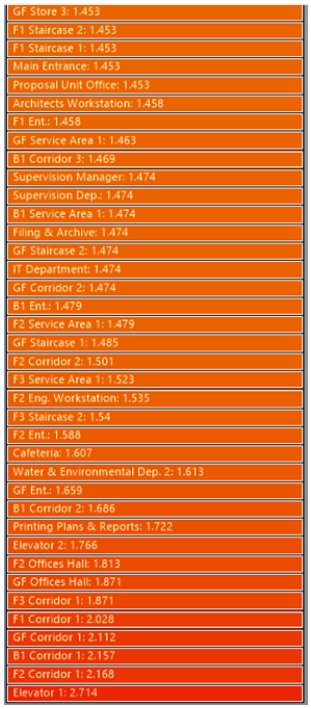
Office (13) – Basement 2 Floor Plan



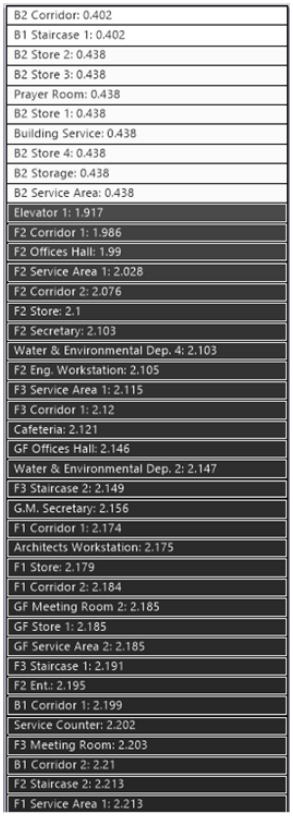
Office (13) – Basement 2 Floor Spatial Definitions

Office (13) – Integration Part 1

Office (13) – Integration Part 2

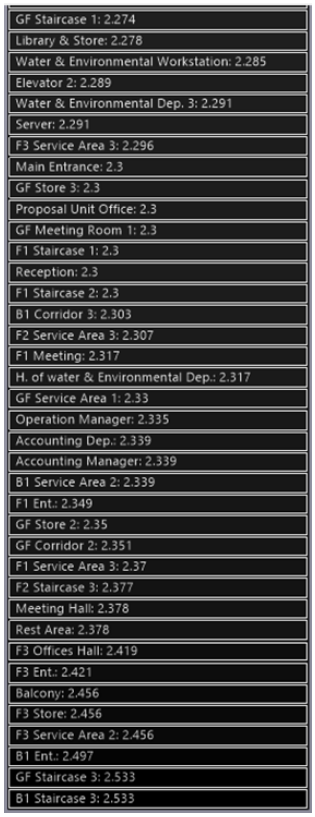


Office (13) – Integration Part 3



Office (13) – Entropy Part 1

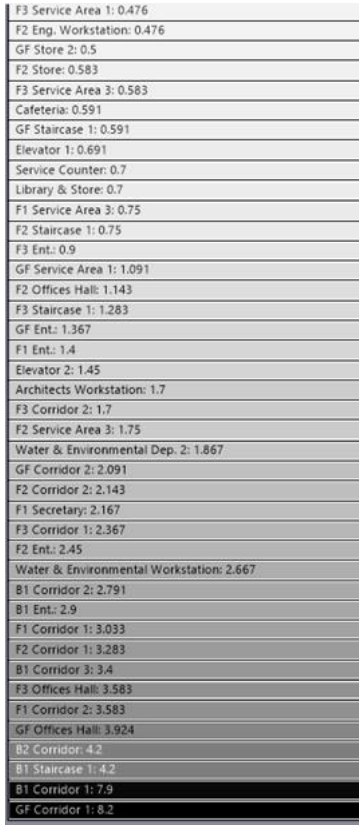
Office (13) – Entropy Part 2



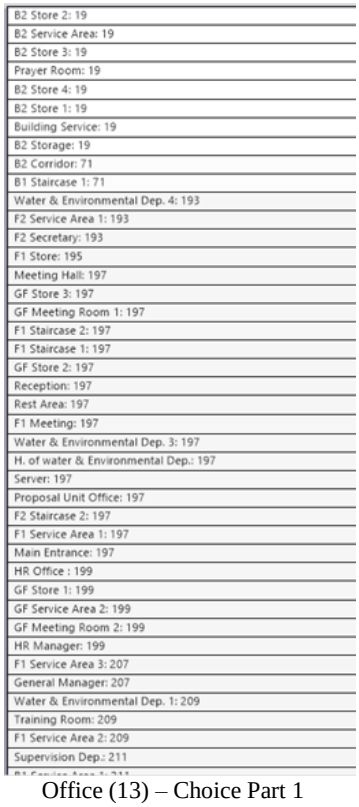
Office (13) – Entropy Part 3

Office (13) – Control Part 1

Office (13) – Control Part 2

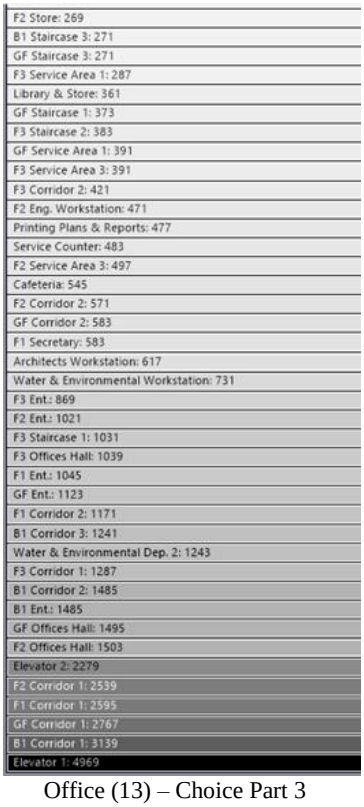


Office (13) – Control Part 3



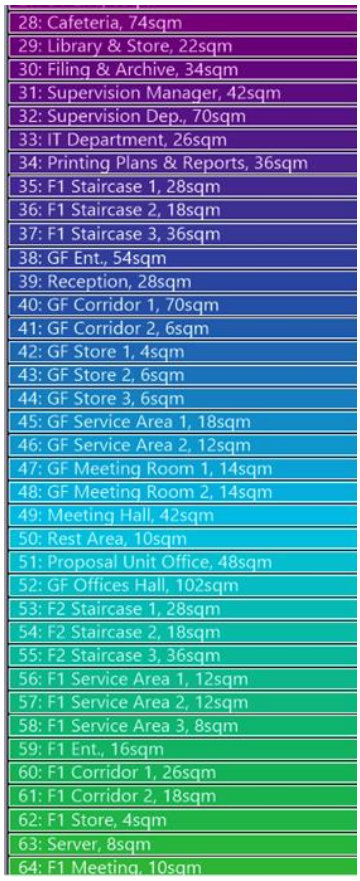
Office (13) – Choice Part 1

Office (13) – Choice Part 2



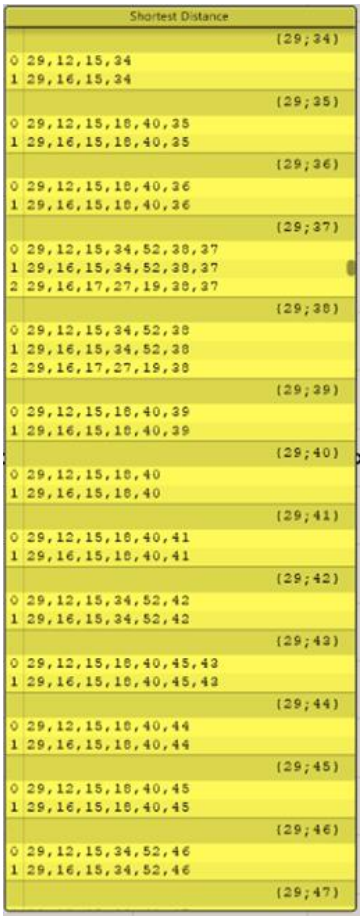
Office (13) – Choice Part 3

Office (13) – Areas Part 1

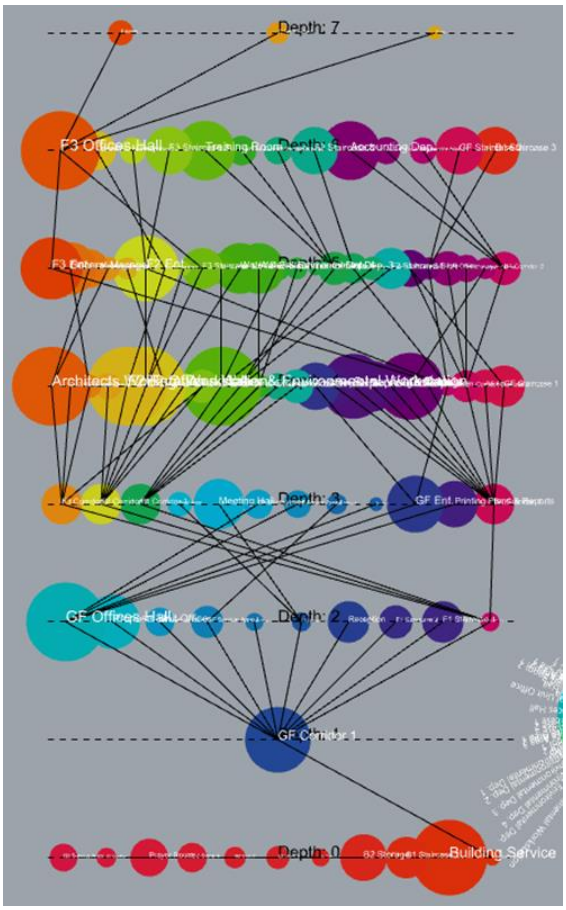


Office (13) – Areas Part 2

Office (13) – Areas Part 3



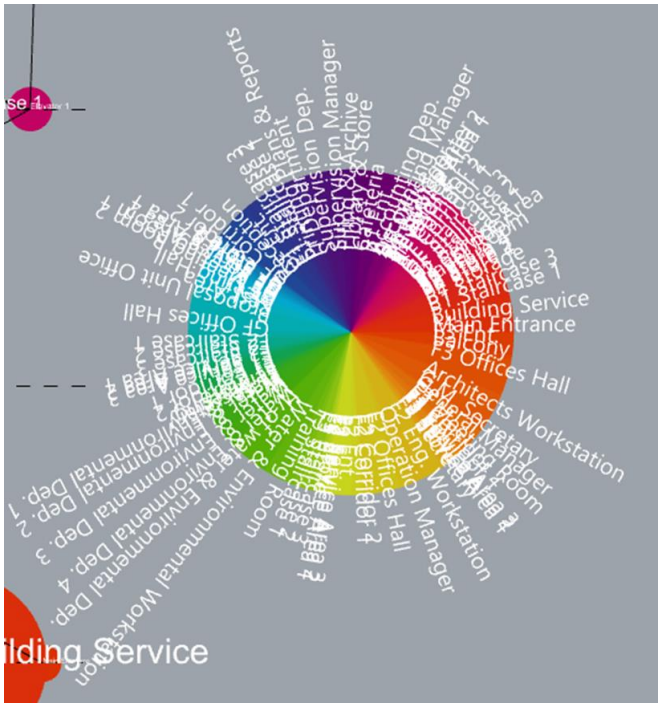
Office (13) - Example of Shortest Distance



Office (13) - View Depth

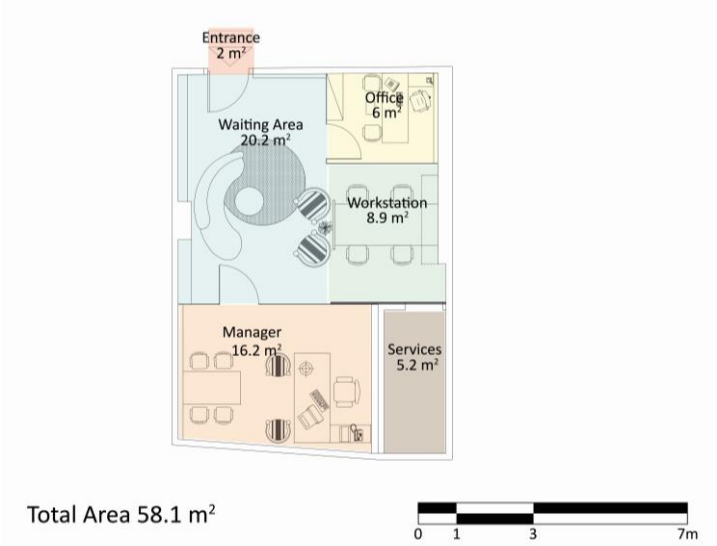
	{0;0}
0	NaN

Office (13) - Difference factor

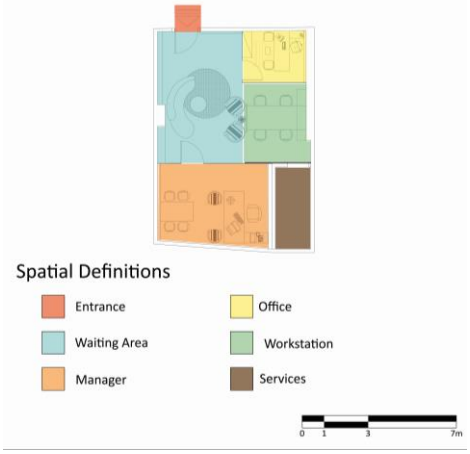


Office (13) - Zones Pie Chart

Office (14)



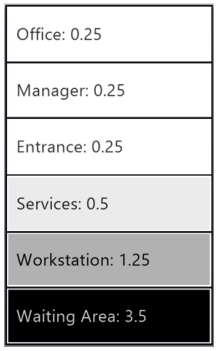
Office (14) - Plan



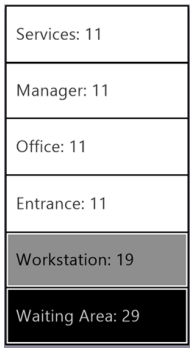
Office (14) - Spatial Definitions

Office (14) - Integration

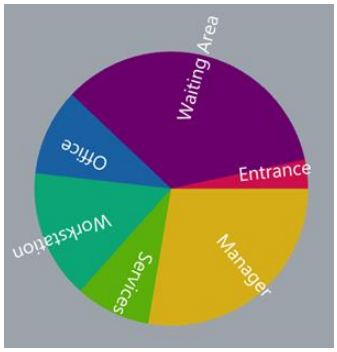
Office (14) - Entropy



Office (14) - Control

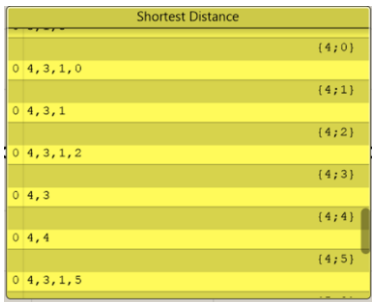


Office (14) - Choice

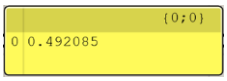


Office (14) - Zones Pie Chart

Office (14) - Areas

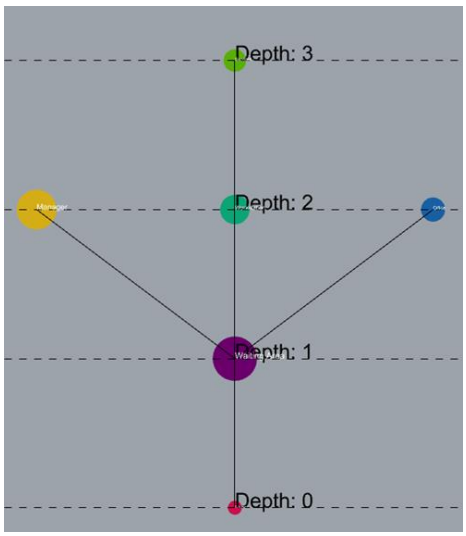


Office (14) - Example of Shortest Distance



Office (14) - Difference factor

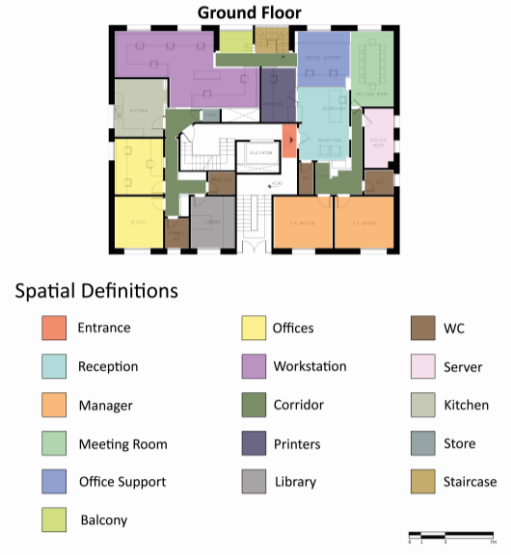
Office (14) - Bubble Diagram



Office (14) - View Depth

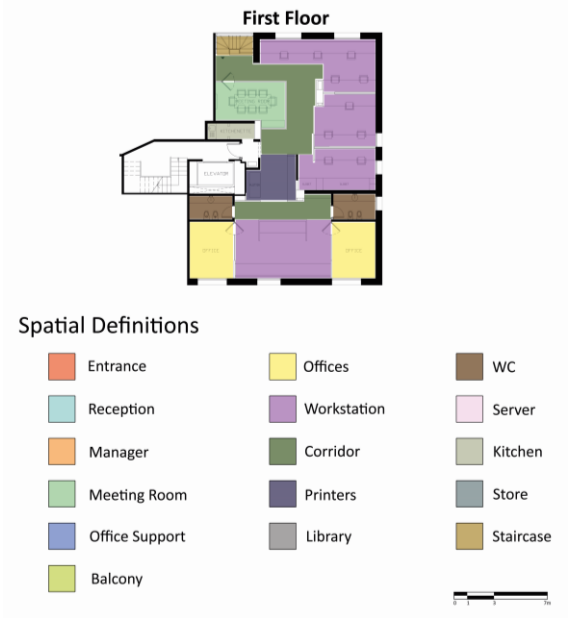
Office (15)

Office (15) - Ground Floor Plan

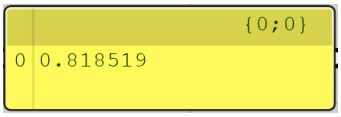


Office (15) - Ground Floor Spatial Definitions

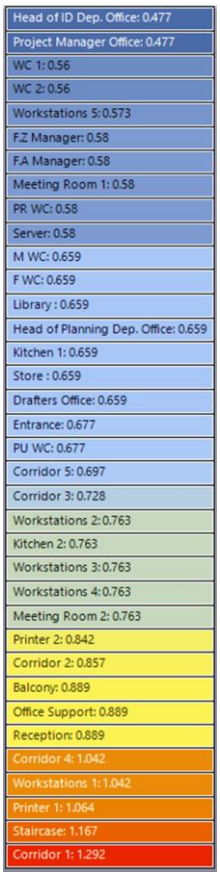
Office (15) – First Floor Plan



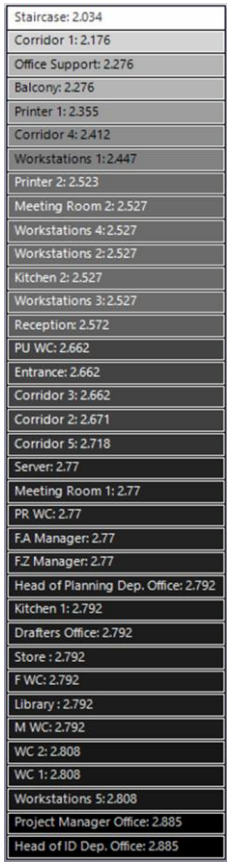
Office (15) - First Floor Spatial Definitions



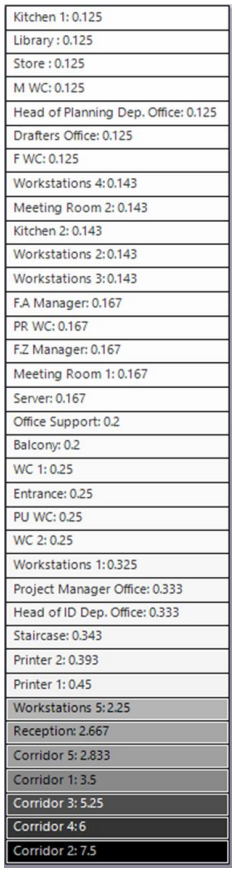
Office (15) - Difference factor



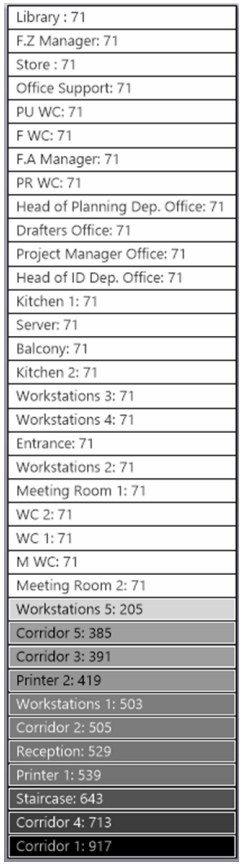
Office (15) - Integration



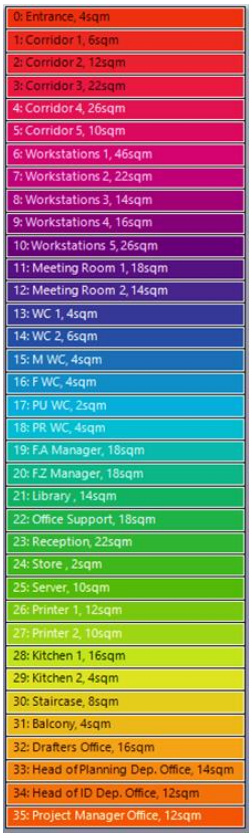
Office (15) - Entropy



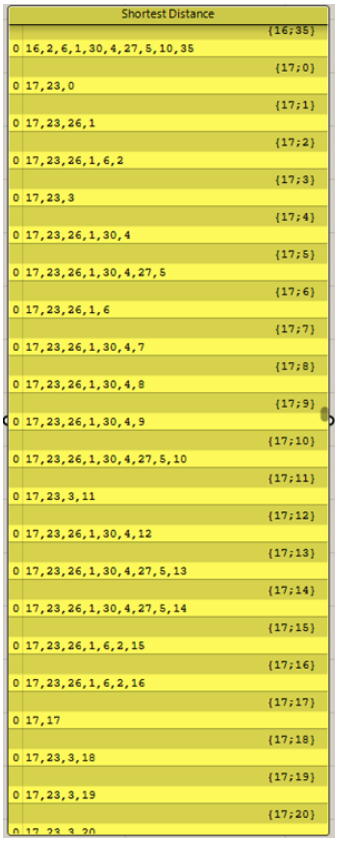
Office (15) - Control



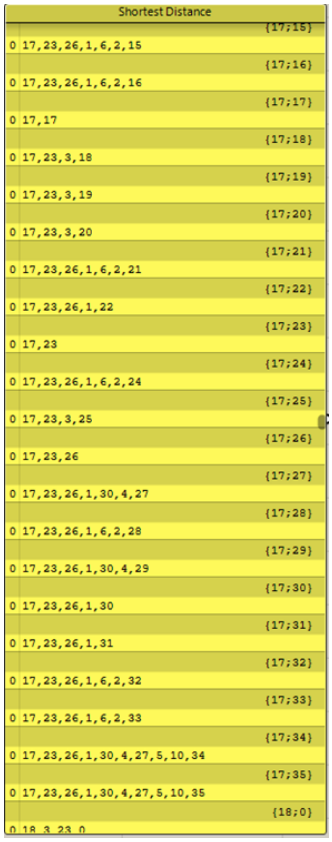
Office (15) - Choice



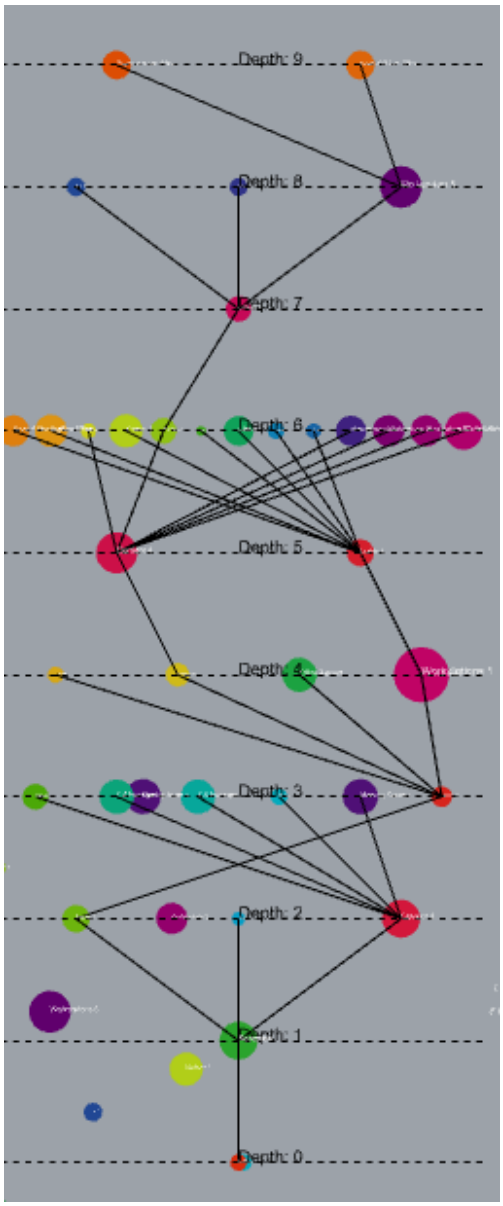
Office (15) – Areas



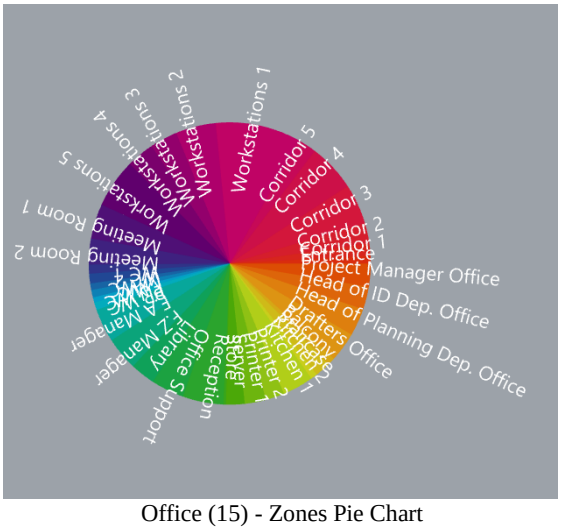
Office (15) – Example of Shortest Distance Part 1



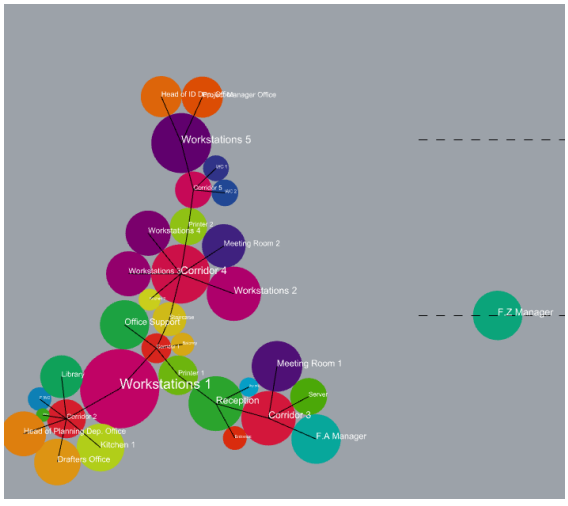
Office (15) – Example of Shortest Distance Part 2



Office (15) – View Depth

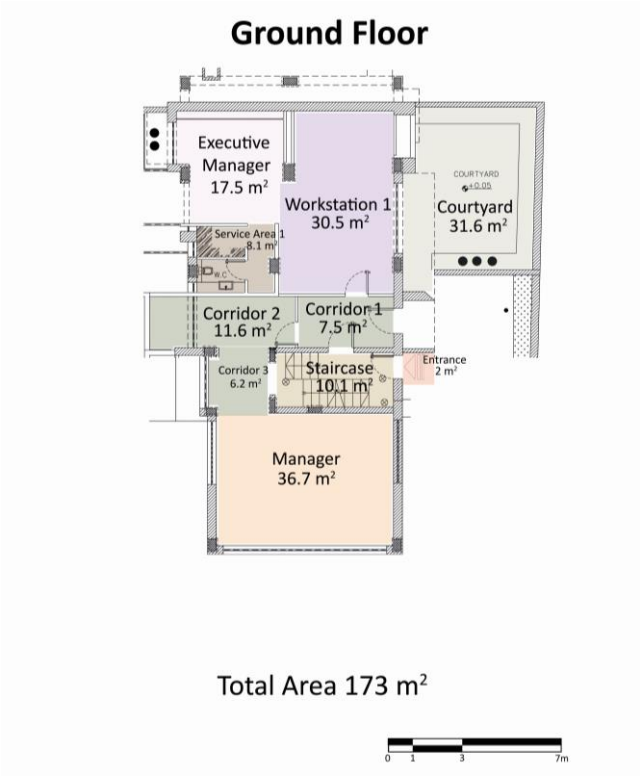


Office (15) - Zones Pie Chart

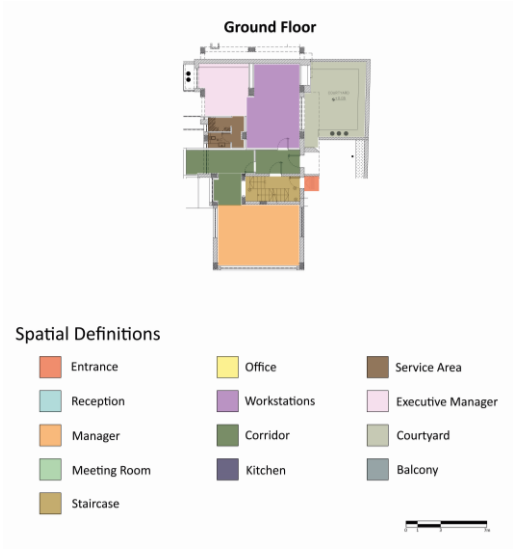


Office (15) - Bubble Diagram

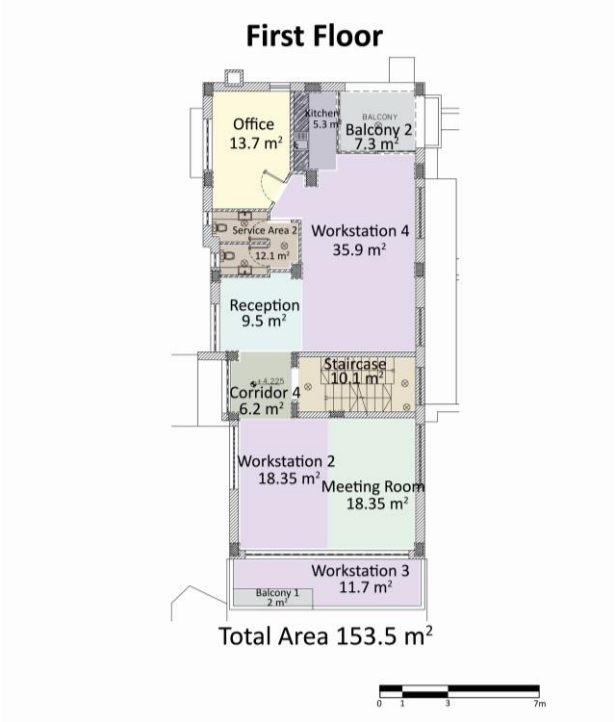
Office (16)



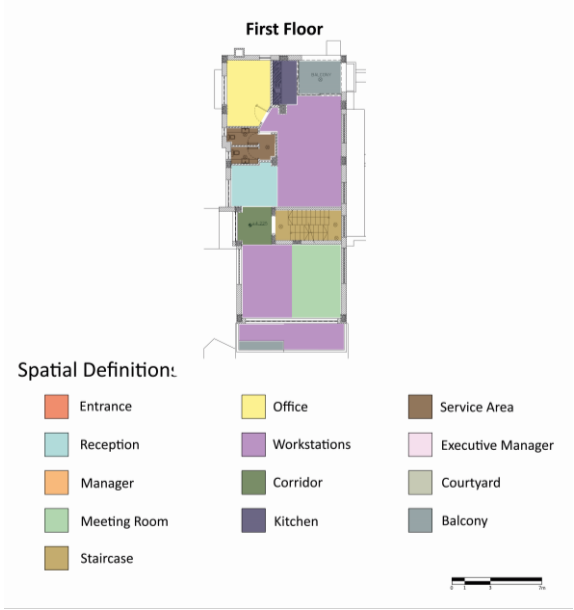
Office (16) - Ground Floor Plan



Office (16) - Ground Floor Spatial Definitions



Office (16) – First Floor Plan



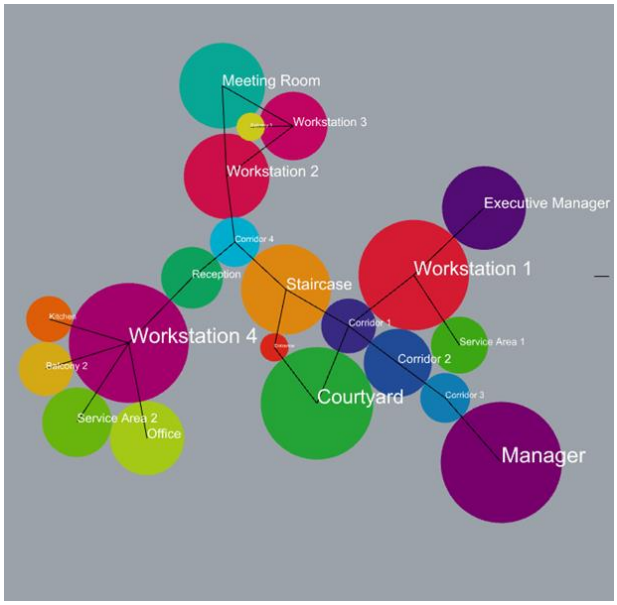
Office (16) - First Floor Spatial Definitions

Office (16) - Integration
Manager: 0.458
Balcony 1: 0.509
Service Area 1: 0.564
Executive Manager: 0.564
Balcony 2: 0.571
Office: 0.571
Kitchen: 0.571
Service Area 2: 0.571
Corridor 3: 0.579
Meeting Room: 0.652
Workstation 3: 0.662
Courtyard: 0.732
Workstation 1: 0.758
Corridor 2: 0.758
Workstation 4: 0.772
Entrance: 0.802
Workstation 2: 0.887
Reception: 0.97
Corridor 1: 1.043
Staircase: 1.192
Corridor 4: 1.227

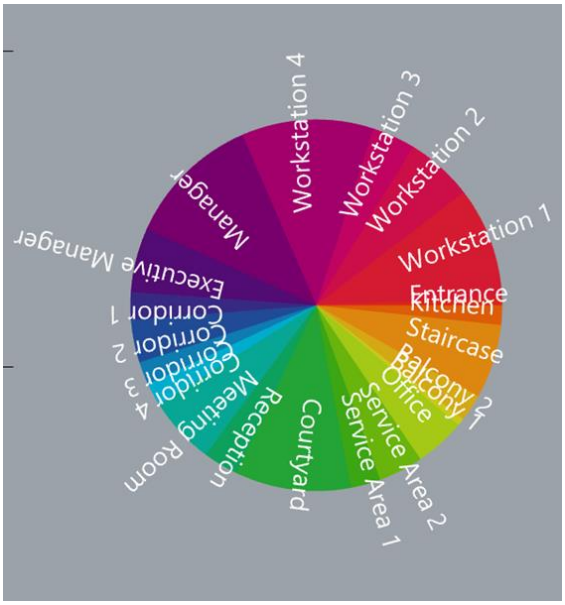
Office (16) - Entropy
Staircase: 1.927
Corridor 4: 2.035
Entrance: 2.135
Corridor 1: 2.244
Workstation 2: 2.342
Reception: 2.361
Corridor 2: 2.452
Workstation 3: 2.473
Courtyard: 2.475
Workstation 1: 2.498
Meeting Room: 2.509
Workstation 4: 2.547
Balcony 1: 2.604
Corridor 3: 2.606
Executive Manager: 2.629
Service Area 1: 2.629
Manager: 2.701
Kitchen: 2.719
Balcony 2: 2.719
Service Area 2: 2.719
Office: 2.719

Office (16) - Control
Office: 0.2
Service Area 2: 0.2
Balcony 2: 0.2
Kitchen: 0.2
Executive Manager: 0.333
Service Area 1: 0.333
Balcony 1: 0.333
Manager: 0.5
Reception: 0.533
Meeting Room: 0.667
Courtyard: 0.75
Corridor 2: 0.75
Entrance: 0.833
Staircase: 1.083
Corridor 4: 1.167
Workstation 2: 1.167
Corridor 3: 1.5
Corridor 1: 1.667
Workstation 3: 1.833
Workstation 1: 2.25
Workstation 4: 4.5

Office (16) - Choice
Executive Manager: 43
Manager: 43
Meeting Room: 43
Service Area 1: 43
Service Area 2: 43
Balcony 2: 43
Kitchen: 43
Office: 43
Balcony 1: 43
Courtyard: 79
Entrance: 79
Workstation 3: 83
Corridor 3: 83
Corridor 2: 119
Workstation 1: 121
Workstation 2: 151
Workstation 4: 191
Reception: 203
Corridor 1: 265
Staircase: 277
Corridor 4: 311



Office (16) - Bubble Diagram

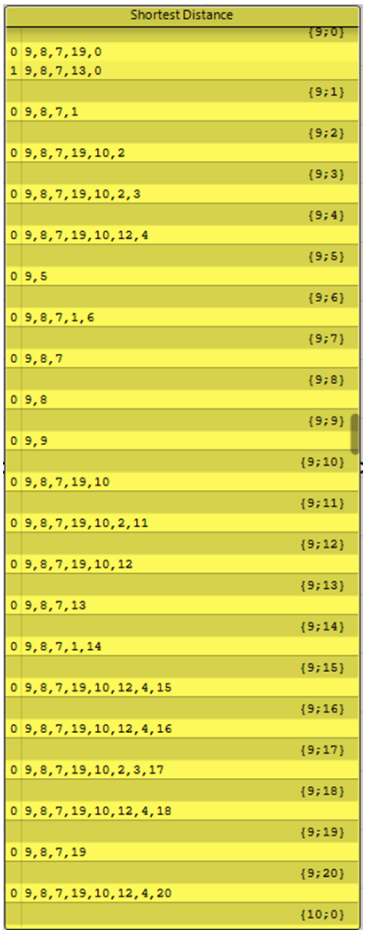


Office (16) - Zones Pie Chart

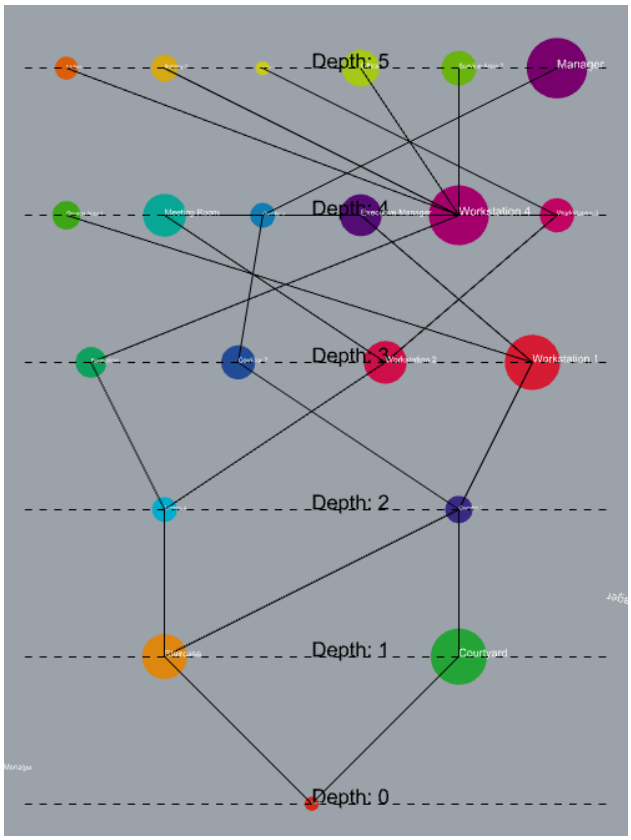
	{0;0}
0	0.82115

Office (16) - Difference factor

Office (16) - Areas



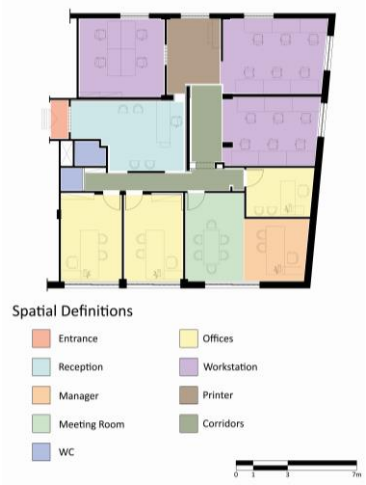
Office (16) - Example of Shortest Distance



Office (16) – View Depth

Office (17)

Office (17) - Plan



Office (17) - Spatial Definitions

Manager: 0.736
Workstation 3: 0.785
Workstation 1: 0.905
Entrance: 0.942
PU WC: 0.942
Office 2: 1.121
PR WC: 1.121
Office 3: 1.121
Workstation 2: 1.121
Office 1: 1.121
Meeting: 1.239
Printer: 1.385
Corridor 2: 1.811
Reception: 1.961
Corridor 1: 2.942

Office (17) - Integration

Corridor 1: 1.302
Reception: 1.38
Corridor 2: 1.486
Office 3: 1.578
Office 2: 1.578
Office 1: 1.578
PR WC: 1.578
PU WC: 1.596
Entrance: 1.596
Workstation 2: 1.67
Workstation 1: 1.702
Meeting: 1.705
Printer: 1.806
Manager: 1.838
Workstation 3: 2.022

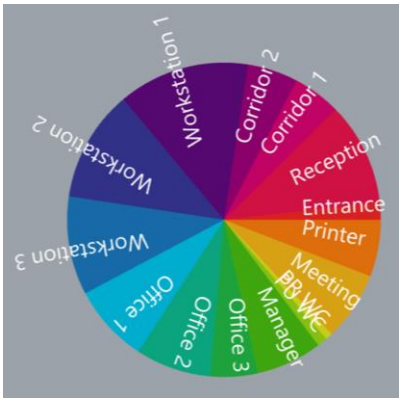
Office (17) - Entropy

Office 2: 0.143
Office 3: 0.143
Office 1: 0.143
PR WC: 0.143
Entrance: 0.25
PU WC: 0.25
Workstation 3: 0.25
Workstation 1: 0.25
Manager: 0.5
Workstation 2: 0.5
Meeting: 1.143
Corridor 2: 1.893
Printer: 2
Reception: 2.393
Corridor 1: 5

Office (17) - Control

Workstation 2: 29
Office 2: 33
Office 1: 33
Office 3: 33
PR WC: 33
PU WC: 33
Manager: 33
Entrance: 33
Workstation 1: 35
Workstation 3: 43
Meeting: 63
Printer: 101
Corridor 2: 109
Reception: 119
Corridor 1: 193

Office (17) - Choice



Office (17) - Zones Pie Chart

0: Entrance, 4sqm
1: Reception, 24sqm
2: Corridor 1, 10sqm
3: Corridor 2, 12sqm
4: Workstation 1, 30sqm
5: Workstation 2, 26sqm
6: Workstation 3, 22sqm
7: Office 1, 18sqm
8: Office 2, 18sqm
9: Office 3, 10sqm
10: Manager, 14sqm
11: PU WC, 2sqm
12: PR WC, 2sqm
13: Meeting, 16sqm
14: Printer, 12sqm

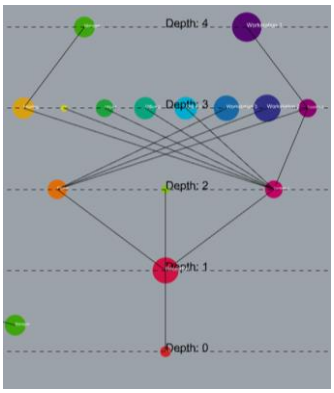
Office (17) - Areas

	{0;0}
0	0.686833

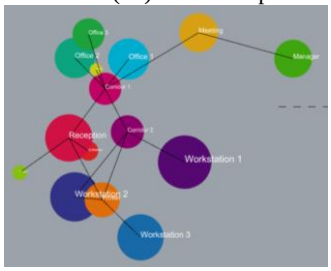
Office (17) - Difference factor

Shortest Distance	
	{6;4}
0	6,14,3,4
	{6;5}
0	6,14,5
	{6;6}
0	6,6
	{6;7}
0	6,14,1,2,7
1	6,14,3,2,7
	{6;8}
0	6,14,1,2,8
1	6,14,3,2,8
	{6;9}
0	6,14,1,2,9
1	6,14,3,2,9
	{6;10}
0	6,14,1,2,13,10
1	6,14,3,2,13,10
	{6;11}
0	6,14,1,11
	{6;12}
0	6,14,1,2,12
1	6,14,3,2,12
	{6;13}
0	6,14,1,2,13
1	6,14,3,2,13
	{6;14}
0	6,14
	{7;0}

Office (17) - Example of Shortest Distance

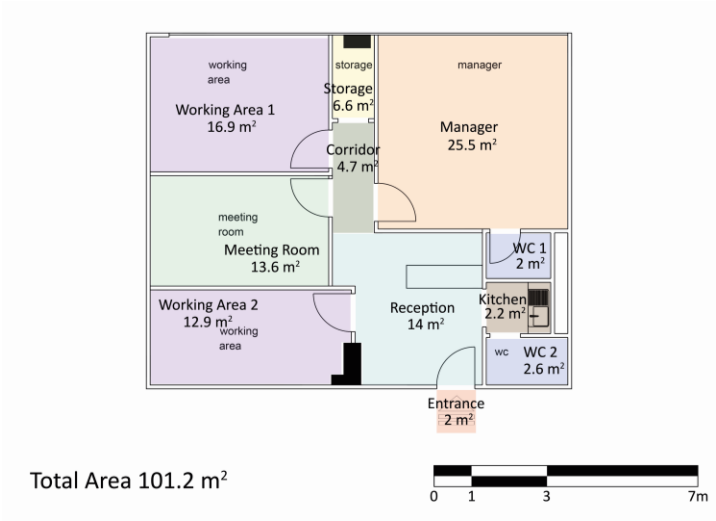


Office (17) - View Depth

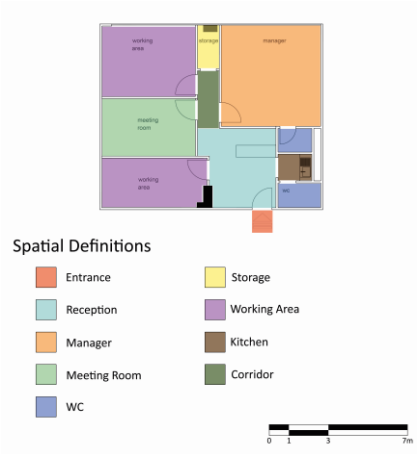


Office (17) - Bubble Diagram

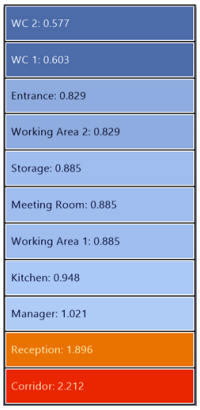
Office (18)



Office (18) - Plan

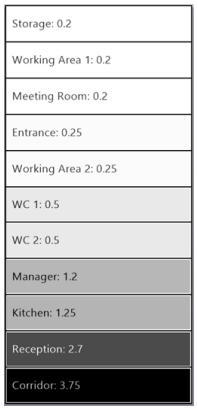


Office (18) - Spatial Definitions



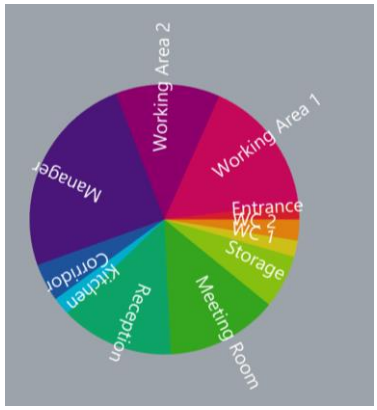
Office (18) - Integration

Office (18) - Entropy



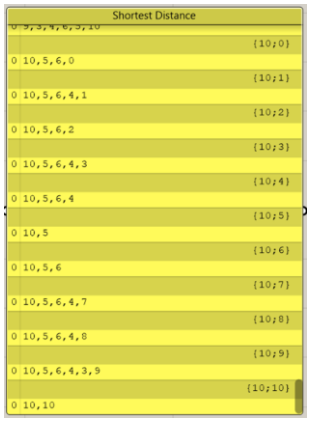
Office (18) - Control

Office (18) - Choice

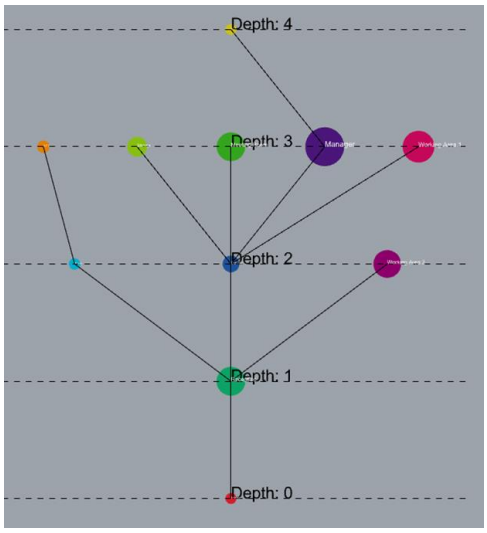


Office (18) - Zones Pie Chart

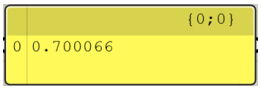
Office (18) - Areas



Office (18) - Example of Shortest Distance



Office (18) - View Depth

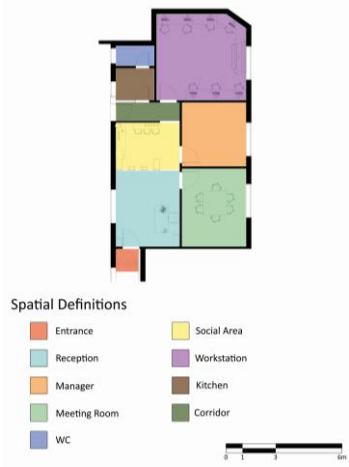


Office (18) - Difference factor

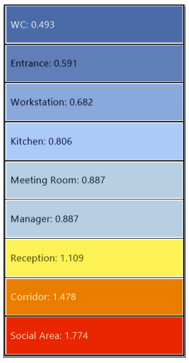
Office (18) - Bubble Diagram

Office (19)

Office (19) - Plan



Office (19) - Spatial Definitions

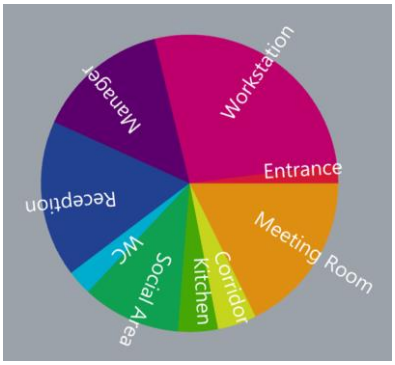


Office (19) - Integration

Office (19) - Entropy

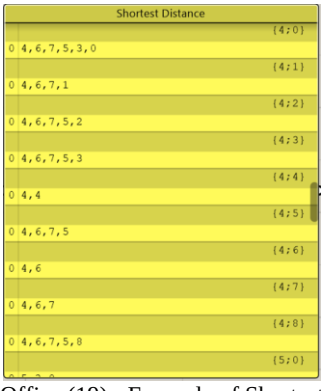
Office (19) - Control

Office (19) - Choice

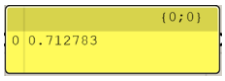


Office (19) - Zones Pie Chart

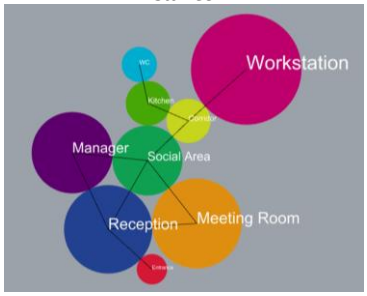
Office (19) - Areas



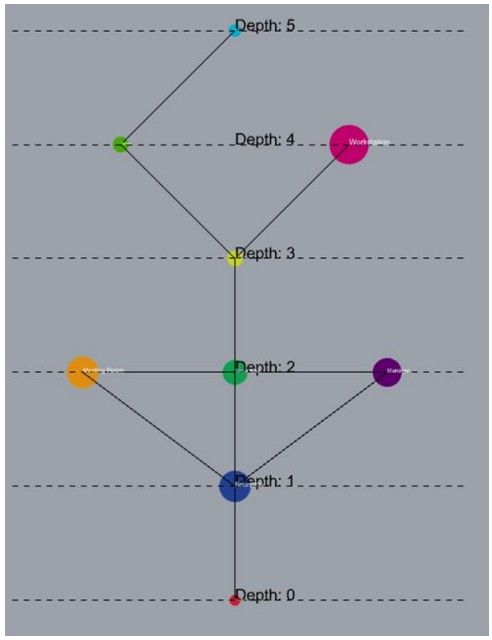
Office (19) - Example of Shortest Distance



Office (19) - Difference factor

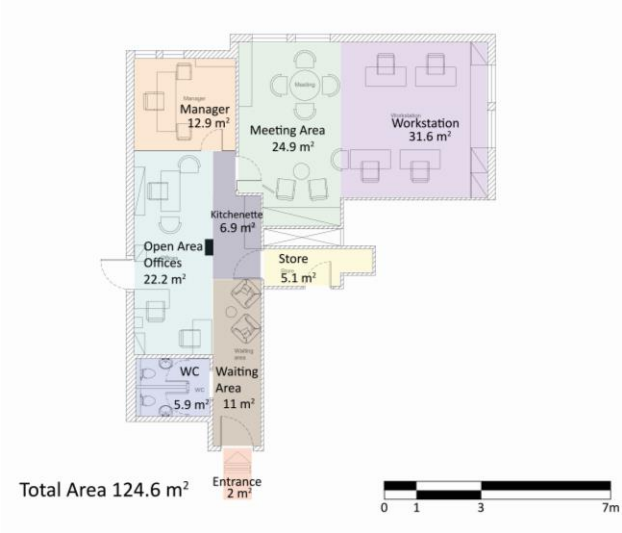


Office (19) - Bubble Diagram

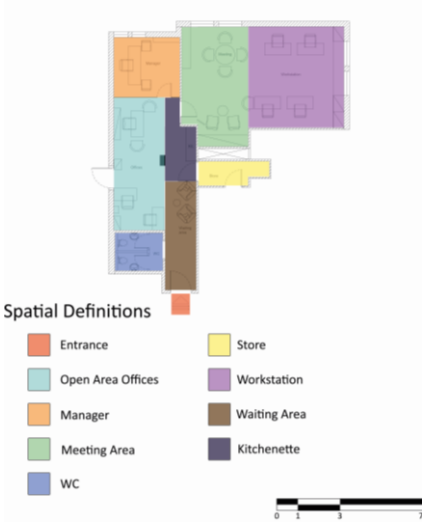


Office (19) - View Depth

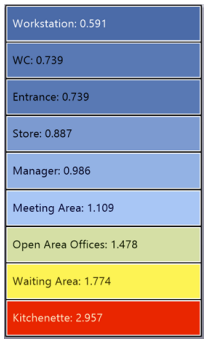
Office (20)



Office (20) - Plan



Office (20) - Spatial Definitions

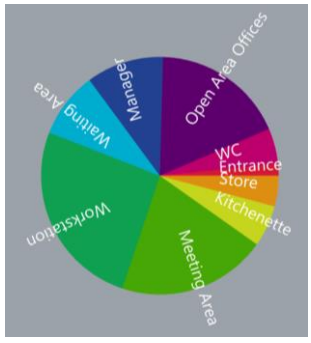


Office (20) - Integration

Office (20) - Entropy

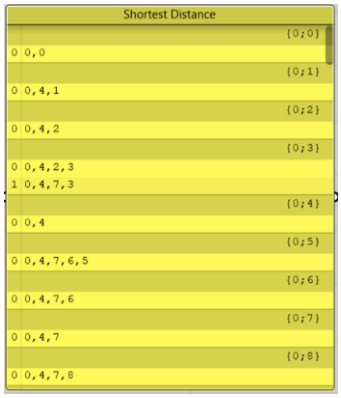
Office (20) - Control

Office (20) - Choice

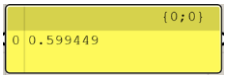


Office (20) - Zones Pie Chart

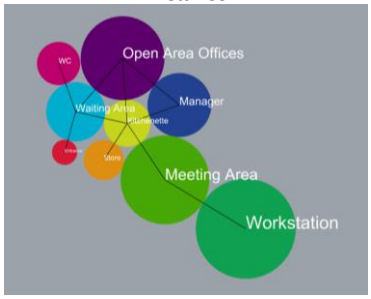
Office (20) - Areas



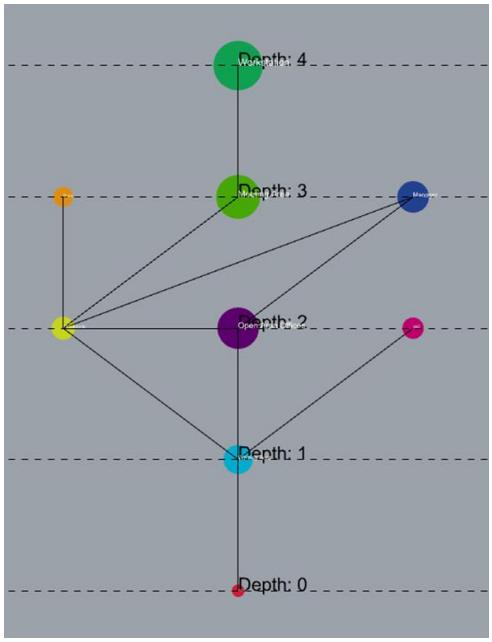
Office (20) - Example of Shortest Distance



Office (20) - Difference factor



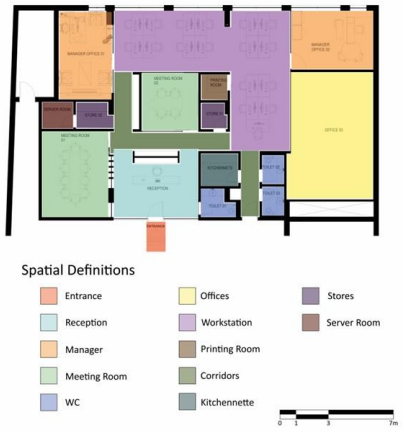
Office (20) - Bubble Diagram



Office (20) - View Depth

Office (21)

Office (21) - Plan



Office (21) - Spatial Definitions

PR WC: 0.77
Kitchen: 0.77
Entrance: 0.836
PU WC: 0.836
Office: 1.084
Manager 2: 1.084
Print: 1.084
Meeting 2: 1.171
Store 1: 1.171
Store 2: 1.171
Manager 1: 1.22
Corridor 2: 1.273
Meeting 1: 1.33
Reception: 1.464
Workstation 1: 1.722
Workstation 2: 2.439
Corridor 1: 2.927

Office (21) - Integration

Corridor 1: 1.405
Workstation 2: 1.405
Workstation 1: 1.419
Office: 1.635
Print: 1.635
Manager 2: 1.635
Store 2: 1.661
Meeting 2: 1.661
Store 1: 1.661
Meeting 1: 1.729
Manager 1: 1.787
Corridor 2: 1.854
Reception: 1.876
PR WC: 2.016
Kitchen: 2.016
Entrance: 2.067
PU WC: 2.067

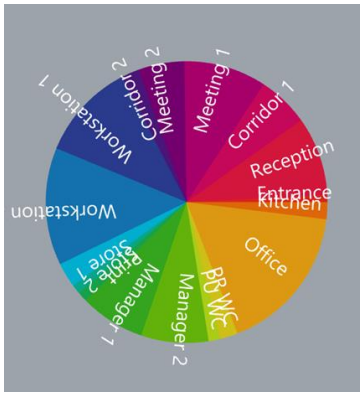
Office (21) - Entropy

Meeting 2: 0.125
Store 2: 0.125
Store 1: 0.125
Print: 0.167
Office: 0.167
Manager 2: 0.167
Entrance: 0.25
PU WC: 0.25
PR WC: 0.333
Kitchen: 0.333
Meeting 1: 0.375
Manager 1: 0.458
Workstation 1: 0.792
Corridor 2: 2.167
Reception: 2.625
Workstation 2: 3.792
Corridor 1: 4.75

Office (21) - Control

Store 1: 33
Meeting 2: 33
PU WC: 33
Store 2: 33
Entrance: 33
Meeting 1: 33
Manager 2: 35
PR WC: 35
Kitchen: 35
Office: 35
Print: 35
Workstation 1: 47
Manager 1: 47
Reception: 91
Corridor 2: 97
Workstation 2: 191
Corridor 1: 203

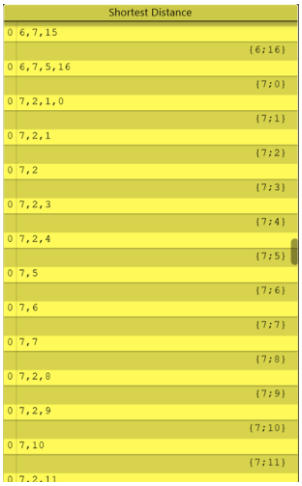
Office (21) - Choice



Office (21) - Zones Pie Chart

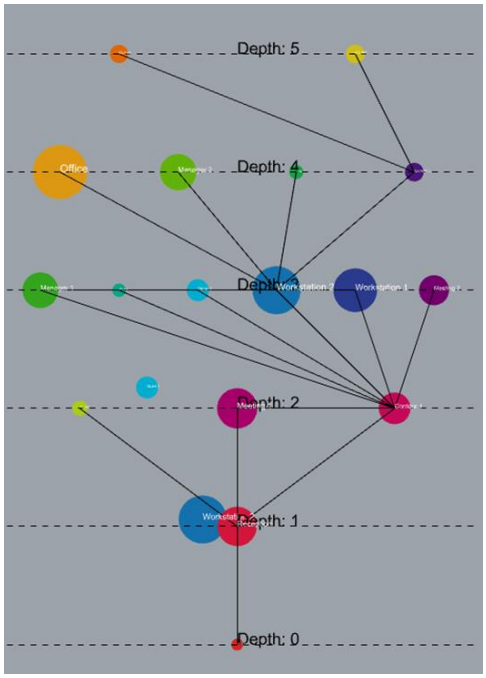
0: Entrance, 2sqm
1: Reception, 26sqm
2: Corridor 1, 16sqm
3: Meeting 1, 26sqm
4: Meeting 2, 14sqm
5: Corridor 2, 6sqm
6: Workstation 1, 32sqm
7: Workstation 2, 38sqm
8: Store 1, 8sqm
9: Store 2, 2sqm
10: Print, 4sqm
11: Manager 1, 20sqm
12: Manager 2, 22sqm
13: PU WC, 4sqm
14: PR WC, 6sqm
15: Office, 48sqm
16: Kitchen, 6sqm

Office (21) - Areas



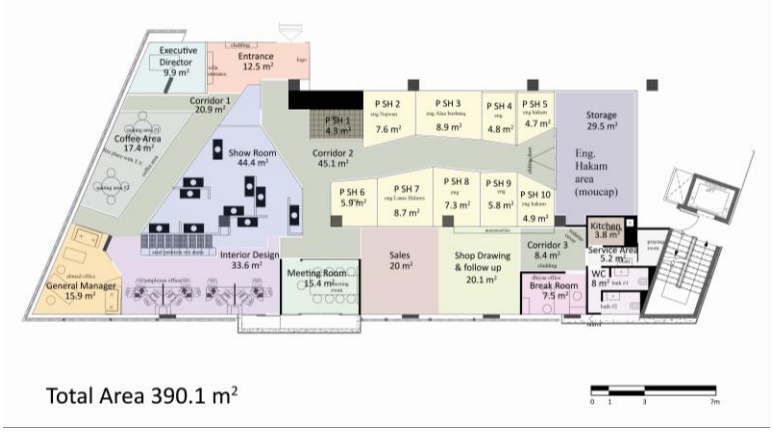
Office (21) - Example of Shortest Distance

Office (21) - Difference factor

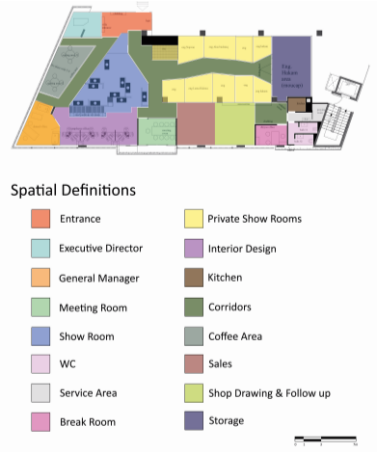


Office (21) - View Depth

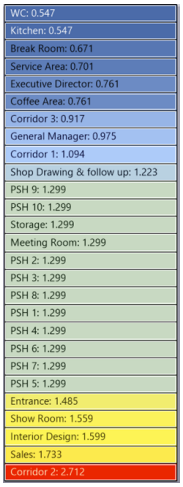
Office (22)



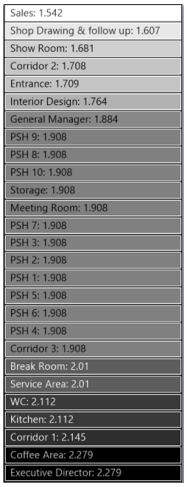
Office (22) - Plan



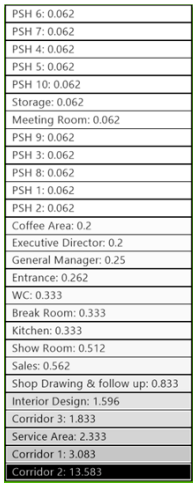
Office (22) - Spatial Definitions



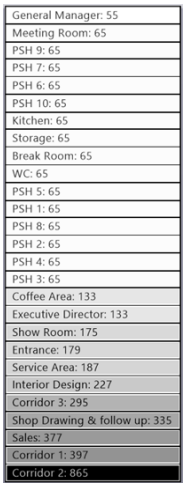
Office (22) - Integration



Office (22) - Entropy



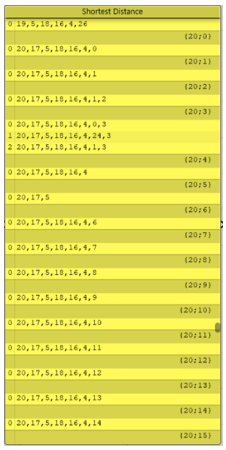
Office (22) - Control



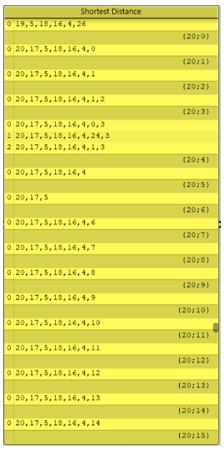
Office (22) - Choice

Office (22) - Zones Pie Chart

Office (22) - Areas

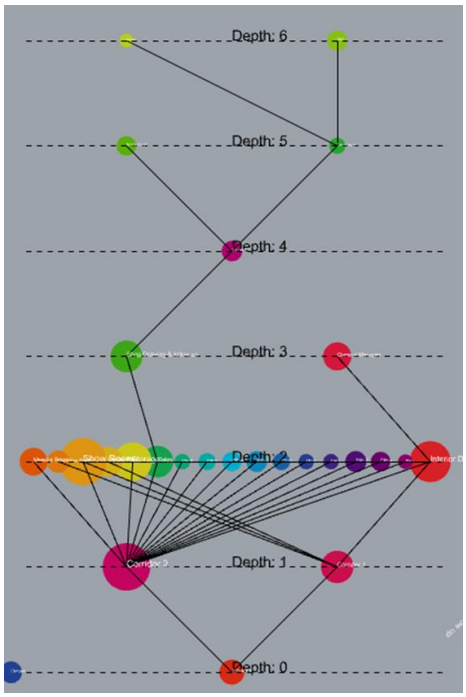


Office (22) - Example of Shortest Distance Part 1



Office (22) - Example of Shortest Distance Part 2

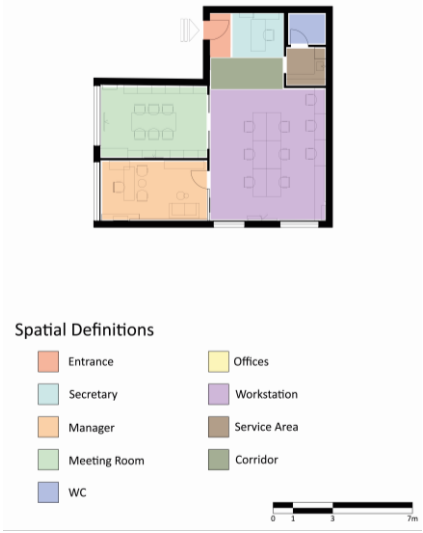
Office (22) - Difference factor



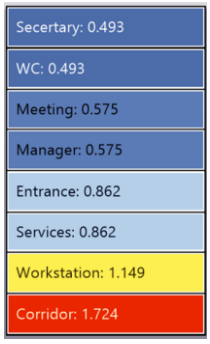
Office (22) - View Depth

Office (23)

Office (23) - Plan

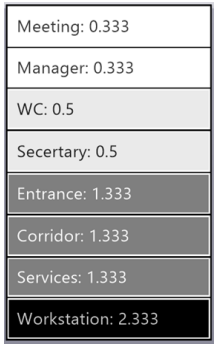


Office (23) - Spatial Definitions

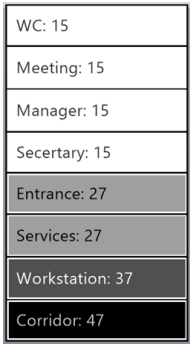


Office (23) - Integration

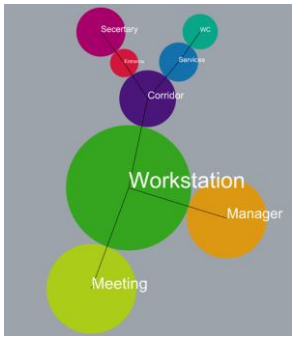
Office (23) - Entropy



Office (23) - Control

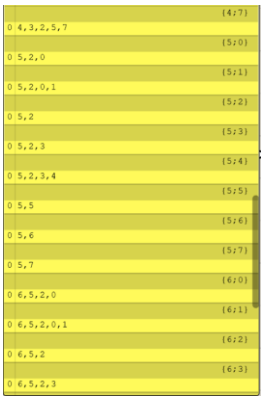


Office (23) - Choice



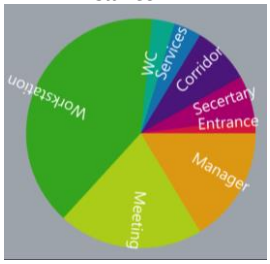
Office (23) - Bubble Diagram

Office (23) - Areas

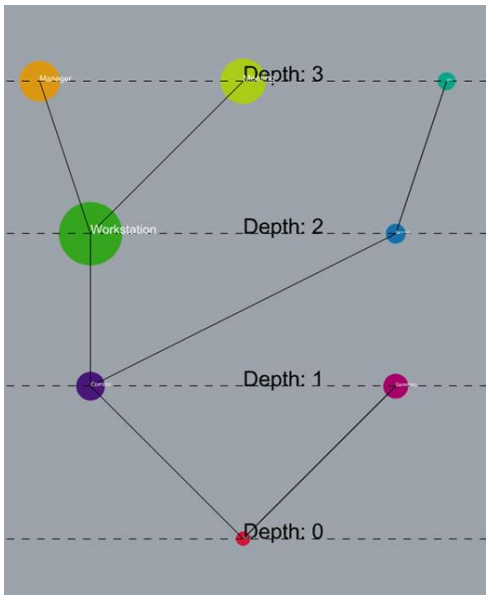


Office (23) - Example of Shortest Distance

Office (23) - Difference factor



Office (23) - Zones Pie Chart

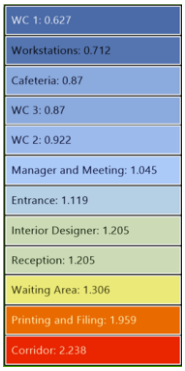


Office (23) - View Depth

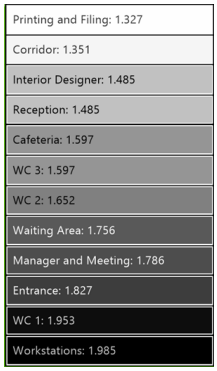
Office (24)

Office (24) - Plan

Office (24) - Spatial Definitions



Office (24) - Integration



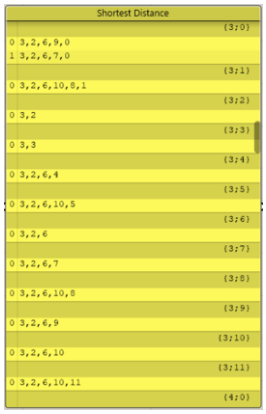
Office (24) - Entropy

Office (24) - Control

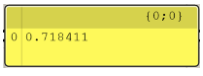
Office (24) - Choice

Office (24) - Zones Pie Chart

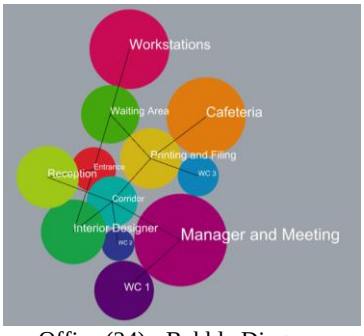
Office (24) - Areas



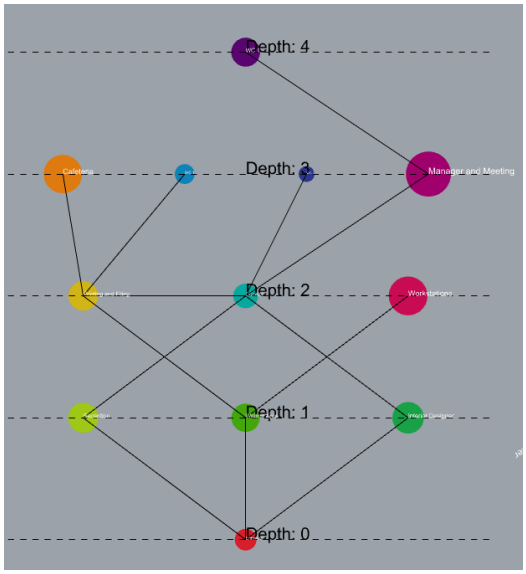
Office (24) - Example of Shortest Distance



Office (24) - Difference factor

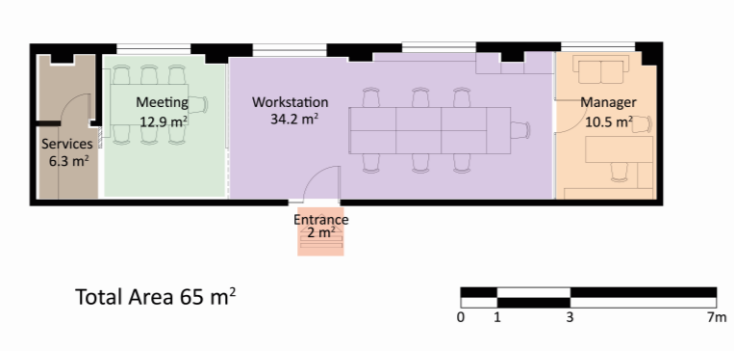


Office (24) - Bubble Diagram

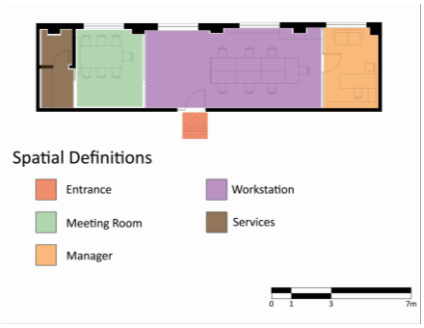


Office (24) - View Depth

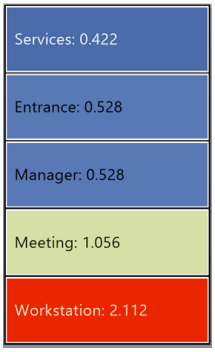
Office (25)



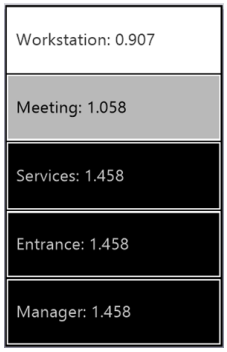
Office (25) - Plan



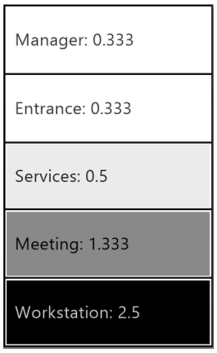
Office (25) - Spatial Definitions



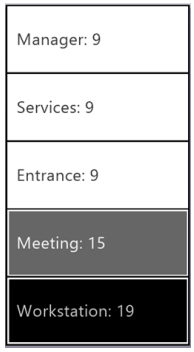
Office (25) - Integration



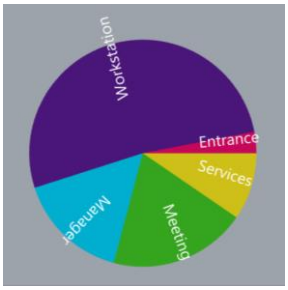
Office (25) - Entropy



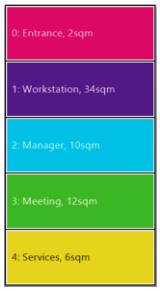
Office (25) - Control



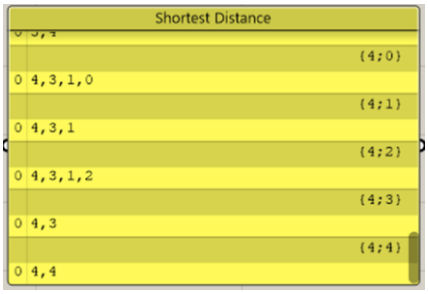
Office (25) - Choice



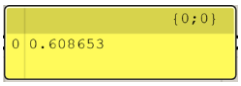
Office (25) - Zones Pie Chart



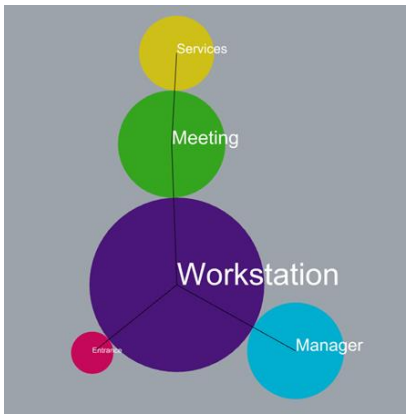
Office (25) - Areas



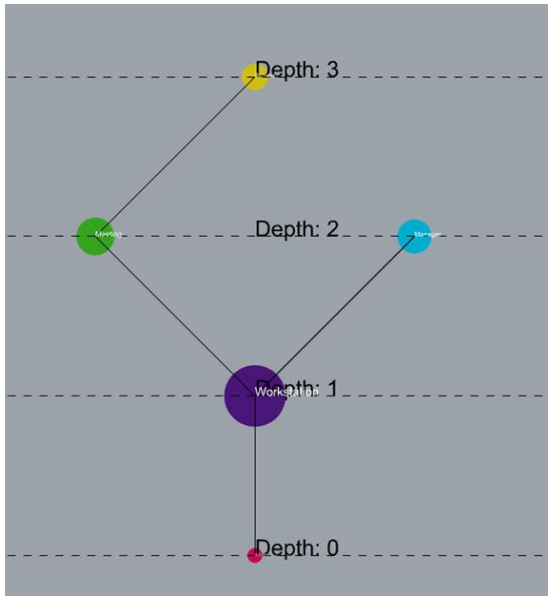
Office (25) - Example of Shortest Distance



Office (25) - Difference factor



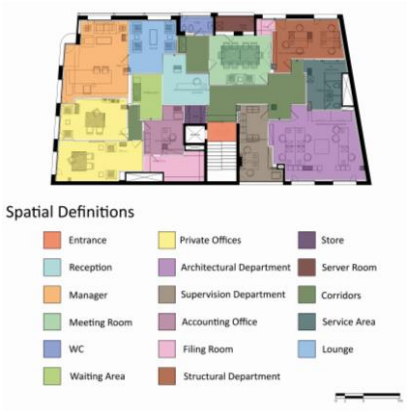
Office (25) - Bubble Diagram



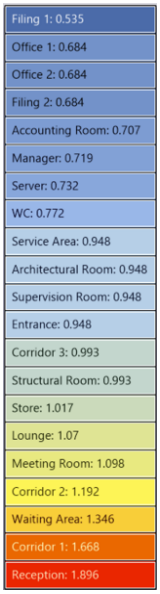
Office (25) - View Depth

Office (26)

Office (26) - Plan



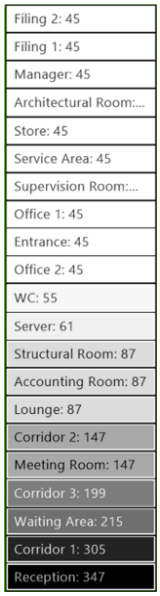
Office (26) - Spatial Definitions



Office (26) - Integration

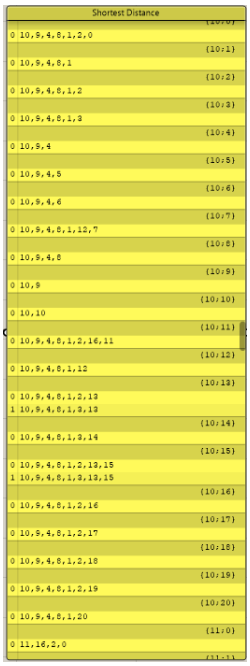
Office (26) - Entropy

Office (26) - Control

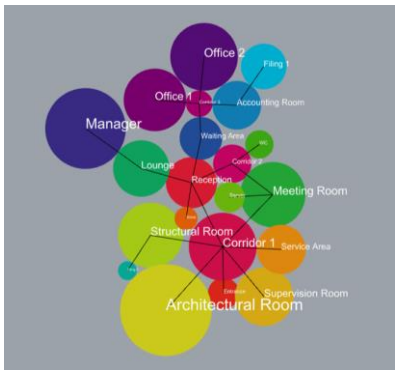


Office (26) - Choice

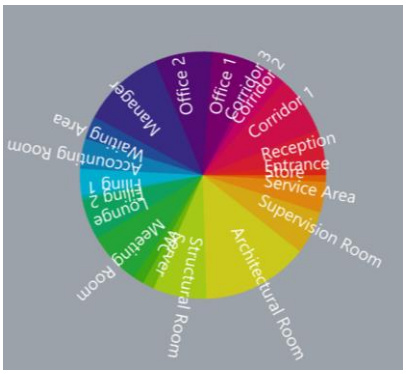
Office (26) - Areas



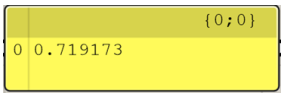
Office (26) - Example of Shortest Distance



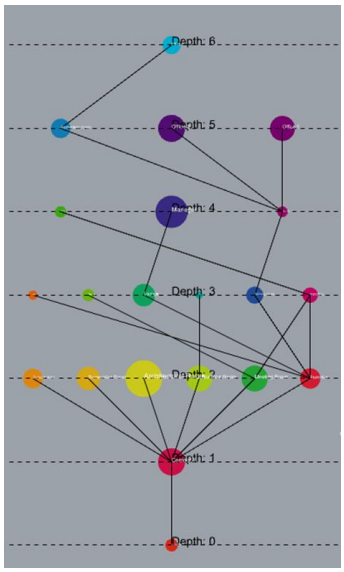
Office (26) - Bubble Diagram



Office (26) - Zones Pie Chart



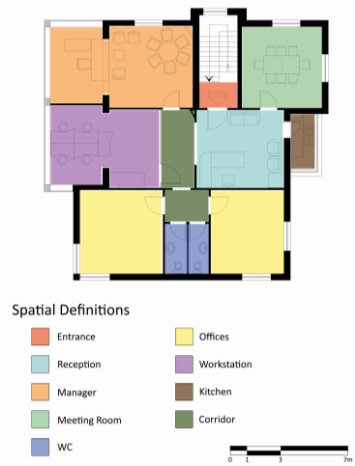
Office (26) - Difference factor



Office (26) - View Depth

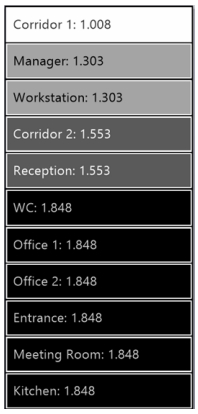
Office (27)

Office (27) - Plan



Office (27) - Spatial Definitions

Office (27) - Integration



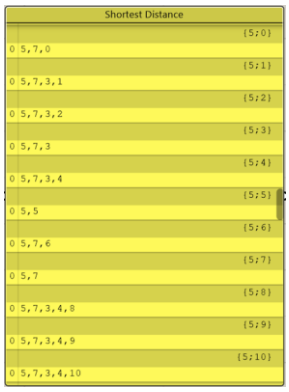
Office (27) - Entropy

Office (27) - Control

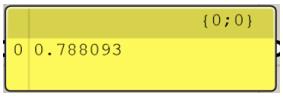
Office (27) - Choice

Office (27) - Bubble Diagram

Office (27) - Areas

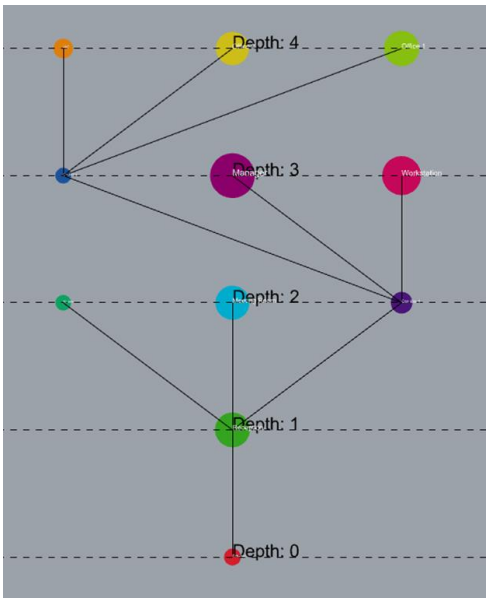


Office (27) - Example of Shortest Distance



Office (27) - Difference factor

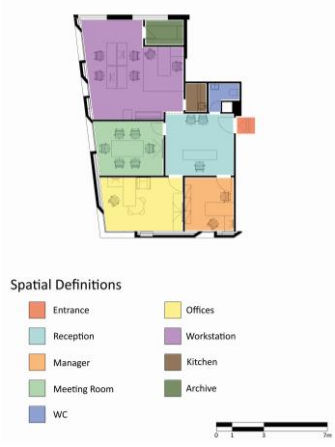
Office (27) - Zones Pie Chart



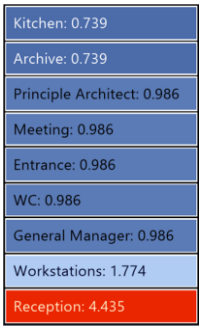
Office (27) - View Depth

Office (28)

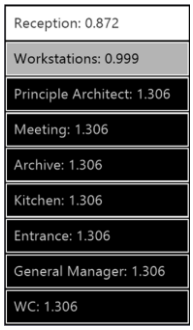
Office (28) - Plan



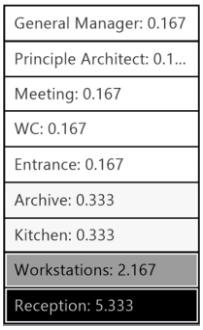
Office (28) - Spatial Definitions



Office (28) - Integration

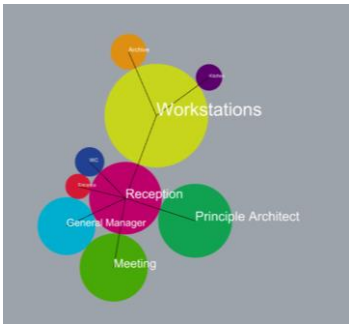


Office (28) - Entropy



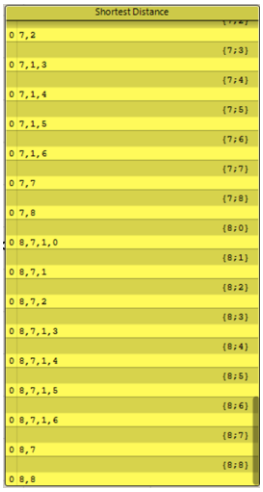
Office (28) - Control

Office (28) - Choice

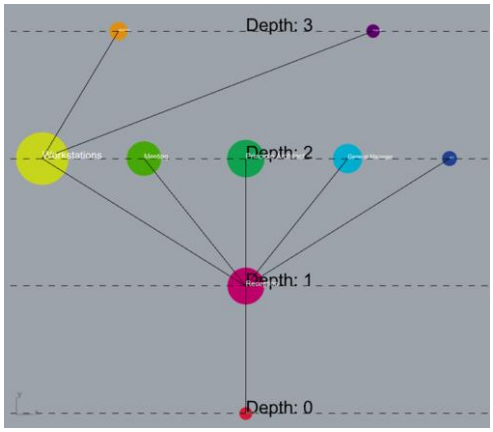


Office (28) - Bubble Diagram

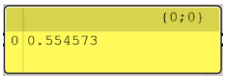
Office (28) - Areas



Office (28) - Example of Shortest Distance



Office (28) - View Depth

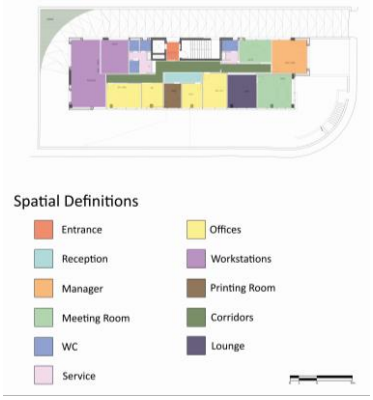


Office (28) - Difference factor

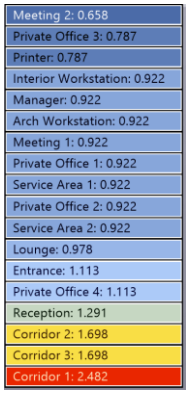
Office (28) - Zones Pie Chart

Office (29)

Office (29) - Plan

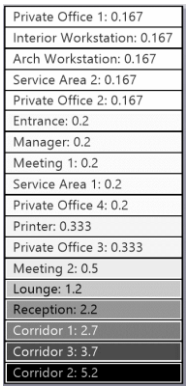


Office (29) - Spatial Definitions



Office (29) - Integration

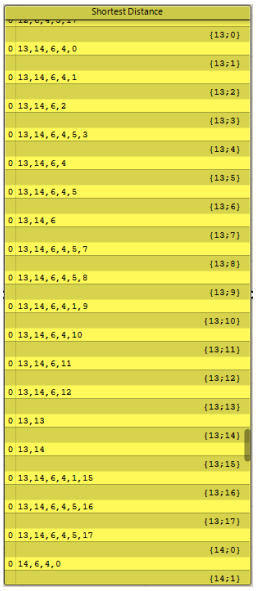
Office (29) - Entropy



Office (29) - Control

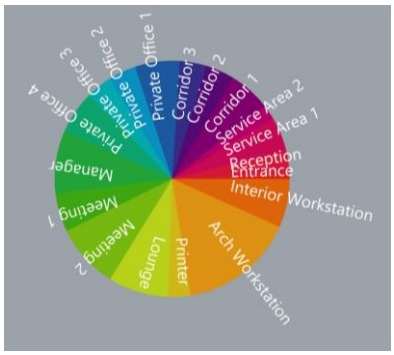
Office (29) - Choice

Office (29) - Areas

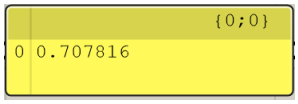


Office (29) - Example of Shortest Distance

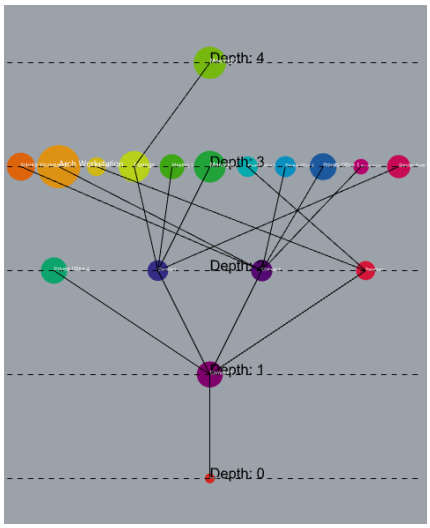
Office (29) - Bubble Diagram



Office (29) - Zones Pie Chart

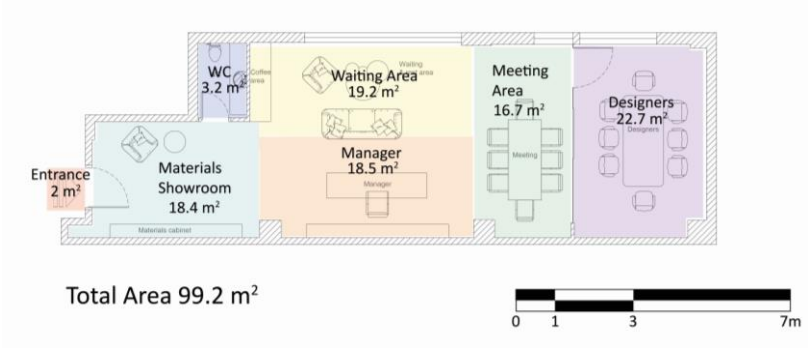


Office (29) - Difference factor

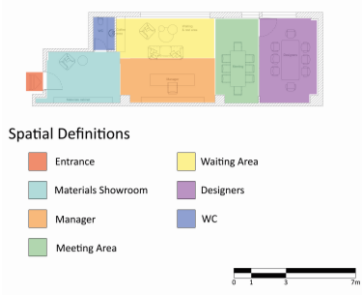


Office (29) - View Depth

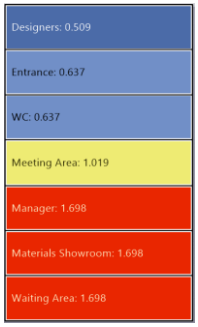
Office (30)



Office (30) - Plan



Office (30) - Spatial Definitions

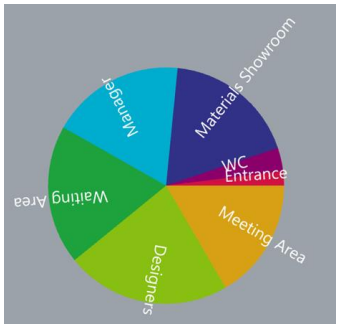


Office (30) - Integration

Office (30) - Entropy

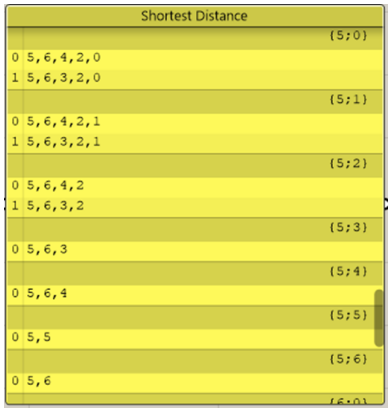
Office (30) - Control

Office (30) - Choice



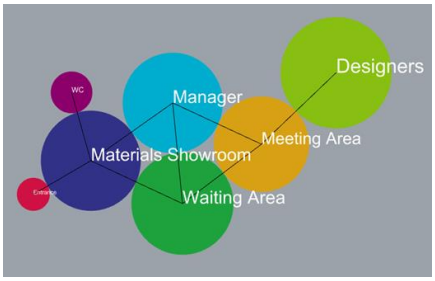
Office (30) - Zones Pie Chart

Office (30) - Areas

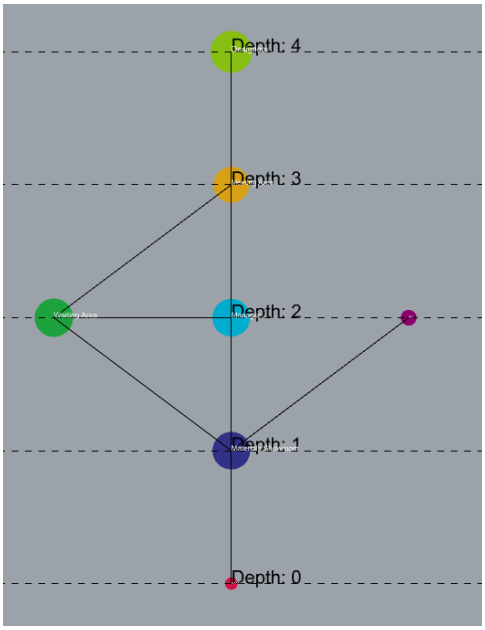


Office (30) - Example of Shortest Distance

Office (30) - Difference factor

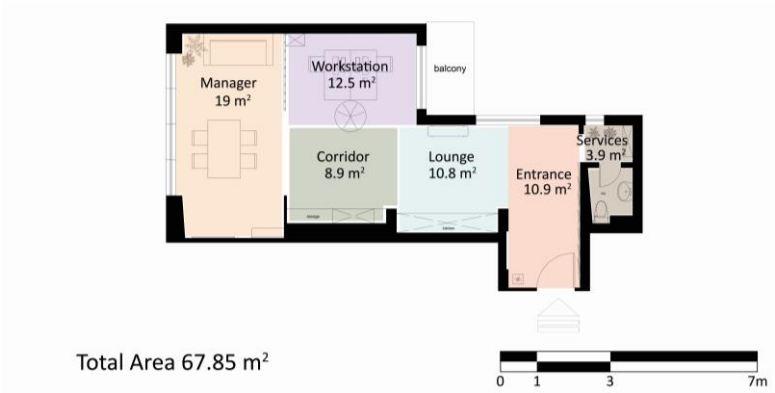


Office (30) - Bubble Diagram



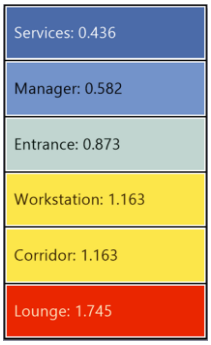
Office (30) - View Depth

Office (31)



Office (31) - Plan

Office (31) - Spatial Definitions

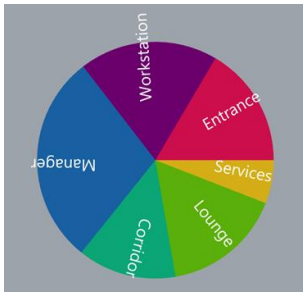


Office (31) - Integration

Office (31) - Entropy

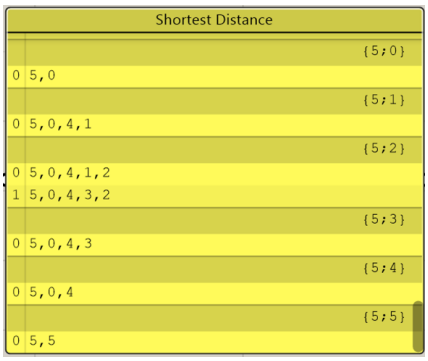
Office (31) - Control

Office (31) - Choice

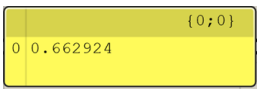


Office (31) - Zones Pie Chart

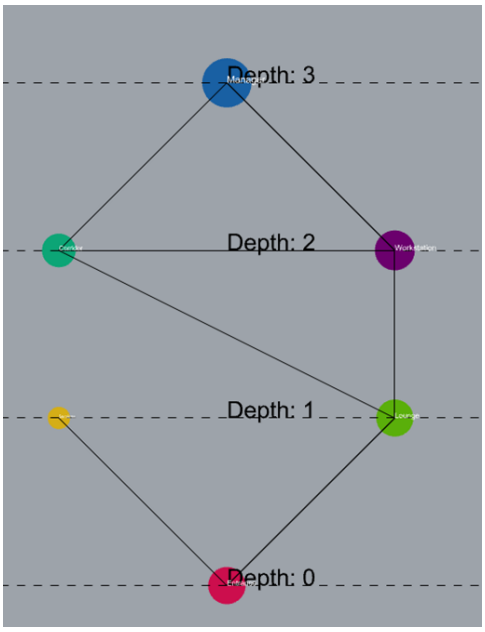
Office (31) - Areas



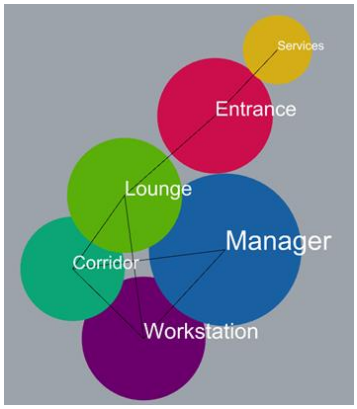
Office (31) - Example of Shortest Distance



Office (31) - Difference factor

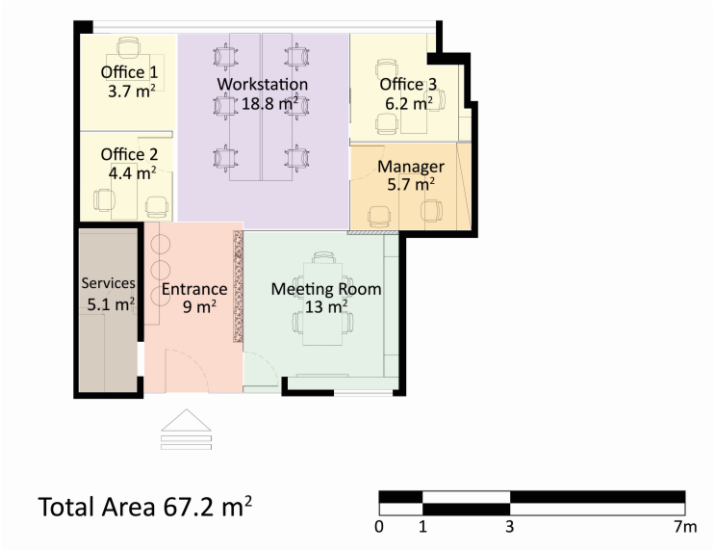


Office (31) - View Depth

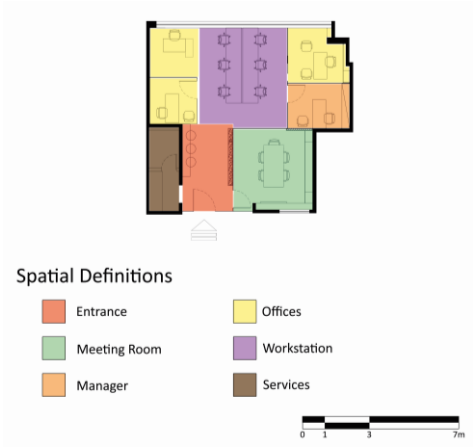


Office (31) - Bubble Diagram

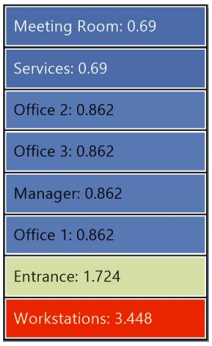
Office (32)



Office (32) - Plan

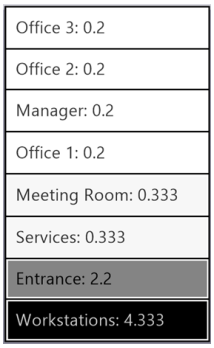


Office (32) - Spatial Definitions



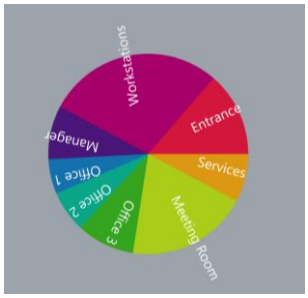
Office (32) - Integration

Office (32) - Entropy



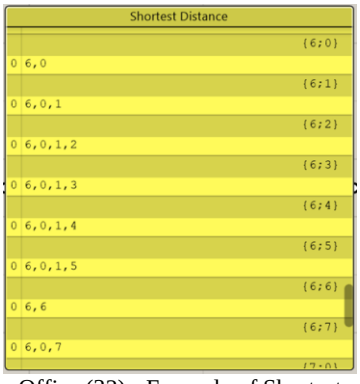
Office (32) - Control

Office (32) - Choice

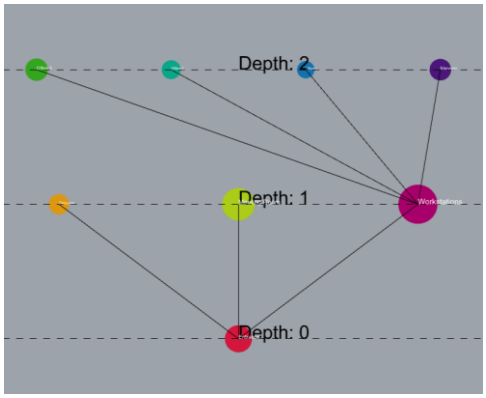


Office (32) - Zones Pie Chart

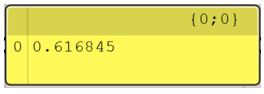
Office (32) - Areas



Office (32) - Example of Shortest Distance



Office (32) - View Depth

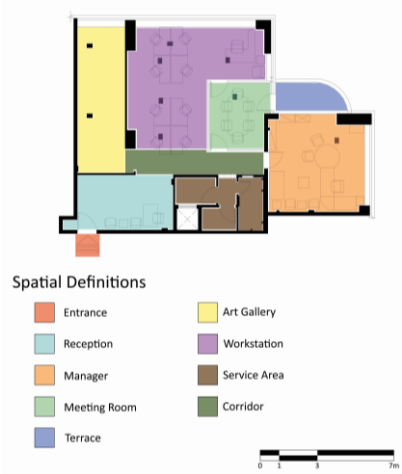


Office (32) - Difference factor

Office (32) - Bubble Diagram

Office (33)

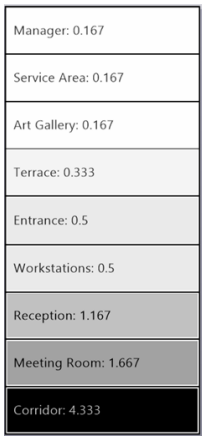
Office (33) - Plan



Office (33) - Spatial Definitions

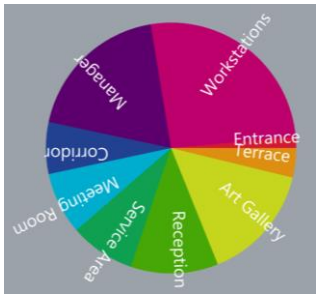
Office (33) - Integration

Office (33) - Entropy

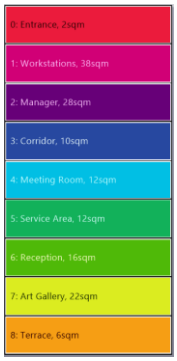


Office (33) - Control

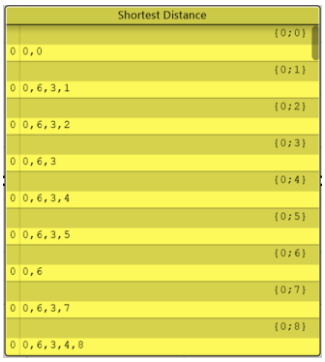
Office (33) - Choice



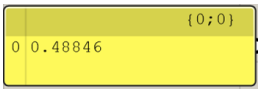
Office (33) - Zones Pie Chart



Office (33) - Areas

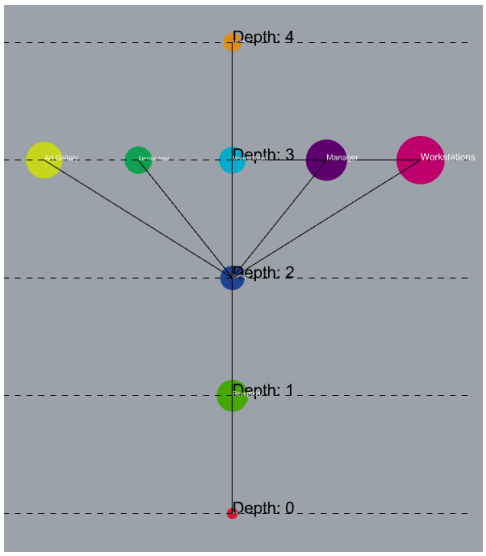


Office (33) - Example of Shortest Distance



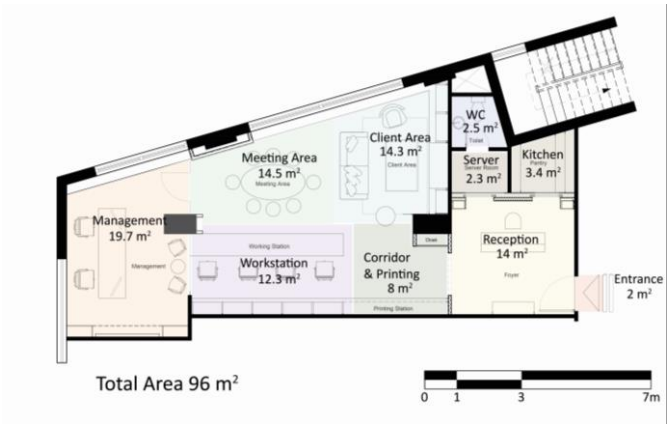
Office (33) - Difference factor

Office (33) - Bubble Diagram

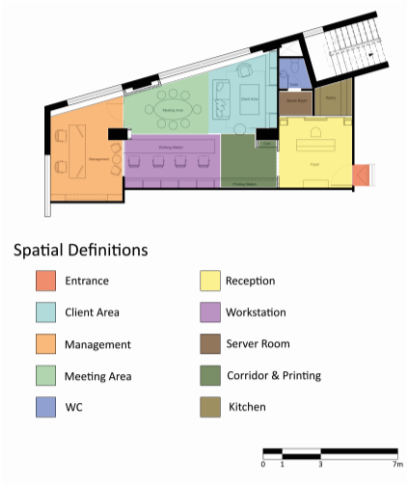


Office (33) - View Depth

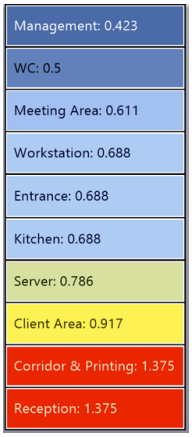
Office (34)



Office (34) - Plan

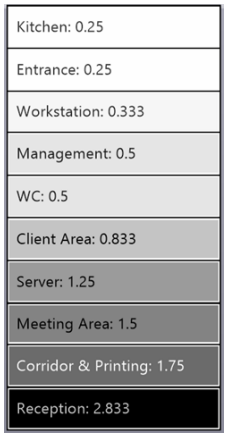


Office (34) - Spatial Definitions

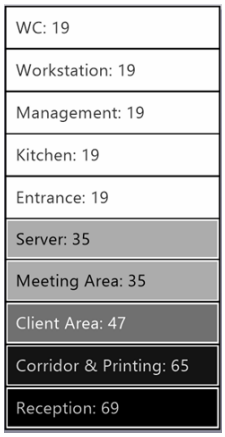


Office (34) - Integration

Office (34) - Entropy



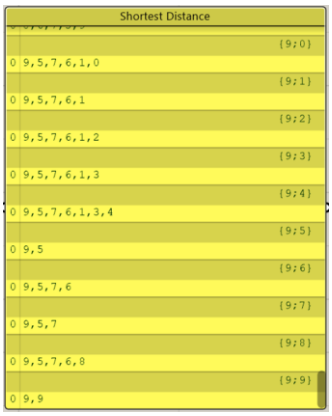
Office (34) - Control



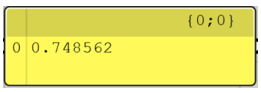
Office (34) - Choice

Office (34) - Zones Pie Chart

Office (34) - Areas

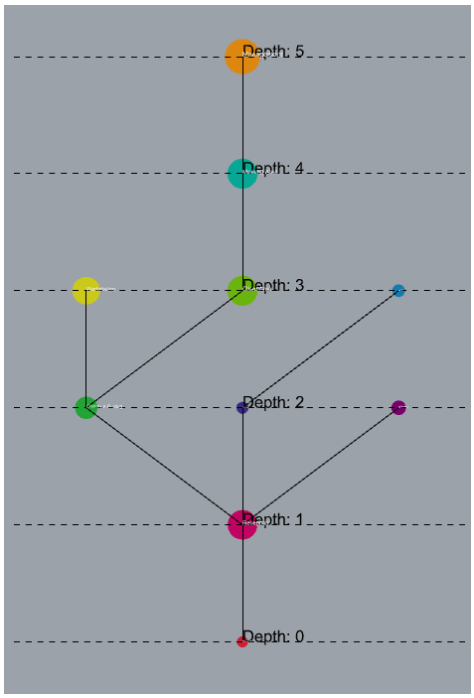


Office (34) - Example of Shortest Distance



Office (34) - Difference factor

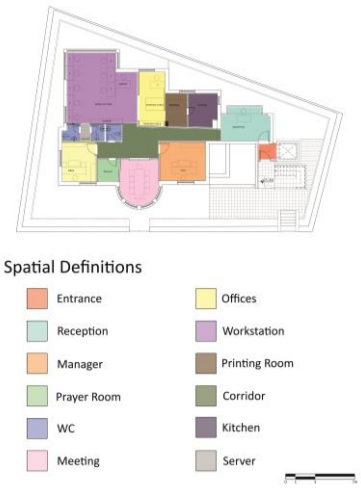
Office (34) - Bubble Diagram



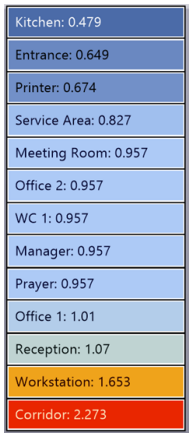
Office (34) - View Depth

Office (35)

Office (35) - Plan

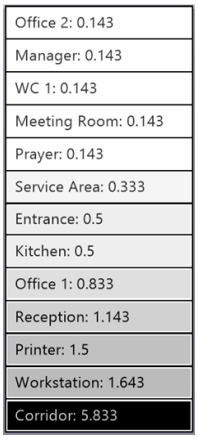


Office (35) - Spatial Definitions

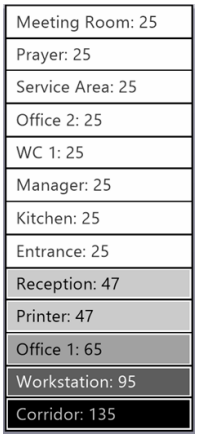


Office (35) - Integration

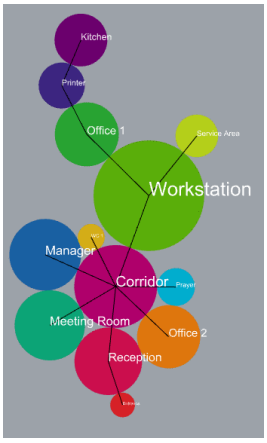
Office (35) - Entropy



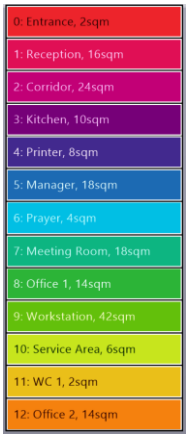
Office (35) - Control



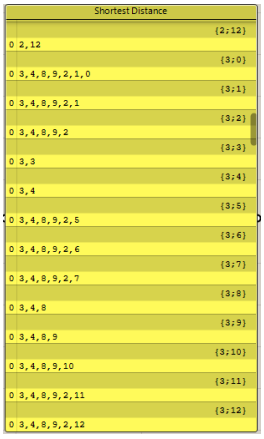
Office (35) - Choice



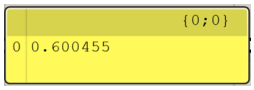
Office (35) - Zones Pie Chart



Office (35) - Areas

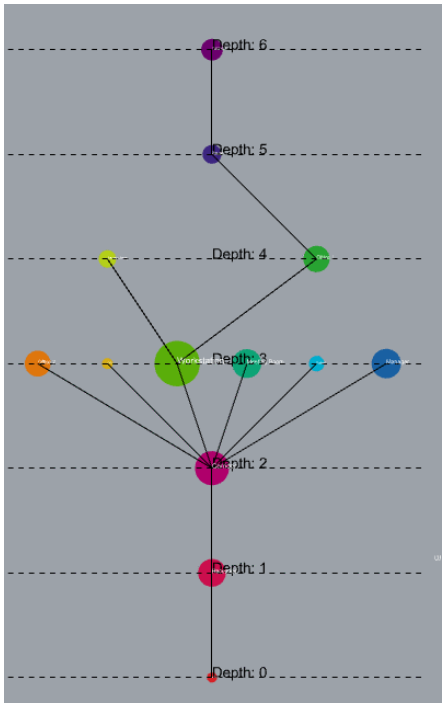


Office (35) - Example of Shortest Distance



Office (35) - Difference factor

Office (35) - Bubble Diagram



Office (35) - View Depth

Appendix C

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Shrouq Altamimi

+962795182678
shorooq-interior-design@hotmail.com

Date and Place of Birth: Kuwait, 19/9/1989
Nationality: Jordanian
Marital Status: Single

Objectives:

Seeking a challenging job in a growth-oriented organization that gives me the opportunity to utilize my skills, knowledge and experience, and to grow with the organization with continuously improving my abilities.

Work experience:

- **February 2022- Present:**
  Interior designer at Asas Casa Trading W.L.L in Doha, Qatar.
- **September 2017- August 2018:**
  Interior design instructor (lecturer) at Applied Science University in different interior design courses: ((2D & 3D Geometric Drawing, Maquette, Architectural Presentation, Principles of Interior Design, Design Principles, and Working Drawings)).
- Part timer interior designer at Istatieh Decorations (Sep 2013 to Feb 2015).
- **November 2012- August 2017:**
  Teaching assistant at Petra University in different interior design courses: ((Architectural Drawing (2D, 3D), Basics of Design (1, 2), Interior Design (1-5), Graduation Project, Landscape Planning and Design, Colors Theory, and Architectural Rendering)).
- Training at Tareq Abdein Architecture and Interior Design-O2 Designs (Apr 2012 to May 2012).
- Training at COX Group for Decoration & Design (Feb 2012 to Mar 2012).
- **March 2011- December 2011:**
  Designing and supervising the interiors of Ark Gym located in university street Irbid-Jordan (Utilizing AutoCAD for producing architectural, mechanical, and electrical shop drawings such as masonry, tiling, lighting plans, elevations and details to produce full construction documents of project).
- Training at Sans Interior Studio (Aug 2010 to Oct 2010).

Education History:

2018 - 2023

- Ph.D. in Interior Design from Near East University / Yakın Doğu Üniversitesi - Nicosia / TRNC. Achieved a GPA of 4 in the second semester of the academic year 2022/2023.

2013 - 2016

- Master's degree in Interior Design with distinction from The World Islamic Science & Education University - Amman, Jordan. Achieved a GPA of 91.1 with distinction and a standing of the first on the Interior Design class that graduated in the third semester (summer semester) of the academic year 2015/2016.
- Thesis: Re-Designing the Interior Spaces of Traditional Buildings by Contemporary Interior Design La Locanda/ Boutique Hotel, Jabal Al Lweibdeh as a Case Study.

2007 - 2011

- Bachelor's degree in Interior Design with distinction from Amman Al Ahliyya University - Amman, Jordan. Achieved a GPA of 90.4 with distinction and a standing of the first on the Interior Design class that graduated in the second semester of the academic year 2010/2011.
- Graduation Project: Six Senses Hotel & Spa.

2006 - 2007

- High school (Tawjihi diploma), Modern systems Schools, Amman- Jordan.

Computer skills:

- General knowledge and experience in a variety of programs and applications.
- Microsoft office.
- AutoCAD program.
- 3Ds Max program.

Skills:

- Paintings & free hand drawings with coal, pencil and watercolors.
- Hard worker with strong problem-solving skills.
- Ability to work under pressure.
- Interaction with new people and environments.
- Time management.
- Team work.