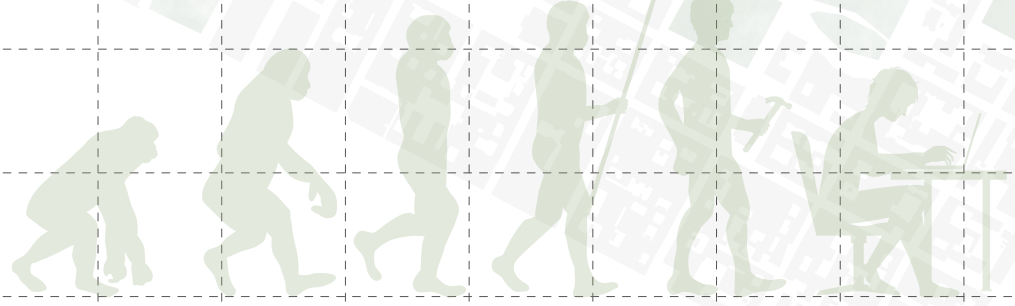
Reducing Employee Stress through Biophilic Design in Public Spaces: *An Architectural and Psychological Approach*



POLITECNICO DI TORINO

Master of Science in Architecture For Sustainability

Master's Thesis

Reducing Employee Stress Trough Biophilic Design in Public Spaces

An architectural and Psychological Approach

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I owe a debt of gratitude to my aunt Arch Ayse Aybek Batman, who always inspired me and made me decide to become an architect before I even started school. Whether we spend a short or long time in this life, she has shown the best example that the traces we leave behind are a fragrance and one day, they grow and turn into a tree that grows in its own soil.

I would like to thank my mother, Beytihan Sezgin, my father, Murat Sezgin, and my brother, Emrecan Sezgin, who supported me a lot in my student life in pursuing my career dreams by coming to another country for always following the principles of science, researching and questioning, and at the same time raising me with love.

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Introduction

"44% of employees worldwide reported feeling an abundance of stress the day before. This is the second year in a row that worker stress has hit new highs.Employee stress, on the other hand, has been on the rise for more than a decade. Many factors influence stress." (Gallup, 2023)

In the rapidly urbanizing landscapes of modern urban environments, the well-being of individuals is increasingly challenged by the demands and stresses of daily life. As our cities grow denser and more fast-paced, it becomes imperative to explore innovative solutions that address the well-documented issue of workplace stress. This thesis explores the potential of green public spaces to mitigate and reduce the stress experienced by workers in urban settings.The foundation of this thesis is rooted in the recognition that humans are profoundly influenced by their surroundings.

This thesis represents a holistic exploration of how green public areas can serve as a powerful tool in alleviating the stressors of modern urban life. The essential role of architecture in fostering a harmonious balance between nature and human life. It posits that architecture should not act as a barrier, but rather as a bridge that seamlessly integrates the natural world into our daily lives. By merging insights from environmental psychology, the science of stress, the concept of restorative environments, and the principles of biophilic design, it offers a comprehensive framework for enhancing workplace well-being, ultimately fostering to inspire more sustainable and health-conscious urban development practices.

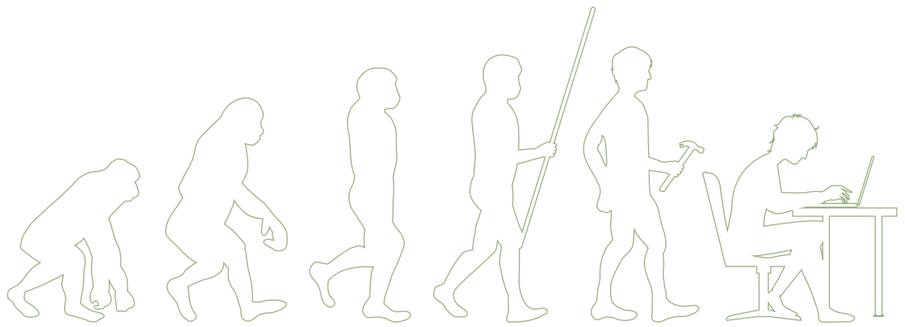
Chapter 1 delves into the intricate relationship between humans and their environment, shedding light on environmental psychology facts within the context of modern urban settings. It sets the stage for understanding how our surroundings can significantly influence our mental state.

Chapter 2 focuses on stress, a common by product of today's fast-paced lifestyle. It provides an in-depth analysis of the scientific effects of stress on our bodies, emphasizing the need for effective stress management strategies.

Chapter 3 introduces the concept of restorative environments and their benefits in reducing stress, balancing hormones, uplifting mood, and restoring directed attention. The chapter underscores the importance of biophilic design, a design philosophy that seeks to connect people more closely to nature.

Chapter 4 presents an array of case studies that examine the relationship between workplace stress levels, the restoration theory, mood change, and the incorporation of biophilic design in public spaces. These real-world examples provide empirical evidence of the potential positive impact of green public areas on worker well-being.

Chapter 5 takes a proactive stance by proposing a project aimed at reducing worker stress in the vibrant area of Turin's city center. This proposal involves an analysis of the quantity and quality of green areas in Turin's Centro district. It further outlines strategies for improving selected areas and creating a project hypothesis for a typical proposal that can be replicated in similar urban contexts globally.



CHAPTER 1

The Relationship Between Human and Environment

1.1 Background of Societies

History has a great impact on shaping the living conditions of today's societies. It is possible to start with a review from history to today in order to understand today's social lifestyles and the problems of modern life. In order to understand the change of societies from past to present, it is instructive to examine Alvin Toff's Wave theory, which analyzes the historical development of societies.(Masini, 1991)

He distinguished three stages in development of society and production: agrarian, industrial and post-industrial. This separation on a timeline creates an increased acceleration paradigm on informations and innovations. When agriculture first developed during the Neolithic Era, civilisation as we know it today emerged from barbarism. Many people engaged in prosumer behaviour (eating their grown food, hunting animals, building their own houses, making clothes, etc.) (Chu, 2022). People conducted trade by exchanging their own goods for those of others. (Toffler, 1970)

The second stage started in England during the Industrial Revolution, when the steam engine and machine tool were created. To earn money to purchase the products they needed, people worked in factories (it means they produced for exchange, not for use). New social structures were also developed by nations (Ann Kordas, 2022).

The third stage started In the West, automatic production, robotics, and the computer were developed in the latter half of the 20th century, ushering in the third stage. The services industry has become quite valuable (Ann Kordas, 2022). Toffler advocated the percentage of the people employed in agriculture compared to the percentage of city workers employed in the services sector as a criterion for separating industrial society from post-industrial society. In a post-industrial society, less than 15% of the population is employed in agriculture, while more than 50% of city workers are employed in the services sector(Ritchie,Roser, 2018). In a post-industrial society, the proportion of persons engaged in intellectual activity therefore vastly outweighs that of those engaged in physical activity. In order to understand change parameter on individuals than society we need to consider also length of the period. The powerful, massive and rapid changes come with overload information's (Toffler, 1970).

"On a long and narrow road
Walking all day and all night
Unaware of the condition I am in
Walking day and night
From the moment I was born
I started walking right away
In an inn with two gates
Walking day and night"

Asik Veysel, 1944

Asik Veysel, descendants of the tradition of Yunus Emre, the great 13th century Turkish poet, "asiks" became the voice of common people, expressing their relationship with their land; their loves, inner conflicts, and expectations generally depicting all aspects of life.

As Asik Veysel said we are moving in a long line with sequential points where we are is no longer a point because time is faster now, when we turn our head, we can see the stress of the place we are, when we look at the past. When we look ahead, increasing points may make us suspicious. To understand our current concerns, we must look to the recent past to rethink them further back and focus only on our future to correct and apply them.

At the sensory level, hyperarousal increases the distortion in our perception of reality, while cognitive overstimulation interferes with our ability to think .
The quantity of information that we can receive, process, and recall is subject to severe constraints. According to psychologist George A. Miller of Rockefeller University, people can push these boundaries by categorising information, abstracting it, and “coding” it in different ways (George A. Miller, 1989). Researchers disagree on this idea, but they are in complete agreement on two fundamental ideas: first, that man has a finite capacity, and second, that overloading causes a major breakdown in performance. The consequences of this are a tremendous level of increasing stress on societies in today’s everyday life (Szpunar et al., 2014). In a new line the fact that the conditions are so novel causes a radical shift in the type of choices they must make. The delicate balance of “programmed” and “non-programmed” judgments in our businesses and our personal lives is disturbed by the quick introduction of novelty into the environment. However, we do not have autonomous control over the quantity or nature of the decisions that are asked to us (M., 2004). The variety of judgments we must make and the speed at which we must make them are fundamentally influenced by society. The strains of acceleration and the pressures of invention are at odds with one another in our modern existence. One compels us to make decisions more quickly, while the other compels us to make the most difficult, time-consuming choices (R., 1998). Increased amount of stress value on individual is affecting the life of whole societies. And coping with stress became most durable problem of us today (Muthukrishna M., Henrich J., Slingerland E., 2020).

1.2 From Nature to Cities

The source of basic energy need for human being, affected type of settlements on the land. Hunter-gatherer societies used mobility as a survival strategy, to find a food for energy they need. This kind of lifestyle required access to large areas of land, between seven and 500 square miles. They were nomadic people and they tended to live for small groups (no more than 100 people). Around 12,000 years ago, with the advent of the Neolithic Revolution and the development of agriculture, some societies gave up hunter-gatherer lifestyles in favor of building long-term settlements that could support considerably larger populations(Kelly, 1992).
Indigenous people began to sevirate and develop infrastructure in order to improve their living conditions and meet their needs (Boyle, 2021).
For sure, as a result of the recent archaeological excavations in Turkey, surprisingly, all our knowledge of history has been updated. As a result of the excavations carried out in Urfa Gobeklitepe in 1995, it was learned that people organized and built a place in 12,000 BC and used this place as a place of worship (Caletti, 2020). Based on community establishments, while plants or animals are not yet cultivated, that is, agriculture is not done, this community comes together for a religious purpose and forms a community. Living for the same purpose that exists in human nature has formed the basis of concepts such as religion, language and race, which form the basis of today’s societies. This community system, which succeeds or tries to take control of large crowds while transforming the human into the desire to be one, has undergone a change with the emergence of different purposes over time (Kramer, 1963) (Minami, 2021).

Although agrarian part of history has not yet been fully enlightened, people who lived 12 thousand years ago observed that the plants, fruit trees, and seeds that fell on the ground brought new formations depending on the seasons. This has driven them to agriculture and food storage. Thus, the transition to settled life has begun, never to return.
An agrarian economy becomes a manufacturing economy through the process of industrialisation (Del Moral de la Vega & Del Moral Martínez, 2023). Manual and specialised employees are replaced by assembly lines and mass production. While economy was growing in big metropoles people started come to suburbs from countryside. The factory was developed as a result of industrialization, and as a result of the factory system, urban areas grew as a result of workers migrating to the cities in pursuit of manufacturing jobs (Rees, 2016). The percentage of people living in cities increased in England and Wales from 17% in 1801 to 72% in 1891 (Law, 1967). The current opportunities for finding jobs in large markets are growing, especially in urban areas. As the population increased, basic needs such as infrastructure, healthcare, settlement of commercial areas, new roads and main roads, and public transportation expanded to the suburbs. The fact of this there is rapid increase on density of cities (buildings and the population). After industrial revolution biggest change happened on human and surroundings. Thus, it started the main problems of the major metropolises we are currently living in. In the past, urban development was oriented according to nature-based energy sources, features (settling by a river, encircled by mountains to deter intruders, etc.). In the modern era those features replaced with the technology-industry hubs the place of manufactur-

ing infrastructure like factories. (Bisaschi et al., 2021)

During the mid- and late 19th century, the surge of industry in both Europe and the United States was accompanied by rapid population growth, unfettered business enterprise, great speculative profits, and public failures in managing the unwanted physical consequences of development. Giant sprawling cities developed during this era, exhibiting the luxuries of wealth and the meanness of poverty in sharp juxtaposition (Summerson, 2022). Eventually, the corruption and exploitation of the era gave rise to the progressive movement, of which city planning formed a part. The transition to a post-industrial society has had a significant impact on city infrastructure and people's lives. As the economy shifted from manufacturing-based to service-based, there was a momentous increase in the process of urbanization. Larger populations in small areas meant that new factories could draw on a big pool of workers and that the larger labour force could be ever more specialized (Britannica, 2022). This shift in the economy resulted in changes in urban planning and development. The slums, congestion, disorder, ugliness, and threat of disease provoked a reaction in which sanitation improvement was the first demand (UN-Habitat, 2020). Significant betterment of public health resulted from engineering improvements in water supply and sewerage, which were essential to the further growth of urban populations (Fainstein, S. S., 2022).
The development plans specified the desired traffic flows, the extent and density of the development, and the required public facilities (Simon Elias Bibri, 2020).

The lack of metropolitan planning jurisdiction led to largely unplanned growth and a resulting urban sprawl. Like how industries used to, these technological hubs attract labour from surrounding areas, contributing to urbanization. Today's urban development is business oriented. This leads to the conclusion that modern life has less connection with nature (Plouin, 2011).
The population of the Earth is not distributed uniformly over its territory. According to UN reports, in 2020 there are 1934 metropolises with more than 300,000 inhabitants representing approximately 60% of the world's urban population. At least 2.59 billion people live in metropolises in 2020 which is equivalent to one third of the global population (UN-Habitat, Global State of Metropolis 2020 – Population Data Booklet, 2020). 34 metropolises have surpassed 10 million inhabitants; while 51 have a population of 5 to 10 million; 494 of 1 to 5 million; and 1355 of 300,000 to 1 million (Fainstein, 2022).

Europe, China have the highest population densities per country's land area, averaging between 300 and more than 1000 people per square kilometre. However, a low number like this may be misleading therefore more telling picture is density in urban areas, sometimes known as urban population it should be concentrated on land area. (Samanta, 2015)

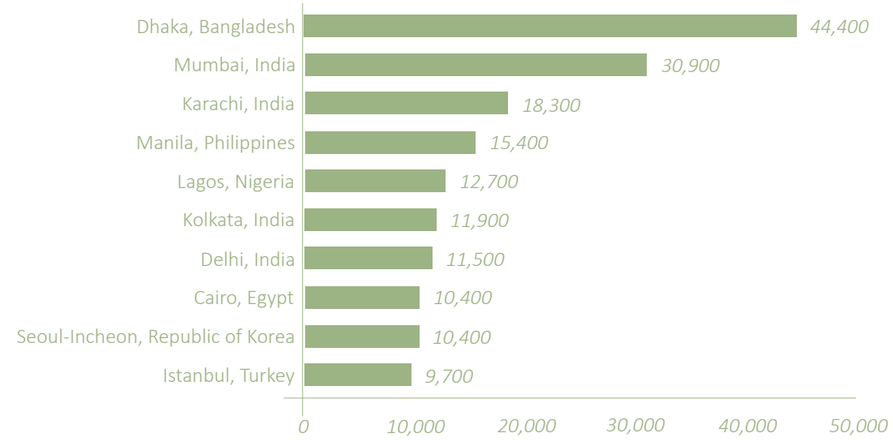


Figure 1: Top ten densest cities (over 10 million population) in the world, population density (persons per km2): 2012 *Source http://www.demographia.com*

New York has an urban population density of only 1750 individuals per square kilometre; London has 5100; whereas Asian cities such as Delhi and Tehran have higher densities of 10,700 and 12,300 individuals per spare kilometre, respectively. Some cities such as Hong Kong and Mumbai have very high urban densities in excess of 20,000 people per square kilometre (Ng, Edward, 2009).

1876

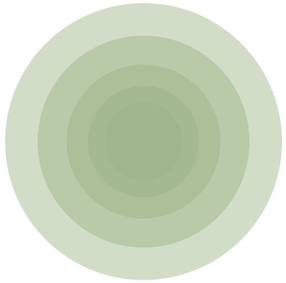


Figure 2: Map of Istanbul *(Prof. Dr. A. Yaşar Koçak, Abdullah Ademoğlu)*

1922

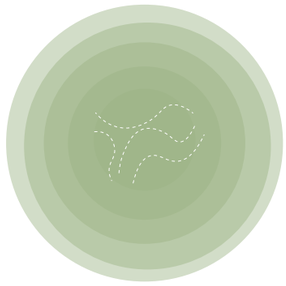
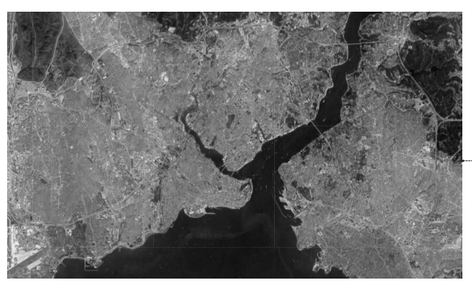


Figure 3: Map of Istanbul *(http://www.istanbulur-bandatabase.com/, n.d.)*



current

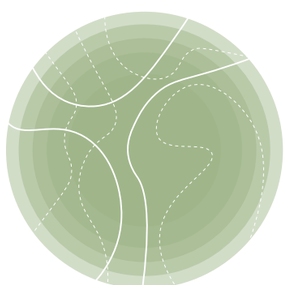


Figure 4: Map of Istanbul *(http://www.istanbulur-bandatabase.com/, n.d.)*

City Core
City Gardens
Forests
Fields and Grains
Ranching Livestock
Main Roads and Transportation
Municipality Boundries

Istanbul has a good example urban planning which affected from wars, agro-industrial flows and a culture that tried to modernise after them. In early nineteenth the city planning based on agricultural production. More than a thousand gardeners worked in the hundreds of market gardens Istanbul had in and around the city. These gardens maintained their prominent position far into the nineteenth century, and their stability throughout the years demonstrates their tenacity and essential place in the urban economy. The previously existing agricultural system in Istanbul was endangered due to the population increase from the village to the city that started in the 1950s and some infrastructure works (Akdal, 2021).

Additionally, market gardens in Istanbul lost their relevance in the urban economy and food system as a result of road construction projects carried out around the nation, which increased the food market's dependency on fossil fuels. Today, few cultural artifacts remain because the majority of the market gardens have vanished. The few remaining gardens were no longer useful for agriculture. The names of the streets, mosques, and squares carry the memories of the gardens, giving directions to their location. (Akdal, 2017).

Population of Istanbul is 15,907,951 in 2022 (https://data.tuik.gov.tr/Bulten/Index-?p=49685) .This population data is taken from the official website of the Turkish Statistical Institute. Larger and denser cities and metropolises have resulted in the growth of uncontrolled urban land consumption demand and increased populations. Urbanization and higher-density living is an irreversible path of human development. Finding ways of designing high-density cities must therefore be one of our humanitarian goals (Jensen, 1966).Higher-density living will continue to be developed and will soon be the norm. (Ng, Edward, 2009)

Figure 5: Sisli, Istanbul *(Eski İstanbul: Şişli, 1949, n.d.)*

Figure 6: Sisli, Istanbul *(Eski İstanbul: Şişli, 1949, n.d.)*

Figure 7: Sisli, Istanbul *(Eski İstanbul: Şişli, 1949, n.d.)*

1.2.1 Living Conditions in Congestion

Living in a city can be difficult: automobiles and buses honk, people jostle, and concrete and brick predominate over grass and trees. There is a research about residents of densely populated areas have higher rates of mental illnesses, including anxiety disorders and schizophrenia by using functional magnetic resonance imaging in three independent experiments, that urban upbringing and city living have dissociable impacts on social evaluative stress processing in humans (Costa E Silva, 2019).

Current city living was associated with increased amygdala activity, whereas urban upbringing affected the pregenual anterior cingulate cortex, a key region for regulation of amygdala activity, negative affect and stress. These findings were regionally and behaviourally specific, as no other brain structures were affected and no urbanicity effect was seen during control experiments invoking cognitive processing without stress. The results identify distinct neural mechanisms for an established environmental risk factor, link the urban environment for the first time to social stress processing, suggest that brain regions differ in vulnerability to this risk factor across the lifespan, and indicate that experimental interrogation of epidemiological associations is a promising strategy in social neuroscience (Lederbogenet al., 2011). Brain region called the amygdala which is associated with memory and emotional intelligence with a particularly large effect in people from big cities. Even more surprising, subjects who had grown up in a city showed higher activation of a brain area called the anterior cingulate cortex, essentially the amygdala's boss, even if they had later moved to the suburbs or country. Another recent study suggests that the amygdala and anterior cingulate cortex become activated when one's personal space is invaded (Abbott, A., 2011).

When a population's size increases, changes in individuals' behaviours will arise as a result. For example, crowding produces a stressful increase in competition for limited resources, and increased aggression and territoriality are maintained in the offspring of crowded populations (Lederbogenet. al, 2011).Nevertheless it's important to distinguish between density and crowding. Density tends to be a far more tangible and impartial spatial indicator of the quantity of people or objects in a space. In contrast, crowding is regarded as an experiencing state that is influenced by several more arbitrary aspects. The limitation of space and the subsequent cultural, physiological and psychological response may result in incongruence. (Sharon, Chief Supervisor: Dr Angela Spinney. ,

2019). These considerations include the need for control over one's own personal space, territorial identity and privacy, psychological and subjective requirements, and the suitability of the physical environment for addressing those needs. A sense of congestion brought on by stress might result from not meeting some or all of the requirements and expectations in the environment (Sharon, Chief Supervisor: Dr Angela Spinney. Supervisors: Dr, 2019). When there is incongruence, a level of physiological and psychological stress is generated, demanding an adaptive reaction. Overload or social overstimulation has also been associated with the experience of crowding (Sharon, Chief Supervisor: Dr Angela Spinney. Supervisors: Dr, 2019). Overload or overstimulation also relates to excessive input of social and informational stimuli (Lederbogen et al., 2011). When the level provided exceeds either the capacity to manage the quantity or the desired level of stimuli, a sense of being crowded is the response (Gifford, Nilsson, 2014).

The transition between modernity to postmodernity is also defined by production of goods to information and service era which is the rapid change structure of societies such as increasing discontinuation of the traditional way of thinking. Dominant character of this era is flexibility which accursed many instable conditions. Instability refers to the unpredictability of events in the modern world, consequently new world become a chaotic unpredicted area full of information. As a result of this postmodernism era is related to the mental illness (Bessa et al., 2013)

1.3 Environmental Psyhchology

Environmental psychology is the study of the interactions between a person's behaviors and experiences and his or her constructed environment (Mersal, 2018). Environmental psychology reflects man's effort to interpret and understand his environment, which has developed as the end of some breaking points in the world. If you can understand how people are affected by their environment, you can make those environments more effective for people. People design the environment they live in, their own living spaces, and start using them. In this process, the points they care about can affect people's perception of memory (Lang, 1987). As we can see from here, psychology and architecture have become an integrated theory that cannot be considered separately. At this point, it is inevitable for us designers to consider living spaces with interdisciplinary collaborations such as environmental psychology theories (Russell et al., 1982).
Since the beginning of this thesis, I wanted to emphasize how societies and cities have changed from the past to the present. Western European cities and North America, which entered a new period of restructuring after the World Wars, are dealing with problems such as rapid urbanization with increasing inner eyes. The social transformations experienced have always brought about some crises. From the concept of the subject that emerged with modernism, the industrial revolution and urbanization, the world wars and ideological conflicts, the energy policies of the countries, technological developments, and the post-Chernobyl disaster cannot be separated from the important green politics and actions related to climate change. (Smith, 1982)
Examining the history of psychology, shows that social psychology did not consider the effects of physical environments on human psychology in the past days, whereas the physical environments we live in affect our emotions and behaviours.Environmental psychology is the study of the interactions between a person's behaviors and experiences and his or her constructed environment (Mersal, 2018). While the individual changes the environment during these interactions, the environment also changes and transforms his behaviour and experiences.It aims to conduct research and applications that aim to make the buildings in which people live more humane and improve our relations with the natural environment.
According to Gürkaynak, the concept of environment has only been used until very recently to indicate the "social environment", that is, the environment created by other people around the person (Gürkaynak et al., 1978).

Thanks to human perception, peopole begin to categorize the things around them. Although it is congenital, each of us have a relationship with its environment, but in very rare cases it is instinctive. With the help of the mind, we begin to match objects with properties such as place and space. For example, we imagine a book not in a full glass or in the refrigerator, but in the library or on the table. In fact, in our imagination, everything is always expressed in relation to the environment (Rasoulpour et al., 2020).
On the other hand, the concept of environment in environmental psychology is physical, natural, artificial and social environment divided into four main headings (Steg et. al, 2018).

It is an interdisciplinary field and carries traces from many different disciplines, especially psychology, architecture, anthropology, fashion and sociology. Environmental psychologists examine both the effect of the environment on human behaviour and health and the effect of humans on the environment (Steg, P.G., James, S.K., Atar, D., et al. , 2012).
According to the definition made by Canter and Craik (1981), environmental psychology is a sub-branch of psychology that examines the exchange and interrelationship between the elements of the socio-physical environment and human experience and behaviour (Canter, D. V., & Craik, K. H. , 1981)
Environmental psychology, began to emerge in the 1960s. One of the first psychologists to talk about environmental psychology was Willy Hellpach. He examined (Hellpach, W., 1911) the effects of different environmental stimuli such as colour and shape, sun and moon on humans (Enric Pol , 2006). Although Hellpach's work is the subject of environmental psychology, is not positioned as systematic research examining the human-environment relationship. Therefore, Brunswik (1903-1955) and Lewin (1890-1947) the founders of environmental psychology, they initially focused on investigating the effects of artificial physical environments, such as buildings, on humans.
Developments in the second period of environmental psychology coincided with the end of the 1960s, when people began to become more aware of environmental problems. In those years, research on sustainability issues began. Researches of this period focused on air pollution (Steg et al., 2013), urban noise (I.D. Griffiths, F.J. Langdon, 1968), and environmental quality assessment (Donald Appleyard , 1977). Since the 1970s, research has begun to include issues such as energy supply and demand (Zube et al.,1983) and risk perceptions and risk assessments of energy technologies (Fischhoff, B., Slovic, P., et.al, 1978).Melting glaciers, extinct animals, disappearing forests. Unfortunately, our

world is under threat. Problems such as global warming, air pollution and deforestation affect people all over the world. As we are all aware, the main source of all these problems is human behaviour. One of the subjects of environmental psychology is to seek ways to stop the damage caused by human behaviour to the environment. As Gifford argues, environmental psychology is gradually becoming "the psychology of sustainability. (Leila Scannell,Robert Gifford, 2017)
According to the Journal of Environmental Psychology, the following are among the topics that environmental psychology studies (Ackerman, Elliot, 2021):

- Perceptions of buildings, natural connect and landscapes Ecological consequences
- Personality, norms and attitudes
- Theories of space, space attachment, and spatial identity of space
- Social use of spaces, Privacy, personal space (Ackerman, Elliot, 2021).

Architecture is not just about spaces created for the future, it also gives us an experience that is a representation of the memory of the past. When architects build a building, it creates a new chain in which it establishes a mutual relationship beyond just a concrete conclusion made in the context. The social and cultural environment of people can influence the context to a certain degree. The environment defined by the space around us can influence our experiences and actions. Designers should emphasize how behaviors, emotions, and feelings of well-being are affected by the physical environment. Our emotions and behaviors should be shaped by our natural environment and cultural environment. (Gibson, J.J, 1966). The environment can be seen as a collection of opportunities, or an arranged set of possibilities. If the way an environment functions do not align with our mental expectations, it lacks the ability to perform effectively and can result in stress. The ability of an environment to function effectively and our understanding is intricately linked.. If the design and its elements provide the necessary opportunities, people can comprehend the environment (Nancy M. Norman, James T. Tedeschi, 1989).
When there is a lack of space, both in terms of density and volume, the options for modifying the environment to meet our needs and desires is limited. This results in a loss of control over the environment, which can lead to stress. Flexibility in an environment is determined by how open the space is, and the ability to move partitions and semi-mobile furniture. When the layout is rigid and cannot altered, an individual's control over their surroundings diminishes. The ability of an environment or object to respond to a person's actions quickly and clearly is known as environmental responsive-

ness (Hills et. al, 2014).
When there is a discrepancy between the level of privacy we desire and the level of privacy we have in our surroundings, it can result in stress. “When a person or group can achieve their desired level of privacy in a built environment, they have greater control over their social interactions.” (Evans, G. W., & McCoy, J. M. , 1998) This sense of control is a key factor in how an individual perceives their surroundings.
According to Archea, depth is a key factor in providing control, as deeper spaces offer greater privacy (John Archea, 2010). Long-term exposure to an unpredictable environment can foster a sense of helplessness and mental illness (Jonathan St B. T. Evans,Keith E Stanovich, 2013).A man in space will experience emotions and psychological reactions, such as stress, anger and aggression, helplessness, and eventually disappointment as time goes on, when he recognizes the need for change in accordance with his needs, then faces doing so within the boundaries of his authority. (Gary W. Evans, Janetta Mitchell McCoy, 1998).

The task expected from the architectshould not only create a context, but also consider the experience of the people who will spend a part of their life here and this structure-human mutual relationship. It is time to think about the existence of the volumes we create in real life rather than just the line and model with the concepts of sustainability, re-use, and flexibility (Jencks, 1997).

1.4 Urbanity and Mental Health

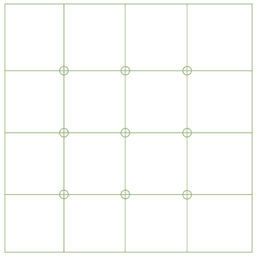
Studies conducted in these areas with the development of urbanization have shown that it has significant effects on human psychology and mental health. Urban areas offer opportunities for social interaction and community engagement (Chen et. al, 2021). Access to public spaces is important because it improves people’s sense of belonging to social networks.(Roe, 2016). Urban environments that encourage social connections can reduce feelings of isolation and loneliness (Moore et.al, 2023). Studies conducted in this field show that exposure to green areas has positive effects on human psychology. Urban areas that incorporate parks, gardens, and other natural elements provide opportunities for relaxation, stress reduction, and improved mood. It has been revealed that when access to public spaces becomes difficult in highly urbanized areas, it has negative psychological effects on people. (Jimenez et. al, 2021). Urban areas that designed with walkability in mind, including pedestrian-friendly streets, bike lanes, and accessible public transportation, can promote physical activity (Crouche K, Meyers L, Bretherton J, 2007). Regular exercise has well-documented benefits for mental health, including reducing symptoms of depression and anxiety and improving overall well-being. Accessible and safe urban environments encourage active transportation and contribute to better mental health outcomes.With the increasing population in urban areas, some physical problems may cause psychological adverse effects on people. Increasing noise and air pollution can be given as examples of these physical problems. Chronic exposure to noise pollution, such as traffic noise, has linked to stress, sleep disturbances, and cognitive impairments (Craft, L. L., & Perna, F. M., 2004). Similarly, air pollution can have detrimental effects on mental health, including increased risk of depression, anxiety, and cognitive decline. Urban planning strategies that prioritize noise reduction and air quality improvement can help mitigate these negative impacts (Hahad, Prochaska, et al., 2019).
The design and aesthetics of urban environments can influence an individual’s sense of place and identity. Well-designed urban spaces that reflect local culture, heritage, and values can foster a sense of pride, attachment, and well-being among residents. Conversely, environments lacking identity and character may contribute to feelings of disconnection and dissatisfaction (Ahmad Nia, Hourakhsh, 2021).
It is important to remember that socioeconomic status and access to resources may vary among individuals living in cities. Urban planning and design strategies that prioritize mental health considerations, such as creating inclusive and supportive communities, enhancing access to nature, and mitigating environmental stressors, can contribute to improved mental well-being among urban residents (Chen et al.,2021).

Barcelona

Barcelona, the city that was saved from the epidemic, deaths, and population growth with a single project. Barcelona in the mid-1850s, we see that the city is on the verge of collapse. In this city, whose street widths have decreased to 1 meter, the worker and the middle class live in an intertwined form. Due to this, diseases are increasing due to population growth. With a population density of 856 per hectare, health conditions are getting worse and death rates are increasing. Average life expectancy drops to 36 years for the wealthy and 23 for the working class. After each epidemic, 3% of the population died. As the facades of the houses rise, they expand towards the street until they almost touch the opposite building and prevent air circulation (Caves, 2004). This situation reveals the need to demolish the walls and expand the city. Ildefons Cerda, who changed the concept of "modern city", seeking a solution to change the city's structure to change the fate of the city, intervenes in the situation (Neuman, 2011).

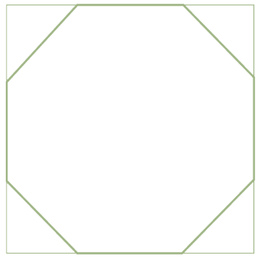
Ildefons Cerda, an engineer unknown at the time, is designing the area called Eixample, which means "expansion" in English, with its square grid and octagonal transitions outside the old walls. He produces the plan that will quadruple the space used in the city (Pallares-Barbera, Montserrat & Badia, Anna & Duch, Jordi. , 2011). He wanted to ensure that every citizen has enough water, fresh air, sunlight, ventilation, and space. It even considers the volume of air that would be needed to breathe adequately. It directs the blocks from northwest to southeast to maximize daily sunlight (Aibar, E., & Bijker, W. E. , 1997).Another crucial point is that the plan embodies egalitarianism in a striking way. Each block is shaped with the same proportions in height, occupancy-space ratios and green space density. The trade is located on the ground floors. The bourgeoisie is settling in the upper floors of these blocks together with the working class instead of the mansions on the outskirts of the city (Aibar, 1995).

Thus, all citizens share the same streets and public spaces and exposed to the same hygienic conditions. With this theory, Cerda coined the term "urbanisation." It refers to periods when large groups of rural workers moved to the cities (Puig, 1995).



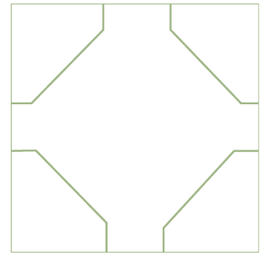
Grid Layout

This layout aimed to improve circulation, enhance connectivity, and provide better access to sunlight and ventilation.



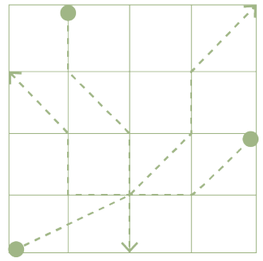
Octagonal Blocks

These blocks were designed to facilitate easier movement of people and vehicles, as well as to create open spaces at their inter-sectionsventilation.



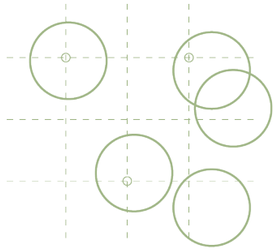
Green Spaces

Incorporated numerous small parks, gardens, and squares through-out the Eixample district, ensuring that no resident would be more than a short walk away from a green area.



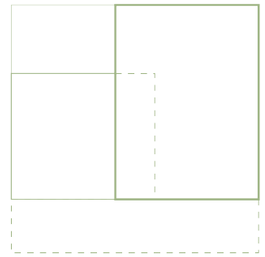
Grid Layout

The Eixample district featured a hierarchical road system with main avenues, secondary streets, and smaller local roads, all inte-grated into a coherent network.



Social Integration

The layout of the Eix-ample district included a mix of residential, commercial, and institutional areas, ensuring that different socioeconomic groups lived in proximity.



Modern Infrastructure

plan included modern infrastructure elements for the time, such as efficient sewage and water systems.

Figure 8: Priciples of Selye's Urban Plan for Barcelona *(Aibar, 1995).*

1.4.1 Green Environment and Menthal Health

In studies investigating the relationship between psychological health and natural urban environments, self-realization, resilience, problem-solving, and lessness of psychological distress, stress, or loneliness are considered hedonic and demonic. (Bowler et al., 2010). Many studies have been conducted on the abundance of green areas in cities and the relationship between closeness to these areas and psychological well-being. In the meta-analysis studies conducted by Bowler, Buyung- Ali Knight, and Pullin, it was concluded that even if there is no direct interaction with these green areas (sports activities, etc.), people living in these regions are psychologically affected in a good way. In the studies conducted by Alclock White Wheeler Fleming and Depledge in 2014, the psychological changes experienced in moving the participants to greener or fewer green environments were determined (Acklock et. al , 2014).

The psychological scores of the participants before and 3 years after their appointment were compared. Accordingly, an increase was observed in the psychological health levels of individuals who moved to green areas. However, the same was the case with the participants who moved to a place with less green space. (Alcock et al., 2014)

In the study conducted by Beyer et al. in 2014, they reported that a 25% increase in the density of tree cover in a neighbourhood caused a decrease of approximately 1 point in the level of depression and stress. According to the study conducted by Person and Kingham in 2013, it was reported that the availability of usable green space within a 3 kilometre area and the ability to reach the areas decreased the number of treatments for anxiety disorders. (Beyer et al., 2014)

Several tests were conducted for the relationship between psychological health and vegetation density (Jiang et. al, 2016). In one experimental study, she showed participants exposed to stress in a laboratory setting to watch videos of increased tree density. At the end of these 6 yellow-minute videos watched, it was revealed that there was a 60% decrease in the stress level of the participants. This research allows to reach an interesting conclusion in two ways. The first is that tree density can affect people's perception and stress level, and the second is that even just watching the video of the green area can relate to the human mind (Jiang et. al, 2016). Outdoor sports etc. without one-on-one experience. The human mind can only react to this with visuals without performing activities (Jiang et. al, 2016).

Exposure to green space and activities done in these green spaces can also be called "green exercise". The effects on human health with the meta-analysis study made by Barton and Pretty in 2010 (Barton, J., Pretty, J. , 2010). Regardless of the type of exercise and green space, after the first 5 minutes of exercise, it had positive effects on self-esteem in young people and on mood in middle-aged people. At the same time, in the study conducted by Marselle, Irvine and Waber in 2013, it was reported that a 15-minute walk in the green area is associated with a decrease in anxiety, tension and depression in individuals (Marselle et al., 2013)

The possibility of the city dwellers to meet nature has gradually decreased. The biggest reason for this is the changing urban structures and densities since the industrial revolution. In increasingly expanding cities, adults spend most of their lives at work, and children and students in school buildings. Spending about 10-12 hours a day in these areas reminds us architects once again how important these areas need to be designed. Activities organized in these environments should be organized according to physical, psychological and social resources. It is extremely important to design structures that promote well-being and quality of life (Collado et al., 2017). Spending time in a garden in a park and seeing a green space when looking out of the window, the office worker can live more concentrated and stress-free with the restorative benefits of nature (Lygum et. al, 2023).

For example, the number of studies dealing with the relationship between green spaces and health in Turkey is very few and recent (Akpinar, Abdullah, 2016) and shows the fact that Istanbul, the largest city in Turkey, has the least green area among the 20 big cities in the world, with a rate of 1.5%. Although there are many socio-economic, political and geographical factors underlying this, it is important not to overlook the existence of the real problem. According to the Turkish Statistical Institute (TÜİK), the total population of Istanbul (within the boundaries of Istanbul Metropolitan Municipality and its affiliated municipalities) is 15,907,951 people. According to the 2022 Address Based Population Registration System (ADNKS) results the area of Istanbul is 5,313 km² and the population density is 2994 people per km²(https://data.tuik.gov.tr/).

The cities we live in, they reflect our lifestyles. Today, the increase in the population density in the cities and the growth of the cities only dependent on the car, and the fact that most people work in places far from closed green areas, as well as diseases such as heart health and obesity. (Sandifer et al., 2015)

1.3.1 Office Environment and Menthal Health

This section examines the problems of the employees in the office environment and how is the existing situation.
It has been observed that at least one-third of people working today spend their time in stressful and tiring workplaces (Chen-Yen Chang,Ping-Kun Chen, 2005). According to the World Health Organization, job-related stress is a reaction that people may have when confronted with job expectations and pressures that are not suited to their knowledge and talents and that put their capacity to deal to the test. (WHO TEAM-Environment, Climate Change and Health, WHO Headquarters (HQ), 2020). The American Psychological Association reported that nearly 3 in 5 employees reported negative impacts of work-related stress, including lack of interest, motivation, or energy (26%) and lack of effort at work (19%). Meanwhile, 36% reported cognitive weariness, 32% reported emotional exhaustion, and an astounding 44% reported physical fatigue a 38% increase since 2019(The American Psychological Association, 2022). Office environmental conditions such as thermal and indoor air conditions, lighting, and noise, as well as interior design parameters such as office layout, colours, furniture, access to views, distance to window, personal control and biophilic design have been found to affect office workers' stress levels (Awada et al.,2023).
The World Health Organization has recognized stress as the "global epidemic of the 21st century" is work-related stress which can also be caused by poor work organization (managing and organising) by poor work design (control of work), poor management, unsatisfactory working conditions and lack of support from colleagues and supervisors. (WHO Team, 2023)
According to a study by Chang and Chen 2005, the effect of space conditions on human psychophysiology was investigated . Six different office environments were used in this laboratory study, which shows how much the window view and the presence of indoor plants in the workplace affect. It was determined that the people watching the human health psychologically and physiologically, the most positive response was to see the nature view from the window. It has been stated that those who watch office environments with both nature views and indoor plants in the same working environment have the least anxiety(Chen-Yen Chang,Ping-Kun Chen, 2005).
In another experiment (Yin et al.,2019)using the virtual reality method, it was determined that indoor plants and natural light entering the indoor area have the lowest physiological stress in office environments as well as high creativity.
In laboratory studies that will strengthen these findings, some findings have shown us that, apart from the quality of the environment, physical activity in free time in natural environments works with creativity and vitality, in which employees have less job discontentment and higher psychological well-being scores(Abror et al., 2018; Korpela et al., 2017).

According to the research of Wallner conducted in 2018, an attention test was conducted according to the categories (small park, large park, forest) for lunch break for university students. As a result, it was stated that the most positive scores were obtained for adolescents and adults who spend a long time in the forest area. (Wallner et al., 2018)
Today, depending on the increase in the population density in cities, the growth of cities depending on cars and the fact that most people work in closed places leads to the emergence of an unhealthy sedentary lifestyle that causes the development of diseases such as obesity, heart disease and depression (Sandifer et al.,2105). Evidence is that green spaces reduce the city's air pollution, absorb sound and noise, and serve as a resting place or breathing space amid all the city's densities (Ward Thompson, C & Silveirinha de Oliveira, 2016).
However, the importance of accessibility of these green spaces and their effects on public health are extremely important. At the same time, the quantity should be properly designed in terms of maintenance and quality. Otherwise, the use of trees that spread too much pollen, which will pose a threat to public health, will cause allergenic stimuli to human health, increased contact with some animals may increase the infection rate or people may be more exposed to pesticides and pesticides. (Braubach et al., 2017) (Markevych et al., 2017). As a result, it is argued that most of the potential harmful effects can be eliminated or minimized with the appropriate design, maintenance and operation of green spaces. (Lõhmus M, Balbus J., 2015).
Measuring the availability and accessibility of green spaces, monitoring the use of green spaces according to certain population groups with low education levels, and developing evidence-based practices are at the top of the steps (Braubach et al., 2017). For example, several studies have reported that people with low incomes and poor health, and ethnic/racial minorities have more limited access to green spaces compared to more affluent or white people (Chao-Jie He et al., 2020) .

However, it has been shown that the beneficial associations between green space and heat show the strongest positive results for those with lower incomes and those living in more rural areas (James et al.,2015) (Maas et al., 2009). ; (Markevych I et al, 2017) (Twohig-Bennett C, Jones A., 2018), (David P. G. van den Berg, ; Paul A. J. M. de Bont, Berber M. van der Vleugel, ; et al, 2015). In all these studies, it has been argued that the provision of high quality, large green spaces close to the places where socio-economically disadvantaged communities live can reduce health inequalities. In this context, it is thought that the benefits of green spaces on health can reduce the negative effects of health inequalities experienced by socio-economically disadvantaged groups. Studies guide urban planning and characteristics of targeted for greening (D. Kelly et. al, 2022)

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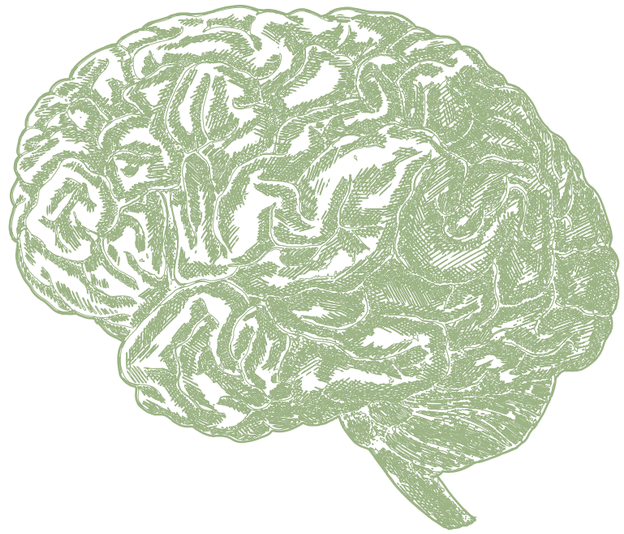


CHAPTER 2

Anatomy of Stress: Scientific Perspective

2.1 Stress

The first person to introduce the concept of “stress” is Hans Selye, a Canadian physician and endocrinologist. Selye (1956) defined stress as “the body’s response to any pressure on itself” (Butcher et al., 2013). In another definition, stress is defined as any internal or external element that disrupts the balance between a person and his/her environment and causes the person to try harder to maintain or provide balance (Humphrey, L. T. and King, T., 2000). Richlin-Klonsky and Hoe (2003), on the other hand, state that the demands faced by the individual in daily life and the processes of keeping up with the changes he/she experiences are the main sources of stress.

At the dictionary meaning of stress is that comes from the words “estrictia” (Latin) and “estree” (French) which means “strainand pressure”. In the seventeenth century, it was used in the meanings of trouble, calamity, affliction, grief, affliction. In the eighteenth and nineteenth centuries, the meaning attributed to the concept changed and it was used in meanings such as power, pressure, difficulty and for objects, individuals, organs or psychological structures. It has started to be used in the sense of “resistance to the deformation of the object and person by the effect of such forces”. In addition, the word also expresses the state of “preserving the integrity” and “effort spent to return to the existing situation” (A., Baltas, 1997).

In modern societies the word “stress” is generally used to express the different experiences that individuals feel uncomfortable with. Stress, which has become a part of the daily life of almost all people living in big cities in today’s world, has been the subject of many studies and has been defined similarly by many scientists (Kostas Mouratidis, 2021). They is expressed it as a disease of modern society and part of daily life. Most people today have an intense stress load without realizing it. Good or bad whatever happens, mental changes in our lives are stressful situations. In daily routine anything that causes a change in our lives is stressful. In our body health any change that occurs will cause stress. Mental changes are also real, tangible cause stress as well as changes. Claims we witness in our daily lives, comments, disagreements and conflicts also cause us stress.

Graham defined stress as “a harmful external force/pressure that causes unwanted and unpleasant effects on the person” (Graham-Bonnalie, F. E., 1972). It is the name given to the complex behavioral and emotional reactions that occur during stress, strain and adaptation processes and the physical connections of these reactions. (Yamak, 2015). McNerney (1974) defined stress as “the physical, mental and chemical reactions of the body to fearful, exciting, confusing, dangerous or disturbing situations” (Susan A. Randolph, RN, MSN, 1984 ; Byars, J. L., 2005). According to Lazarus and Folkman, stress is “the interaction between the person and the environment, which jeopardizes the well-being of the organism, reduces its capacity and is evaluated as compulsive.” (Lazarus, R. S., & Folkman, S., 1984)

Stress is a state of strain or distress felt as a result of events encountered in daily life or pressure in interpersonal relationships (Schneiderman, 2005). Stress is defined as an emotional, bodily or cognitive response resulting from a person’s response to environmental pressures, conflicts, tensions and similar stimuli (Newbury-Birch, D., & Kamali, F., 2001). The same source of stress may not cause the same emotional reactions in everyone. How a stressor is perceived by the person is very important. The level of stress experienced by the person may vary according to the way person who perceives the source of stress. For example, the level of stress that everyone will experience will be different in the face of events such as intense armament, wars, marriage, divorce, taking exams and passing a red light, which are increasing all over the world(Özer, Ş., & Özmen, E., 1999).

Stress is a state of overstimulation that occurs in mental and physical dimensions as a result of the internal and external factors being evaluated as harmful or threatening by the person (Karahan & Hamarata, 2020). When talking about a stressful situation, it is necessary to pay attention to how the person perceives and interprets that situation, the defense mechanisms he/she uses, and his ability to cope with stress (Aydın & Imamoglu, 2001).Stress response can occur when there is an imbalance between the expectations of the environment and what the individual can do. The individual initially attacks and resists stress, and eventually the stress may reach serious levels with burnout (Maraşlı, 2005).

Causes of stress include controllability, pushing the limits, predictability, pressure, frustration, internal conflict, threat and change (Aydin K.B., 2010). Stress is a symptom of adaptation that occurs as a result of an action, event or external factor that creates physical and mental expectations, psychological state and individual differences (Arpacı, 2005; Durna, 2004). Stress response is a situation that occurs when the psychological and physical limits of the organism are forced and threatened. Stress arises not depending on what happens in the environment, but on how the organism reacts to the situa-

2.1.1 Stress Symptoms

Stress can cause many physiological and psychological disorders (Baltaş and Baltaş, 2008). In addition to physical symptoms such as headache, digestive problems, high blood pressure, difficulty breathing, excessive sweating, anxiety can lead to conflict, anger, tension, resentment, irritability, distractibility, pessimism, indecision, sleepiness, disordered eating, emotional depression, threats to self or safety, disappointments, etc. psychological and behavioral symptoms such as may also be observed (Braham, B., 2002).
Some symptoms occur before or after the occurrence of stress. Stress symptoms have been classified in different ways in the literature. In some studies (Rowshan, 2000; Aydın, 2008; Yamak, 2015), stress symptoms are grouped under three main headings as physical, psychological and behavioral. In this study, this binary classification was preferred.

1.Physiological Symptoms: Physical changes in the human body can sometimes be the result of stress. These changes can also be a symptom of a biological problem that is not caused by stress but is usually a reaction of the human body to a stressful event. Physiological symptoms, which are very common in stress, can be listed as follows: loss of appetite or overeacting, weight loss and weakness, chronic fatigue and weakness, insomnia, excessive or irregular sleep, fatigue, frequent headaches, pain in various parts of the body and joints, shortness of breath, high blood pressure, heart palpitations, hypersensitivity , feeling emotional, tears in the eyes, excessive smoking or alcohol use, physical pain and suffering beyond normal, loss of energy, sweating, tremors, allergies, nausea or stomach cramps, hypersensitivity to loud sounds, hot or cold flashes (Aydın, K. B., 2010).

2.Psychological Symptoms: Although mental symptoms are not as easily understood as physiological symptoms, they are generally very difficult to notice in appearance. Such symptoms are mostly related to the thinking process, the thoughts of the individual, and how stress affects this functioning. The psychological symptoms of stress are manifested by the individual's explanation of his thoughts to other people and through his behavior. Psychological symptoms, which are very common in case of stress, can be listed as follows: fear and anxiety, excessive uneasiness, irritability, tension, irritability, disagreement, inadequacy, undue fuss, believing that everything is futile, not enjoying life, being afraid of being sick or thinking that one is sick, forgetting what to do, not remembering events and people, inability to focus on a job for a long time, decrease in self-esteem, difficulty in making a decision, inability to start a job, generally being pessimistic, anxious, depressed, focusing on negativities (McMahon, G. , 2011).

3. Behavioral Symptoms: Concentration, difficulty making decisions, forgetfulness, confusion, poor memory, excessive daydreaming, preoccupation with a single idea or thought, loss of sense of humour, low productivity, decreased work quality, increased errors, impaired judgment, distrust towards people, blaming others, not going to appointments or cancelling them too soon, trying to find fault with people and hurting them with words, overly defensive attitude, being offended by many people, not speaking (Aydın, K. B., 2010).

2.1.2 Biological Responses to Stressors

Selye calls the body's three-phase response to stressful situations "general adjustment syndrome" (Fink, 2009). According to this theory, the body's response to stress develops in three phases (Åkerstedt et. al, 2017).
Alert Phase: When a person encounters a stressor, the body shows a "fight or flight" response due to activation of the sympathetic nervous system (Schnepper et. al,2020). Through physical and chemical changes, humans are prepared to face and escape the sources of stress.This is the heartbeat it develops in the form of acceleration, increased blood pressure, accelerated breathing, sudden secretion of adrenaline. The phase in which the fight-or-flight response occurs is called the "alarm phase." During the stress alert phase, the stress curve rises rapidly above normal resistance levels as the stress source and its intensity increase, and the first signs of deviation from normal behaviour appear (Sharma et al., 2022).
Rresistance Phase: Alertness levels are followed by "adaptation or resistance levels". Once the cause of the stress is resolved, everything will return to normal. During this stage, an attempt is made to regain lost energy and dissolve the destruction within the body. When you deal with stress, your parasympathetic nervous system begins to activate. Heart rate, blood pressure and breathing are regulated, and muscle tension

is reduced. In the resistance phase, individuals do their best to resist stress and exhibit stressed person behaviour. This situation may be observed over a period of time in an individual's behaviour and life (David Cantor & Edmund Ramsden, 2014).
Fatigue stage: Unless the cause of the tension in the adjustment phase and its intensity increases or decreases, the individual's efforts are interrupted, and a phase is entered in which significant deviations and disappointments in behaviour appear. When the sources of stress cannot be managed and coordination cannot be achieved, physical resources cannot be used, and the phase of fatigue begins. During the fatigue phase, the parasympathetic nervous system becomes active. The person is exhausted, but the source of stress is still present. At this stage, you are no longer able to fight long-term stressors and are susceptible to other stressors (David Cantor & Edmund Ramsden, 2014).

In order to understand why stress causes mental and physical problems, it is necessary to know what changes occur in the organism when stress is experienced. A series of biological changes take place in the organism. There are two different systems here. The first, the "sympathetic-adrenomedullary" (SAM) system, is designed to mobilize resources and prepare for the "fight or flight" response (Gunnar and Quevedo 2007). Stress begins in the hypothalamus, which stimulates the sympathetic nervous system. Following this, the adrenal glands release adrenaline and noradrenaline, also known as epinephrine. As they mix with the blood, the heartbeat speeds up, it also enables the body to metabolize glucose more quickly (Butcher, J. N., Mineka, S., & Hooley, 2013). The second system that has a role in the response to stress is the "hypothalamic-pituitary adrenocortical" (HHA) system. In addition to activating the sympathetic nervous system, the hypothalamus secretes a hormone called "corticotropin-releasing hormone" (CSH). This hormone, which spreads throughout the body with the blood, stimulates the pituitary gland. The pituitary gland then secretes "adrenocorticotropic hormone" (ACTH). This hormone causes the adrenal cortex to generate stress hormones called "glucocorticoids". This stress hormone produced in humans is called "cortisol". Cortisol works great in emergency situations. They prepare the organism to flee or fight. It also inhibits the innate immune response. In other words, when there is an injury, the body's inflammatory response is delayed. Recovery takes priority over recovery. In addition, the hormone cortisol also has a negative function. If cortisol production is not stopped, it can damage brain cells, particularly the hippocampus. Therefore, there are receptors in the brain that detect cortisol. These receptors send a feedback message designed to stop the activity of the glands involved in the stress response (Butcher et al., 2013) . When the organism encounters a threat or a distressing stimulus, a nerve cell in the brain transmits impulses to different regions of the body and activates a complex set of bodily responses within seconds. The sympathetic system responsible for energy and movement accelerates. The digestive system stops and the blood in the system goes to the muscles and brain. Hormone production increases to provide more energy to the body. Saliva secretion is inhibited, pupils dilate, the activity of the genitals is inhibited. The bladder muscles and intestines relax to relieve the body in case of escape, sweating increases and overheating of the body is prevented. The fat and sugars stored in the body mix with the blood to provide quick energy. Goosebumps appear as blood is drawn from the skin surface and the skin also cools. Respiration is accelerated to provide the oxygen needed to convert this sugar into energy. The pulse accelerates and blood pressure increases to send enough blood to the brain, muscles, and essential organs. The blood in the hands, feet and areas close to the skin moves towards the muscles of the trunk and brain. In the event of an injury to the legs and arms, less blood loss is ensured. More red blood cells are mixed with the blood, and more oxygen is carried. Muscles are prepared for movement and become tense (Civan & Özdemir, 2018)

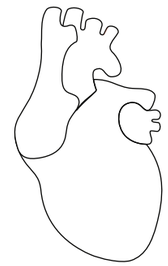
STRESS
Response

1
Amygdala sends a distress signal, the hypothalamus

2
Hypothalamus activates the sympathetic nervous system by sending signals through the autonomic nerves to the adrenal glands.

3
These glands respond by pumping the hormone epinephrine (also known as adrenaline) into the bloodstream.

4
The heart beats faster than normal pushing blood to the muscles, heart, and other vital organs

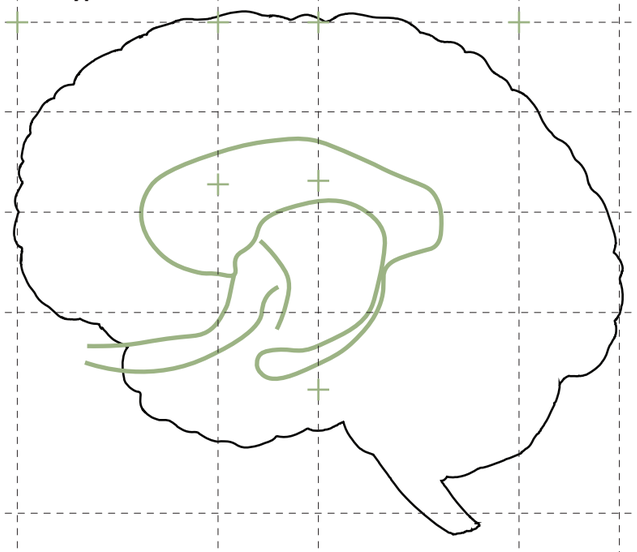


controls such involuntary body functions

Hypothalamus

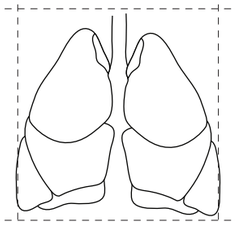
memory cognition

Cerebral cortex



Amydalga
emotional processing

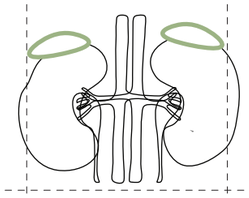
7
Epinephrine triggers the release of blood sugar (glucose) and fats from temporary storage sites in the body.



6
Lungs can take in as much oxygen as possible with each breath

5
Pulse rate and blood pressure go up. The person undergoing these changes also starts to breathe more rapidly

cortisol
Adrenal Glands



8
The hypothalamus activates the second component of the stress response system known as the HPA axis

9
This reaches to pituitary gland , triggering the release of adrenocorticotropic hormone (ACTH).

10
Hypothalamus releases corticotropin-releasing hormone (CRH)

11
This hormone travels to the adrenal glands, prompting them to release cortisol

12
The parasympathetic nervous system the "brake" then dampens the stress response

Figure 9: Biological basis of the stress response *(Henry, 1992)*.

The hormone oxytocin is secreted from the pituitary gland with stimuli from the hypothalamus. Therefore, stimuli from the hypothalamus may suppress the release of oxytocin. Any situation that creates stress will result in a decrease in oxytocin release. Oxytocin is also called the “love hormone”. Oxytocin levels increase when giving birth, breastfeeding, sexual activity and seeing a loved one (Romano, A. M., & Lothian, J. A., 2008)

Fearful and stressful situations cause oxytocin release both in the central nervous system and outside the central nervous system by stimulating the oxytocin system (Neumann, I. D., 2007; Say, G., & Müjdeci, M, 2016). Oxytocin has a bidirectional function in its relationship with stress and anxiety. Oxytocin is released in response to stress as well as affecting the symptoms caused by stress (Türen, E., 2014) (Carter, 1998). Although studies are relatively limited, it has been reported that oxytocin has a stress-reducing effect (Heinrichs et al., 2003)

It is known that the hormone oxytocin plays a key role in the regulation of social tendencies, attachment, social support, maternal behavior and trust, as well as protection against stress and anxiety (Eşel, E., 2007). One of the effects of oxytocin is that it suppresses the release of cortisol triggered by stress, reducing anxiety and creating a sense of confidence (Heinrichs, M., von Dawans, B., & Domes, G., 2009). In a study, it was observed that the hormone oxytocin given to couples before the discussion decreased the level of cortisol and anxiety and increased positive communication (Ditzen, B., Schaer, M., Gabriel, B., Bodenmann, G., Ehlert, U., & Heinrichs, M., 2009). It has been found that the release of oxytocin is stimulated in the brain by touch, music and good smells. Alternative therapies such as meditation, aromatherapy, and art therapy are considered to increase the release of oxytocin hormone (Uvnas-Moberg K, Petersson M, 2005).

2.1.3 Coping Strategies

Some strategies used individually are necessary in coping with stress. The common aspect of these strategies is that almost all envisage controlling personal habits and physical, psychological, and behavioral structures. In dealing with stress individually, bodily movements (exercise), breathing exercises, meditation, biofeedback, relaxation, nutrition and diet, social support, participation in social, cultural, and sportive activities, massage, prayer and worship techniques such as time management, and time management may be helpful to (Pehlivan, İnayet, 1995). On the other hand, Erdoğan (1999) stated that effective time management, relaxation practices, positive imagination, exercise and body movements, behavioral self-control, and communication are individual strategies for coping with stress. It recommends setting up, meditation, food control, massage, getting a unique hobby, and extroversion (Erdoğan, İlhan, 1999).

Organizational struggle methods that can be used to cope with stress should be developed to reduce or prevent work stress on individuals. General policies among organizational stressors, structural defects of the enterprise, physical environment deficiencies, and favorable regulations affect the corporate dimension of stress management concerns. (Erdoğan, İlhan, 1999).

Strategies for coping with the stress arising from work life are the managerial arrangements made to control and reduce the stress sources at the organizational level in order to reduce or prevent the work stress of the employees. The policies, structures, physical conditions, and process-related stress sources need to be reduced or avoided. (Ertekin, 1993; Erdoğan, 1999; Pehlivan, 1995).

Stress management is ‘lifestyle management’ at the last stage. Deciding to manage stress means deciding to improve the emotional, physical, and spiritual quality of life of the individual. The change-Accept-Forget It-Manage Lifestyle (CAFM) Model, developed by Braham, helps individuals control the stress they experience. This approach is briefly explained below (Braham, J. B., 1996).

The first step, C (Change), is to change the negative situation you are in if you can. You can change the negative situation, and you can start to eliminate the stress caused by this situation.

The second step is A (Accept). You may encounter situations that you cannot control. In this step, you must learn to accept the circumstances you cannot control without anger and not to lose your positive attitude.

The third step, F, represents ‘Never mind.’ Letting go is a powerful method that works emotionally, mentally, and spiritually. Trying to control situations we cannot change leads us to obsession with control. This also causes stress.

The fourth step, M, is ‘manage your lifestyle.’ This step allows you to combat today’s future stressors through exercise, diet, relaxation, and emotional support.

2.2 Burnout

The concept of burnout first entered the literature in 1974 with an article written by Freudenberger(Maslach & Schaufeli, 1996). These sediments have been described as an “occupational hazard”. Freudenberger defines development as “a state of exhaustion in internal resources obtained as a result of failure, weariness, loss of strength and energy as a result of overload, or unfulfilled desires” (Dvorákov & Putová, 2012).

1
You feel there is a strong need to prove yourself.

2
You keep working harder and harder to achieve this.

3
You begin to neglect own needs.

4
You are conflicted and blame others or the situation.

5
You change your values and focus on work more.

6
You deny the problems that arise due to work stress.

7
You withdraw from social life and your family as well.

8
Your behaviour changes which upsets your loved ones.

9
Depersonalisaton happens, do not feel like yourself.

10
You feel empty an numb, substance abuse can occur.

11
You feel depressed, lost and completely exhausted.

12
You mentally and physically collapse full burnout.

Figure 10: 12 stages of ‘burnout’ *(Freudenberger & North, 1992)*

After Freudenberger, various definitions and research have been made about the concept of burnout. The most accepted definition of burnout today was made by Christina Maslach. Christina Maslach developed the Maslach Burnout Scale, which is named after her. According to Maslach, burnout is a syndrome that occurs when feelings such as anger, fatigue, fear, hopelessness, and disappointment, especially seen in jobs that require face-to-face relations with other people, are seen as negative attitudes towards the person and the other party. It represents an erosion of the values, dignity, and spirituality of the individual. In its simplest definition, burnout is the collapse of the human spirit. It is a negative situation that develops slowly and continuously and drags people into a psychology that is difficult to get rid of (Maslach, 1997).

According to Pines, who examines burnout from a psychoanalytic-existential perspective based on burnout, people's need to believe that their lives are meaningful and that what they do is useful, important, or even heroic is not being met. According to this approach, individuals' job perceptions and possible burnout are related to unresolved childhood problems. The individual wants to work in a way that heals the emotional injuries he experienced in his childhood. The success of the individual ensures the healing of childhood wounds; failure triggers childhood traumas and causes burnout (Pines, 2002).

2.2.1 The Relationship Between Stress and Burnout

Burnout syndrome is the name given to occupational stress that symbolizes feelings of inadequacy, depersonalization, and emotional exhaustion toward one's profession. (Gozalez-Roma, February 2006).
Stress is a physical and psychological condition that enables individuals to adapt to environmental conditions that may be dangerous for individuals. (Mcshane et al.,2016). Occupational stress, on the other hand, is defined as the deterioration of the balance of the cognitive, emotional, and environmental systems by external factors (Folkman, S., 2013). According to some studies, burnout mostly occurs due to stress in the workplace, and as a result of not being able to cope with stress, it causes various psychological and physical disorders (Saglam et al., 2008). Jobs with a wide variety of contradictions or jobs with uncertainty in the obligations, authority, and responsibilities of the people responsible for doing the job increase both stress and job dissatisfaction.

In the literature, there are three stages of stress: Alarm, resistance, and exhaustion. The alarm period is the moment when a person perceives and encounters stress. At this stage, the person experiences some physiological changes and either escapes or struggles from this undesirable situation. (Keser et al., 2016)
After the resistance period, in which physical and emotional energy is mobilized, and the negative effects of the stress factor are resisted, the general level of harmony is returned if the problem has been successfully dealt with. However, if the stimulus is too severe and the individual is unable to eliminate the negative effects and has been exposed to the stress factor for a long time, a period of exhaustion occurs. (Saglam et. al, 2008)
Although stress is generally defined as a negative experience, some levels of stress can be expressed as a necessary part of life. According to this view, stress is considered a motivating factor for people to achieve their goals or be successful in their life struggles.

Sub-Dimensions of Burnout Syndrome

The sub-dimensions of burnout are listed as emotional exhaustion, depersonalization, and low personal accomplishment (Kacmaz, 2005).

Emotional Exhaustion

This dimension can also be defined as employees' feeling physically and emotionally worn out and tired (Olcay et al., 2014). In addition to mobbing, psycho-social, mental, and occupational stress factors such as economic pressures and multitasking at work, family, and leisure activities also affect this situation (Weber et al.: 2000). The key part of the burnout syndrome is the heightened sense of emotional exhaustion. The emotional exhaustion dimension appears when the emotional resources of the employee are discharged or decreased (Rothmann, 2008). When the emotional resources of the employee are exhausted, he begins to feel that he can no longer keep himself on a psychological level (Maslach C J. S., 1982). This dimension is expressed as the most critical and determining dimension of burnout in the literature. In other words, emotional exhaustion is the internal dimension of burnout. The person experiencing emotional exhaustion thinks that he/she does not treat the people he/she serves as responsibly as in the past, and having to go back to work the next day becomes a source of great anxiety for the individual who is burdened with feelings of tension and frustration (Saglam et al., 2008).

Depersonalization

Depersonalization is an attempt to distance oneself from the people he serves (Maslach et al., 2001). In other words, depersonalization is defined as the negative attitudes and feelings that a person has towards the people he serves, regardless of their individuality. It also means indifference towards work, emotional detachment from customers, skepticism towards the organization, and strict compliance with the rules and regulations instead of adapting to the needs of customers. Depersonalization represents the interpersonal dimension of burnout and indicates unresponsiveness to work (Gulay et al., 2005). An individual who becomes desensitized thinks that his whole life has been taken over by others and wants to remove people from his life and be alone (Kadir et al., 2015).

Low sense of personal achievement

The relationship between a low sense of personal accomplishment and the other two aspects of burnout is somewhat more complex. It is seen as a function of emotional exhaustion and depersonalization or a combination of both (Maslach et al.,2001). An individual who has become desensitized thinks that his life has been taken over by others and wants to remove people from his life and be alone. The individual realizes the difference between his previous positive attitudes and his current attitudes and thinks that this distanced attitude reduces his contribution to the institution and society he works for. Thus, the individual has a feeling of inadequacy in business and human relations and begins to see himself as unsuccessful in doing his job and providing service to his customers (Santee et al., 1982). In summary, evaluation of oneself as unsuccessful is considered as a low sense of personal accomplishment (Budak & Surgevil, 2005)

2.2.2 Stages of Burnout

Burnout can occur at different stages of working life. It is necessary to talk about the stages of burnout since burnout syndrome does not occur all at once but as a result of a certain process. However, it should not be forgotten that burnout is a continuous phenomenon, not a discontinuous process in which it passes from one phase to the next (Kacmaz, 2005). These stages are explained below:

Stage I Enthusiasm Stage: During this period, professional expectations and energy are at a very high level. For a person, his profession comes before everything else. The person adopts difficult conditions and strives to adapt. Hope and expectation are quite high (Balctoglu et al., 2008).

Stage II Stagnation Stage: In this stage, there is a decrease in desire and hope. He begins to become increasingly uncomfortable with the difficulties he endured while practicing his profession and some issues that he did not care about before (Kacmaz, 2005)

Stage III Frustration: A person who has started working to help and serve other people understands how difficult it is to change people, the system, and negative working conditions. He experiences an intense feeling of being blocked.

Stage IVIndifference Stage (Apathy): In this stage, the person does his job out of necessity, not because he loves it (Balctoglu et al., 2008). The job, which at first seemed attractive and important to him, becomes meaningless and unhappy. Willingness to work, commitment, trust, and joy are replaced by nervousness, anxiety, and depression (Olcay & Dalkilic, 2014).

2.2.3 Combat Burnout Techniques

Studies to be carried out to prevent burnout are grouped under three main headings:

1. Changes and developments in the person
2. Changes to be made in the role and role structure
3. Precautions to be taken regarding the management and the institution

According to Leiter, there are two methods to combat burnout (Gabriel et al., Herman, 2021) :

- The struggle to escape: ignoring or escaping problems,
- Control challenge: Using recommended strategies to tackle problems.

It is observed that those who prefer the first of these methods burn out more, while those who make an effort by choosing the second method experience less burnout.

As the burnout process progresses, the solution becomes more difficult, so the basis of the fight against this syndrome is to eliminate the situations that cause burnout from the beginning. However, if this has not been achieved, burnout should be detected in the early stages and tried to be eliminated (Gabriel & Aguinis, 2021). In the early period, the problem is still at a small level, and the person is open to change. Therefore, periodic monitoring of the person's development can be very useful.

Burnout should not be a problem that a person can cope with alone. Even if a person can correct his own behavior, it is not possible to change the social environment he is in. However, this does not mean that the person surrenders to burnout and does not make an effort towards a solution. There are many options where a person can strengthen himself physically and spiritually to fight burnout.

Individual combat techniques are listed as follows:

• The person should know himself and be aware of his strengths and weaknesses (Maslach C, 1982)

• They should reconsider their very high and unrealistic expectations (Muldary, 1983)

• He should set himself more attainable goals (Maslach, 1986)

• Recognize the signs of burnout (Muldary, 1983)

• The person who realizes that he/she has burnout symptoms should get support from his/her close environment and management staff and seek professional psychological help if needed.

• Must use breaks effectively (Maslach, 1986) and manage time (Muldary, 1983)

• Should not internalize the problems of the people with whom they come into contact with work (Maslach, 1986)

• Create time to rest, relax and discharge

• Must engage in social activities such as sports, music, and meditation (Maslach, 1986)

• Should be able to say 'no' without feeling guilty about issues that they do not want to take responsibility for in their work and family life.

• Be aware of irrational thoughts and perceptions such as controlling everything, being perfect, being loved by everyone, and pleasing everyone (Muldary, 2006)

• When overcoming a stressful situation, one should evaluate the situation within himself and focus on the positive and logical parts instead of focusing on the negatives (Muldary, 2006)

• Should be able to perform relaxation exercises such as controlling breathing and controlling the body (Baltaş A, 1997)

• Must be able to maintain both physical and psychological health (Maslach, 1986)

• Should not lose the sense of humor (Muldary, 1983)

• Emotional and social intelligence should be strengthened (Sürgevil, 2006)

• Instead of working harder, he should aim to work more efficiently (Maslach, 1982)

According to Edelwich and Brodsky, the things that can be done by colleagues in the fight against burnout are listed as follows (Edelwich J, 1980):

• Colleagues should be able to come together from time to time and talk about non-work issues, spend good time together, and develop good relations among themselves,

• Must be able to work in a harmonious team and provide a fair distribution of tasks among them,

• They should try to solve the problems experienced while working together before they become chronic, and they should be realistic and not overly idealized role models for newcomers and more senior employees.

In general, it is possible to list the measures that can be taken at the organizational level as follows:

• Job descriptions should be clear (Sürgevil, 2006)

• Persons with an internal locus of control should be preferred for positions where intense stress is experienced or likely to be experienced, while people with an external locus of control should be evaluated in less stressful areas (T. S., 2004).

• In order to reduce the stress caused by overload, idle sitting, uncertainty, or conflict, the job should be modified to ensure that the hard work is distributed under equal conditions instead of always burdening the same people (Sürgevil, 2006)

• Counselling service should be provided (Sürgevil, 2006)

• The manager should defend him/her appropriately by being on the employee's side, and if necessary, the contact structure of the employee should be changed (Maslach, 2008)

• One's expectations should be optimized, and negative self-evaluation should be avoided by emphasizing positive experiences (Maslach, 1986).

• The manager should be clear and sincere towards his employees and indicate with his words and behaviors that they can apply to him if they have problems (Sürgevil, 2006)

• The manager should provide auxiliary personnel and additional equipment when the work gets busy (Sürgevil, 2006)

• Employee empowerment, which is expressed as giving power and authority to the employees and increasing the belief that the person is effective in the work they do, should be used (Sürgevil et al., 1995).

• The manager should specify his expectations from the employee from the beginning and harmonize the skills of the person with the requirements of the job (Maslach, 2008)

• Professional training and socialization opportunities should be provided(Muldary, 1983)
• Training programs should be given to prevent stress and burnout (Solmus, 2004)
• Job enrichment should be done (Muldary et al., 1983)
• Reliable equipment should be provided with a noise-free, airy, and comfortable working environment (Muldary et al., 1983)
• Managers should learn to be democratic in leadership style (Muldary, 1983)
• The level of social support and trust should be increased within the institution(Muldary, 1983)
• Managers should care about upward communication within the organization and listen to their employees without being directive (Maslach, 2006)
• The manager should increase the employee's ability to make decisions freely and participate in decisions (Maslach, 2008)
• Managers should reduce interpersonal conflicts that cause stress (Muldary, 1983)
• Although anxiety is considered an important stimulus, it should be reduced by the manager as it has inhibitory effects on creativity and innovation (Maslach, 1986).
• An objective performance evaluation system should be adopted, and performance criteria that fully match the personal competencies of the employees should be set.
• The manager should be a mentor (Sürgevil, 2006)
• The manager should not follow a very strict attitude towards leave (Sürgevil, 2006)
• Institutional values should be clarified, value conflicts should be reduced (Maslach, 2008)

2.3 Recovery and Restorative Environment

The term recovery, which is a psychological term in the field of business and organization, refers to the process of a person's transition from the state under stress to the state before. It means recreating some resources that have been exhausted (Sonnentag et al., 2006).
The need for healing is the beginning of this process. It represents the person's request to temporarily escape from the area he is in (Sluiter et al., 1999). It includes non-work activities such as taking breaks from duty when the level of fatigue increases. The mechanisms assumed to underlie the recovery phenomenon refer to the activities an employee engages in during breaks or during his or her off-job time. They may also refer to psychological processes aiding recovery. It is assumed that it is not the specific activity that helps people to recover. Rather, the psychological processes attached to these activities are relevant for recovery (Sonnentag et al.; C., 2007).

2.3.1 Process Of Recovery

These processes are called also recovery experiences:
• Psychological detachment (disengaging oneself not only physically but also mentally from work),
• Relaxation (a state of increased positive affect and low activation), mastery (challenging)
• Experiences and learning opportunities during off-job time),
• Control (ability to choose the activity, its time, and type) during off-job time.
The first two experiences derive from the Effort-Recovery Model (Meijman& Mulder, 1998), and the last two are from the Conservation of Resources Theory (Hobfoll, S.E., 1998).
According to the Effort-Recovery Model, psychological detachment and relaxation may be helpful because they put no further demands on the functional systems or internal resources needed during work (de Bloom et al., 2015).
Mastery and control may aid recovery because they not only restore but also build up new internal resources such as energy, self-efficacy, or positive mood. It can be said that the three prominent theoretical approaches that deal with the effect of contact with

nature on psychological health are the biophilia hypothesis, attention renewal theory, and stress reduction theory (Molinoet al., 2018).

The Biophilia Hypothesis (Kellert & Wilson, 1993) states that the connection of our human ancestors with the natural environment was handed down to us evolutionarily. According to this hypothesis, although modern human life is moving away from the natural environment, individuals desire to engage in interacting intensely with the natural environment. Therefore, contact with nature will have positive consequences on individuals.

Attention Restoration Theory focuses on cognitive processes. According to this, while modern urban environments lead to cognitive exhaustion of individuals, natural environments are regenerative because they are full of stimuli suitable for human evolutionary history and offer renewing experiences both cognitively and emotionally (Kaplan, 1995). This theory will be explained in detail in the next pages.

Stress Reduction Theory (SRT) specifically tries to clarify how exposure to nature might help people experience less (psychophysiological) stress. The theory suggests that contact with the natural environments familiar to humans in accordance with their evolutionary history will reduce stress in individuals and provide regeneration, which is natural for psychological health (Ulrich, Roger, 1992).

In the related literature, there are many studies supporting the assumptions of these theoretical perspectives. Studies show that even limited contact has positive effects on people's psychological health. For example, an experimental study conducted by Hartig, and others reported a decrease in blood pressure of participants who were taken to a room with a tree view for a while after performing a laboratory task; observed that it was more than those who were taken to the room without a view (Hartig et al., 2003). Again, in the same study, the performance of the participants walking in a natural environment in the attention test increased, while the ones walking in the urban area decreased. Participants walking in the natural environment also had an increase in positive emotions and a decrease in anger, while the opposite was observed in participants walking in urban areas (Hartig et al., 2003). In another experimental study, Nisbet and Zelenski reported that after approximately 17-minute walks, individuals outside in urban green areas close to them observed that they reported higher levels of positive affect compared to walking indoors for the same time (Nisbet at. al, 2011). McMahan and Estes reported that interaction with natural environments consistently affected participants' emotional well-being in a meta-analysis of 32 studies conducted with 2356 participants. That is, while positive affect increases with contact with natural environments, a decrease is observed in negative affect, although not as strong as the increase in positive affect (McMahan & Estes, 2015). Researchers state that natural areas are relaxing and calming, providing a way to get away from daily routine and daily worries. In this case, natural environments seem to be an important resource in strengthening the psychological health of individuals (Korpela et al., 2001).

Our interaction with nature is part of not only physical but also psychological healing. While it helps reduce anxious thinking and stress, it also increases creativity and connection abilities (Weir, 2020; Berman et al., 2008). Hormonal changes occur when we spend time in nature, and our bodies often respond by producing "feel-good hormones" such as dopamine, serotonin, endorphins, and oxytocin. These hormones are known to enhance mood, create feelings of relaxation and happiness, and reduce feelings of stress and anxiety (Nakshine et al., 2022).

DMN is the network system with which the brain interacts when the person is not focused on anything, but at the same time, the brain is awake. It includes areas such as the medial prefrontal cortex (mPFC), posterior cingulate cortex (PCC)/precuneus (PCu), inferior parietal lobe, lateral temporal cortex, and hippocampal formation. When you spend time in nature, the brain switches to this system and serves to rest the brain. (Pannekoek et. al, 2012).

Spending time in nature can help to relax our overworked minds. Both correlational and experimental studies have revealed that engaging with nature provides cognitive advantages(Dadvand et al., 2015).

A restorative environment refers to a physical space or setting that has a positive impact on an individual's mental, emotional, and physical well-being, promoting relaxation, stress reduction, and cognitive restoration (Ulrich et al., 1991). Restorative environments are characterized by their ability to offer a respite from the demands and stressors of daily life, allowing individuals to recharge and rejuvenate. These environments are designed or naturally occurring spaces that elicit positive psychological responses and contribute to overall well-being (Appleton, 1975).

Four Elements

According to the theory, restorative environments typically possess four main elements that contribute to their effectiveness in attention restoration (Heather Ohly, 2016):

•Being away: Being away means being mentally disconnected from current anxieties and obligations and diverting from the surroundings that are depleting attention and energy.

•Extent: These environments often provide a sense of openness and freedom, in contrast to the confined spaces of urban environments (Concilio et al., 2019).

•Compatibility: Natural settings are conducive to a person's preferences and inclinations, which reduces the need for directed attention.

•Soft Fascination: Nature offers not demanding stimuli, allowing for effortless attention and relaxation.

Restoration unfolds in place-person interactions that involve preceding or co-occurring processes of recovery

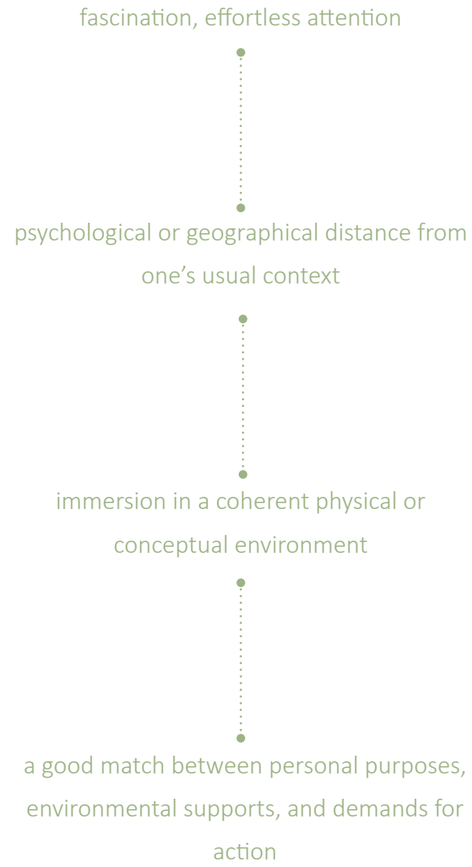


Figure 11: Process of Recovery *(Korpela et al., 2001).*

2.3.1 Attention Restoration Theory – Art

Attention Restoration Theory (ART) is a psychological theory that Rachel and Stephen Kaplan developed in the 1980s. The theory focuses on the cognitive benefits of nature and the environment in restoring mental fatigue and improving directed attention. It suggests that exposure to natural environments can help replenish cognitive resources depleted due to directed attention fatigue, enhancing cognitive functioning and overall well-being (Kaplan et al., 1989).

The theory distinguishes between two types of attention: "directed attention" and "involuntary attention." Directed attention is effortful and required for tasks that demand focus, concentration, and cognitive effort. On the other hand, involuntary attention is automatic and occurs when the environment captures our attention without conscious effort (Kirsten Weir, 2020). Attention restoration theory proposes that natural environments are particularly effective at restoring directed attention. Natural settings provide a respite from the demands of directed attention tasks, allowing involuntary attention to operate. Nature's inherent beauty, complexity, and fascination engage involuntary attention, giving directed attention a chance to recover (Farley & Veitch, 2001).

The function of directed attention is to prioritize stimuli from the environment and effectively ignore irrelevant information. The effectiveness of attention will decrease over time with continuous use(Kaplan et al., January 2010). Attention can only be maintained for so long before the feeling, described by many as "tired" or "stressed," begins to wane. (Kaplan & Kaplan2008)

When overused or mismanaged, directed attention can psychologically contribute to stress. This symptom is strongly connected to "cognitive overload" or "cognitive fatigue," when the cognitive resources necessary for concentrated attention are drained, resulting in increased stress and decreased well-being. (Craig, 2009).

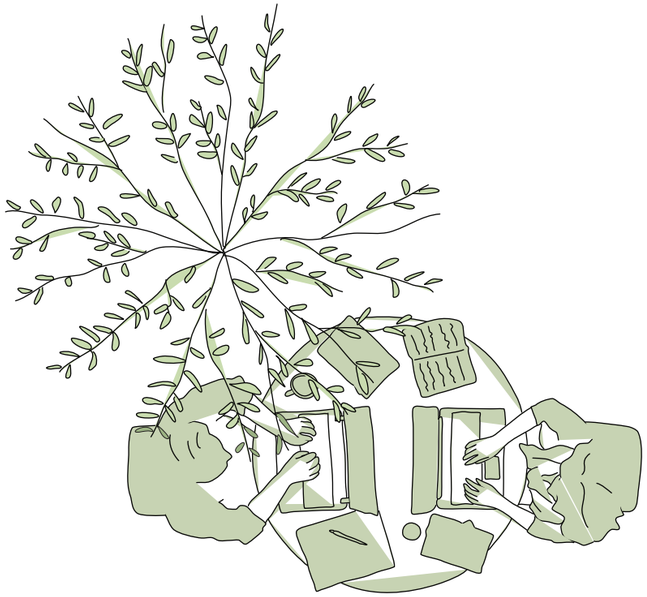
This worldwide everyday phenomenon is known as mental fatigue, increasing the difficulty distinguishing environmental stimuli and prioritizing appropriate information. When forced to focus on one thing, the brain gets tired. Mental fatigue is also a part of burnout syndrome, in which we cognitively distance ourselves from work because our goal-directed attention capacity is reduced (Khammissa et al., 2022).

Directed attention is the cognitive ability to concentrate on a specific task or activity while ignoring distractions and irrelevant information. It involves consciously and deliberately directing concentration towards a particular goal or objective (Cohen A & Rafal RD, 1991). This concept is often associated with selective attention, which is actively choosing what information to process from the sensory inputs and stimuli in the environment (Lev-Ari et al., 2022).

Directed attention is crucial for tasks that require sustained concentration, problem-solving, decision-making, and learning. It involves allocating cognitive resources to process information relevant to the task while ignoring or minimizing the impact of irrelevant or distracting stimuli. This ability is closely tied to executive functions, higher-order cognitive processes that help us regulate our thoughts, actions, and behaviors to achieve our goals (Oberauer K., 2019). The ability to focus one's attention has become increasingly important in a world where digital devices and constant information flow are ubiquitous. Many individuals find it challenging to maintain focused attention due to the constant influx of notifications, emails, and other distractions. To improve productivity, people often use techniques like mindfulness meditation, time management strategies, and creating focused work environments. These methods help to enhance directed attention (Palalas, 2018).

It is best known for being active when a person is not focused on the outside world and the brain is at wakeful rest, such as during daydreaming and mind-wandering.

Recharge your brain.
(Dorsch,2015)



CHAPTER 3

Stress Recovery through Biophilic Design

3.1 Evergreen Nexus: Human, Nature & Architecture

Throughout the annals of history, humanity has shared an intimate relationship with nature. From the beginning of civilization to the modern and urban world, the natural elements, biodiversity, and climates in deleting architecture have been very effective in the natural world. From the moment humans began erecting shelters, nature served as an inspiration. Early civilizations, such as the Mesopotamians, Egyptians, and Greeks, looked to the natural world for architectural inspiration. Columns resembling stylized tree trunks, courtyards adorned with lush gardens, and structures oriented to the sun's path showcased the intrinsic connection between humanity and the environment (Browning et al., 2014).

Religion and spirituality further solidified this connection. Indigenous cultures world-wide built temples, shrines, and sacred spaces that integrated natural elements. Stone circles, like Stonehenge, aligned with celestial bodies, and Native American sweat lodges were constructed with earthen materials, emphasizing harmony with the land. These structures were not just functional but also served as bridges between the earthly and the divine relationships (Rountree, 2017).

For millennia, agrarian societies relied on nature for sustenance and shelter. Thatched roofs, adobe walls, and wattle-and-daub construction resulted from adapting to local climates and utilizing available resources. Homes are often nestled within ecosystems, blurring the lines between indoors and outdoors (McElroy, 2015).

The Industrial Revolution was pivotal in human history, as mass urbanization and technological advancements altered our relationship with nature. Factories, steel skyscrapers, and concrete jungles began to dominate cityscapes. The bond between humans and the natural world weakened as people migrated to densely populated urban areas. As urbanization accelerated, the modern lifestyle distanced us from nature. High-rise buildings and concrete expanses replaced green spaces, leaving little room for natural elements in our daily lives (Dinetti, 2009). A growing reliance on technology furthered this divide, with screens and devices consuming our attention instead of the natural world.

In recent decades, a profound awareness of the detrimental effects of this disconnect has emerged (Firthet al., 2019). Biophilic design, a response to this modern dilemma, seeks to reintegrate nature into our built environments (Barbiero & Berto, 2016).

Architects and designers now incorporate elements like indoor gardens, natural light, and sustainable materials to restore the harmony between people and nature (Conteras et al.,2023).

At the crossroads of history, there is a longing for a reinvigorated connection with the natural world. The pages of our past reveal that humanity's architectural journey has always been intertwined with nature. In this age of environmental awareness, our quest for sustainable, biophilic design is a testament to our enduring desire to bridge the gap between the modern world and the primordial forces that have shaped our existence. Designing the future should continue to honor the timeless bond between humans and nature (Kellert & Calabrese2015).

Historically, humans have built their civilizations using nature for construction and the manufacture of building materials. Stone, wood, brick, and other natural resources have been basic materials for building construction for thousands of years. However, with the rapid development of our cities and lifestyles, we have become more sensitive to the consequences of this approach (Ryan, 2019). Modern cities' concrete jungles and industrial infrastructures tend to destroy nature today. This has led to environmental problems, ecosystem degradation, and the disconnection of people from nature. However, the time has come for a new approach to solving these problems: architecture for nature (Ryan, 2019). However, today, modernization and urbanization have disconnected people from nature, leading them to spend most of their lives indoors. This situation seriously affects our health, happiness, and stress levels. However, architecture may solve this problem by bridging nature and man (Lehmann, 2021).

Architecture is the art of designing and building people's living spaces. However, this dicipline is not limited to creating physical structures, it also can shape people's relationships with nature (Małyszek, 2021).

The rapid, sharp changes that have taken place in the last centuries have affected people psychologically and physically. Although the psychological effects are not immediately noticed, there has been an increase in stress levels and sick-building syndrome as people leave the places they live and live together in the city (Ryan, 2019).

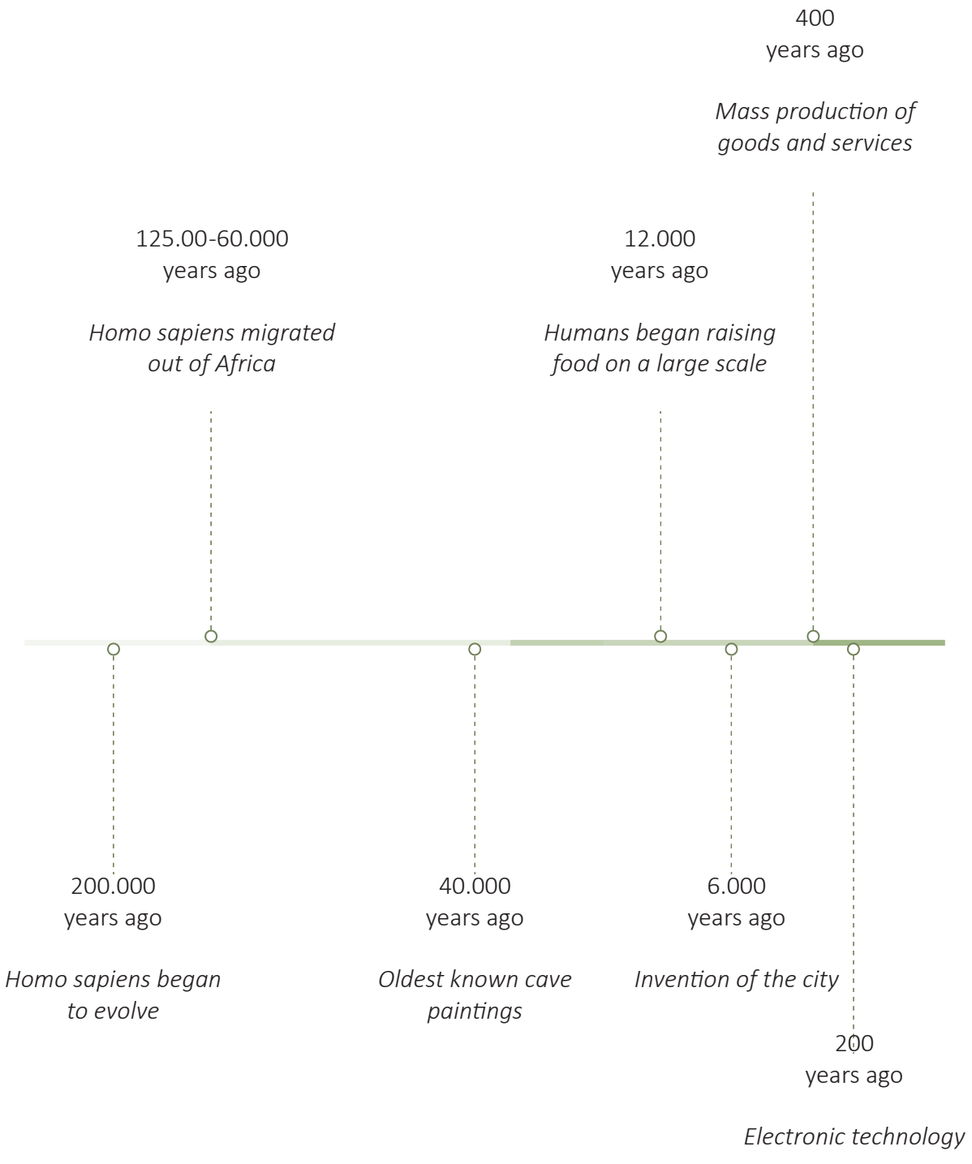


Figure 12: Transformation of Living Conditions *(Kellert & Calabrese2015).*

3.1.1 Sick Building Syndrome (SBS)

Sick Building Syndrome (SBS) is a condition recognized by the World Health Organization as a collection of nonspecific feelings of malaise that are associated with the occupancy of certain modern buildings (Rostron, 2008). The potential causes of SBS can be categorized into several factors, including heating and ventilation systems, temperature, indoor air pollutants, noise, lighting, hygrothermal factors, and psychological factors. It's important to note that some authors differentiate between SBS and Building-Related Illnesses (BRI). In the case of SBS, the occupants of a building are affected over an indefinite period, and it is directly connected with the building itself. On the other hand, BRI refers to a pathological condition that is harmful not only to the regular occupants but also to visitors and passers-by (Seifert B., 1991).

The consequences of SBS range from medical symptoms to personnel/human resources issues and economic consequences (Rostron, 2008). The symptoms associated with SBS often increase in severity with more time spent in the building and improve with time spent away (Burge, 2004).

Ameliorating SBS involves architectural design, mechanical engineering design, maintenance policies, and management techniques. It's crucial to understand that the term SBS should be restricted to multi-factorial problems where no single cause factor exceeds the level of generally accepted recommendations (Rostron, 2008).

It's important to note that SBS is a complex issue, and its causes can vary widely from one building to another. Identifying and addressing the underlying factors contributing to SBS is crucial for maintaining a healthy indoor environment and ensuring the well-being of occupants (Burge, 2004).

Towards the end of the 1970s, symptoms that could not be fully defined began to be recorded in home and office environments. These symptoms were known as "office sicknesses" as they were mostly seen in employees. Exactly 14 years later, the World Health Organization put forward a study on this subject. According to the report of the World Health Organization, 30 percent of the buildings have suggested that the indoor air quality is quite low. The World Health Organization has named these conditions, which have not yet been detected for a clear reason, as Sick Building Syndrome. This discomfort can be described as psychological or physical (Kaushal Modi, Sangramsinh Parmar, 2020).

3.2 Living With Nature: Biophilic Design Theory

"... The innate affiliation people seek with other organisms and especially the natural world." (Wilson, 1993).

Biophilic design theory is a modern architectural and interior design approach rooted in the Latin term "biophilia," which translates to "love of life" or "love of nature." (Wilson, 1984). This theory recognizes and leverages the innate human connection to the natural world, a deep-seated affinity that has evolved over millennia as our species coexisted with nature (Kellert & Wilson, 1993). It seeks to harness this connection to enhance the well-being, comfort, and productivity of individuals within built environments (Zhong et al., 2022).

"...The innately emotional attachment of humans to other living organisms." (Wilson, 1984).

The term "biophilia" was popularized by the American biologist and researcher Edward O. Wilson in the 1980s. It encapsulates the idea that humans have an intrinsic bond with nature stemming from our evolutionary history (Kellert & Wilson, 1993). Our ancestors relied on nature for survival, and this connection is deeply ingrained in our genetic makeup. Thus, biophilia is the Latin-derived concept that encapsulates our instinctive attraction to the natural world (Barbierom & Berto R., 2021).

Habitat

The emotional urge for 'nature' is also described in evolutionary psychology as an inherited attachment from the experience of selecting habitats and creating dwellings. Some natural landscapes or places, it is thought, were more favorable to our ancestors' survival; hence, some features recognized from these 'natural' spaces are also valued in modern architectural settings (Appleton, 1975).

Place

Place attachment theory investigates emotional attachments to locations and contends that people prefer to return to more familiar locations (Hidalgo & Hernández, 2001). This theory also shows how linking to the local natural environment through the incorporation of regional aspects (e.g., geography and landscape) in buildings may develop a sense of place and a sense of community, realizing personal identity, belonging, and cohesiveness (Manzo, 2003).

Theories from several perspectives support the genesis of the concept of biophilic design and merge to demonstrate that the human need for 'nature' is deeply rooted (Heerwagen & Hase, 2001). Although the drive has evolved from survival dependency on 'nature' to preferences for interaction with 'nature,' the psychological desire for 'nature' has not. However, not everything in 'nature' is helpful to people. Unlike good associations (biophilia), some occurrences of 'nature' that have negative psychological repercussions, such as dread of snakes, spiders, the deep sea, and unmeasurable heights, are classified as 'biophobia' (Ulrich, 1993). It is consequently critical to determine what form of 'nature' in the building may generate good associations or, in other words, what constitutes biophilic design.

Biophilic design is achieved by incorporating forms and patterns from nature into buildings (Rogers, 2023). These natural features can be direct, such as light, air, water, or plants, or indirect, such as images, colors, simulations, and shapes inspired by nature. Biophilic design theory encompasses a range of principles and strategies to integrate nature into architectural and interior spaces. These principles are grounded in the idea that when we incorporate elements of nature into our surroundings, we experience numerous psychological, physiological, and emotional benefits (Zhong et al., 2023).

Here are some key biophilic design principles:

Biophilic design is a powerful tool to re-establish people's connection with nature and make interiors more human-friendly. This approach not only improves physical environments but also strengthens people's relationships with nature while increasing their spiritual and emotional well-being. Therefore, biophilic design plays an important role at both the individual and societal levels (Aabouelela,2023).

3.3 Patterns of Biophilic Design and Stress Reduction

"…Biophilia is not a single instinct but a complex of learning rules that can be teased apart and analyzed individually. The feelings molded by the learning rules fall along several emotional spectra: from attraction to aversion, from awe to indifference, from peacefulness to fear-driven anxiety." (Kellert & Wilson, 1993).

Biophilic design concepts are quite successful in lowering stress, improving mood, and enhancing attention at times. In this situation, a study indicates which principle is effective considering existing research on the issue (Gillis & Gatersleben, 2015).
Biophilic design elements, such as natural materials, plants, and views of nature, have been shown to reduce stress levels. Exposure to natural elements and settings can trigger the relaxation response, leading to lower heart rates, reduced blood pressure, and decreased stress hormone levels (Yao et al., 2021).

Starting with the Biophilia Hypothesis, and over the past twenty years, the issues mentioned by Wilson have been re-examined and analyzed separately, using the biophilic design patterns. If there is a common problem, it is important to systematize the solutions developed under suitable conditions. Thus, this becomes a recurring pattern (Keas, M.N., 2018).
Benefits of Patterns (Terrapin et al., 2014) ;

- to provide a consistent and explicit classification
- to prevent misunderstandings with many terminology (metric, attribute, condition, feature, typology, etc.)
- to increase accessibility across disciplines by preserving a recognizable language

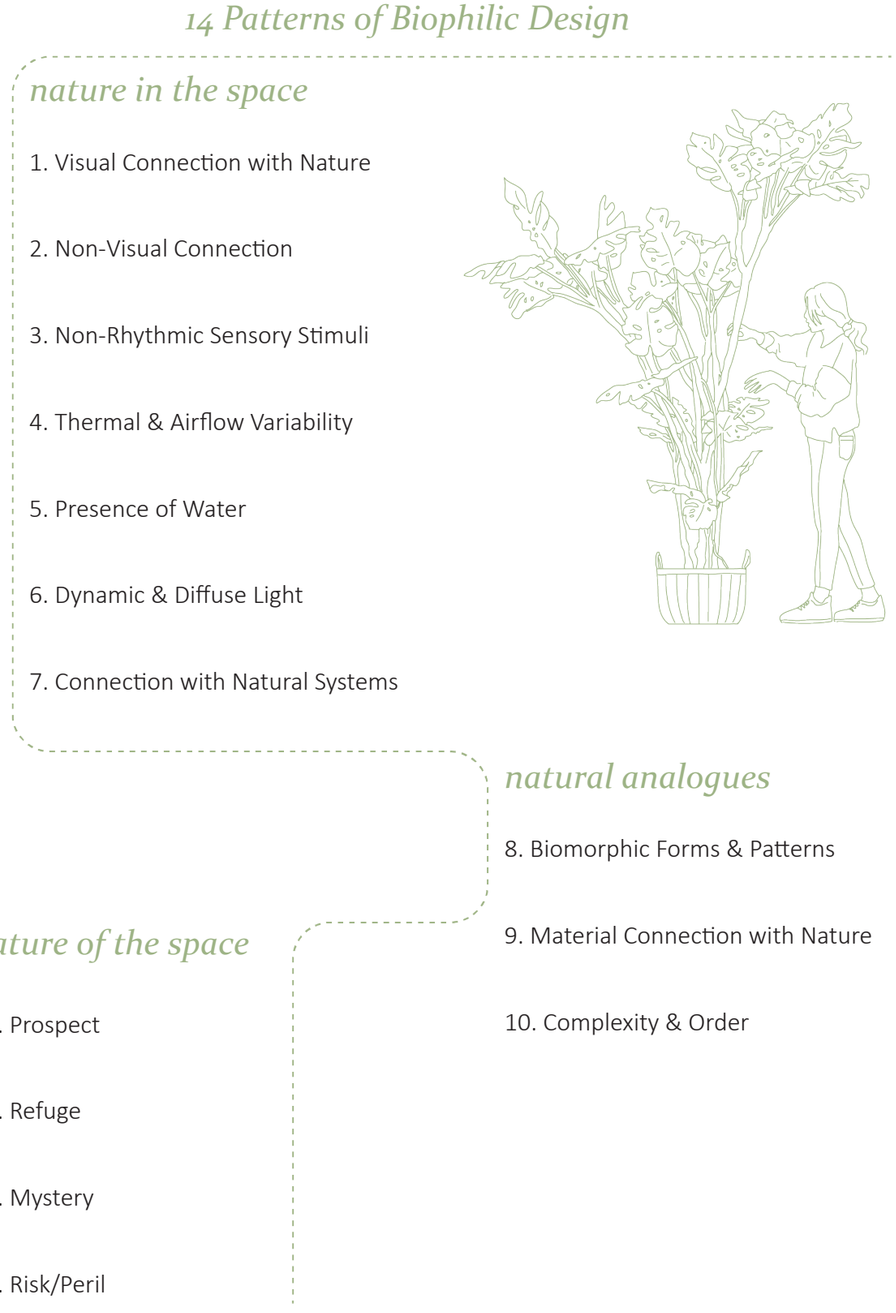


Figure 13: 14 Patterns of Biophilic Design *(Terrapin et al., 2014).*

Figure 14: *The New York Times building, NewYork, Renzo Piano Building Workshop (Photographers : Nic Lehoux Michel Denancé Wade Zimmerman)*

3.3.1 Nature In the Space

Visual Connection With Nature

Visual connection with nature causes a decrease in blood pressure and heart rate, thus getting rid of stress and improving mental attention and the art of happiness (Browning et al., 2014).

The initial five minutes of encountering nature, such as via exercising in a green location, have been found to have the greatest influence on mood and self-esteem (Barton & Pretty, 2010).

It has been observed that a visual connection to nature for ten minutes before encountering any stressor causes the body to go into rest mode due to the decrease in heart rate and parasympathetic activities; that is, the internal organs and hormones that support digestion are stimulated (Brown et al., 2013).

Looking at a forest view for twenty minutes causes brain activity to relax due to cerebral blood flow (Tsunetsugu et al., 2002).

As for the research conducted by Kahn et al. in 2008, it has been observed that viewing natural surroundings through a glass window can significantly enhance the recovery rate of heart rate from low-level stress, compared to no view or a high-quality simulation of the same view. These findings suggest that exposure to nature can have a positive impact on an individual's physiological response to occupational stressors. It is therefore suggested that workplaces should consider providing access to natural views to promote employee wellbeing and potentially enhance work performance (Kahn et al., 2008).

The sensation of touch, especially the act of touching and feeling animal fur, has a profound calming effect on patients. It is also known that touching the soil and gardening activities encourage adults to maintain joint flexibility (Yamane et al., 2004).

Figure 15: Water,*Lane Goodkind Associates Landscape Architects, US*

Non-visual connection with nature

Non-visual connection with nature, such as songbirds, flowing water, crackling fireplaces, sun patches, etc., are the data on the effect of non-visual connection are obstained on systolic blood pressure and stress hormone decreases (Browning et al., 2014).

Exposure to nature sounds provides up to 37% faster recovery from the effects of psychological stress and psychological healing (Alvarsson et al., 2010). It decreases directed attention fatigue and improves mood and motivation (Jahnck et al., 2011).

In a study, half of the participants who entered the restoration period at the end of the task listened to river sounds and watched a nature movie containing river sounds, while other participants listened to office noise or silence. According to the results, it was reported that the group that listened to nature sounds was more active and highly motivated than the other group (Jahncke et al., 2011).

The olfactory system processes the perceived odor directly to the brain and thus can trigger the recall of memories in individuals in a very powerful way. Previous studies have shown that exposure to medicinal plants through scent both strengthens the immune system and has a positive effect on the healing process. It has been found to have a calming effect on people in traditional practices (Kobayashi et al.,2012).

It has been observed that touching a real plant instead of an artificial plant has a relaxing effect due to a change in the rate of cerebral blood flow (Koga, K., Iwasaki, Y., 2013).

Figure 16: Curtain *(Photography: Nin Solis/Living Inside; styling by Tami Christiansen)*

Non-Rhythmic Sensory Stimuli

Non-rhythmic sensory stimuli activates blood pressure and the sympathetic nervous system due to its effect on heart rate (Li, Q., 2010; Park, et al., 2009; Ulrich, R. S. et al., 1991; Beauchamp et al., 2003) reduces attention fatigue, allowing you to focus more easily (Windhager et al., 2011) .

While working, usually when looking at the computer screen and focusing on the individual, the eye muscles begin to contract. When these muscles begin to contract for more than 20 minutes at a time, eye fatigue, headache, and fatigue begin to occur. For this reason, breaks that require the person to look up for about twenty seconds or that will cause a long distance (>20 feet) and short-term distraction will cause the mental and eye muscles to relax (Lewis & Laird, 2012).

Figure 17: Courtyard , *Shopping Centers Bangkok, Thailand, (Photographs:Ketsiree Wongwan)*

Thermal & Airflow Variability

Research shows that changes in the light, sound, and temperature in the environment cause sensory changes in people, and these prevent boredom and passivity. (Heerwagen, J.H., 2006).

As mentioned in the previous chapter, according to Attention Restoration Theory, “soft attraction” elements such as light breezes increase motivation and focus (Zhong et al., 2022; Kaplan, 1995).

Providing various favorable thermal conditions positively affects the performance of students (Elzeyadi, 2012).

At the same time, the change in air flow rate has positive effects on comfort (Wigö, 2005).

Passive design systems provide fresh air flow in external courtyards and public spaces so that external walkways provide access to shade and sunlight (Browning et al., 2014).

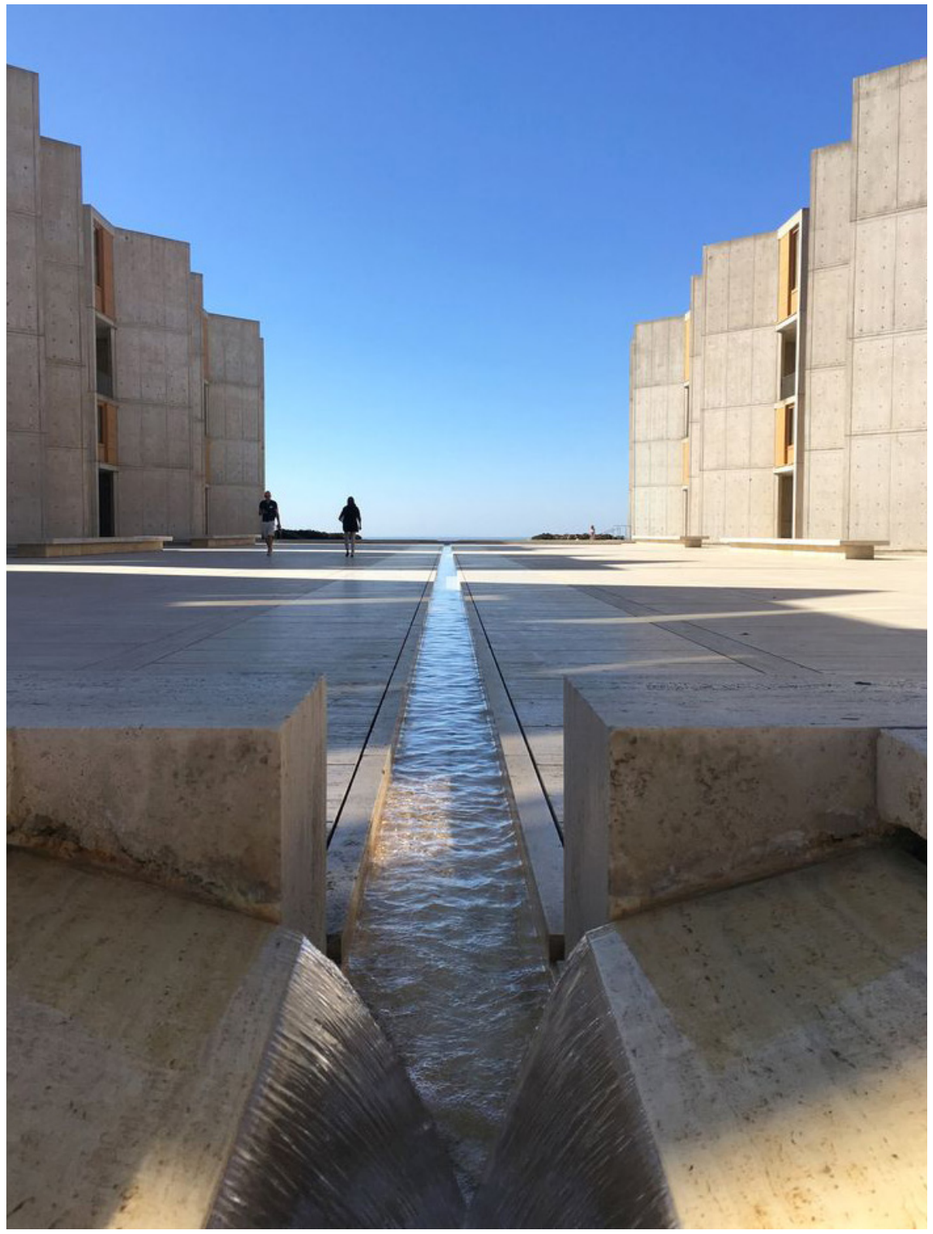


Figure 18: Salk Institute, *Visiting Louis Kahn's Salk Institute, (Robert King)*

Presence Of Water

According to research, visually clean water is something that the general public mostly prefers. (Heerwagen & Orians, 1993).

According to another study, landscapes containing water have proven to have a higher restorative effect (Jahncke et al., 2011).

According to research, activities carried out in green areas led to improvements in both mood and self-esteem compared to green areas without water (Barton & Pretty, 2010).

At the same time, the physical and tactile perception of water reduces stress (Alvarsson et al., 2010).

Repeated water encounters do not dramatically reduce our level of interest over time. Therefore, one small water element is enough. Using the noises produced by small-scale running water, as well as our ability to touch it, we may enhance the intended health response with a multi-sensory experience. Views of huge bodies of water, as well as direct access to natural or artificial bodies of water, might elicit a health response if they are considered 'clean' or unpolluted. Nature images with aquatic components are more likely to assist lower blood pressure and heart rate than identical images without aquatic aspects (Biederman & Vessel, 2006).

Figure 19: Light,*Landscape Architecture,Restaurants & Bars, Lishui, China ,(Photographs:Hao Chen, Ziling Wang, Yang Zhou)*

Dynamic & Diffuse Light

According to research, the human eye can adapt to the conditions in light perception and image processing, but differences in the brightness of the sources on the surfaces may cause glare in the human eye, which reduces visual comfort (Clanton, 2014).

Especially in working areas, the brightness level difference between the immediate environment and the surroundings should be between 1-10. This rate increase in areas which serves the purpose of working, religious or socializing (Clanton, 2014).

The movement of light and shadows sometimes forms a fractal, which the brain tends to adapt to (Clanton, 2014).

Circadian illumination is crucial for sustaining biological health in the same way that fluctuations in lit surfaces are important for understanding surfaces, performing a range of tasks, and safe navigation. Taking the use of chances for illuminance variation, light dispersion, and light color variety that stimulate the human eye without creating pain can improve the user experience (Blume et al., 2019).

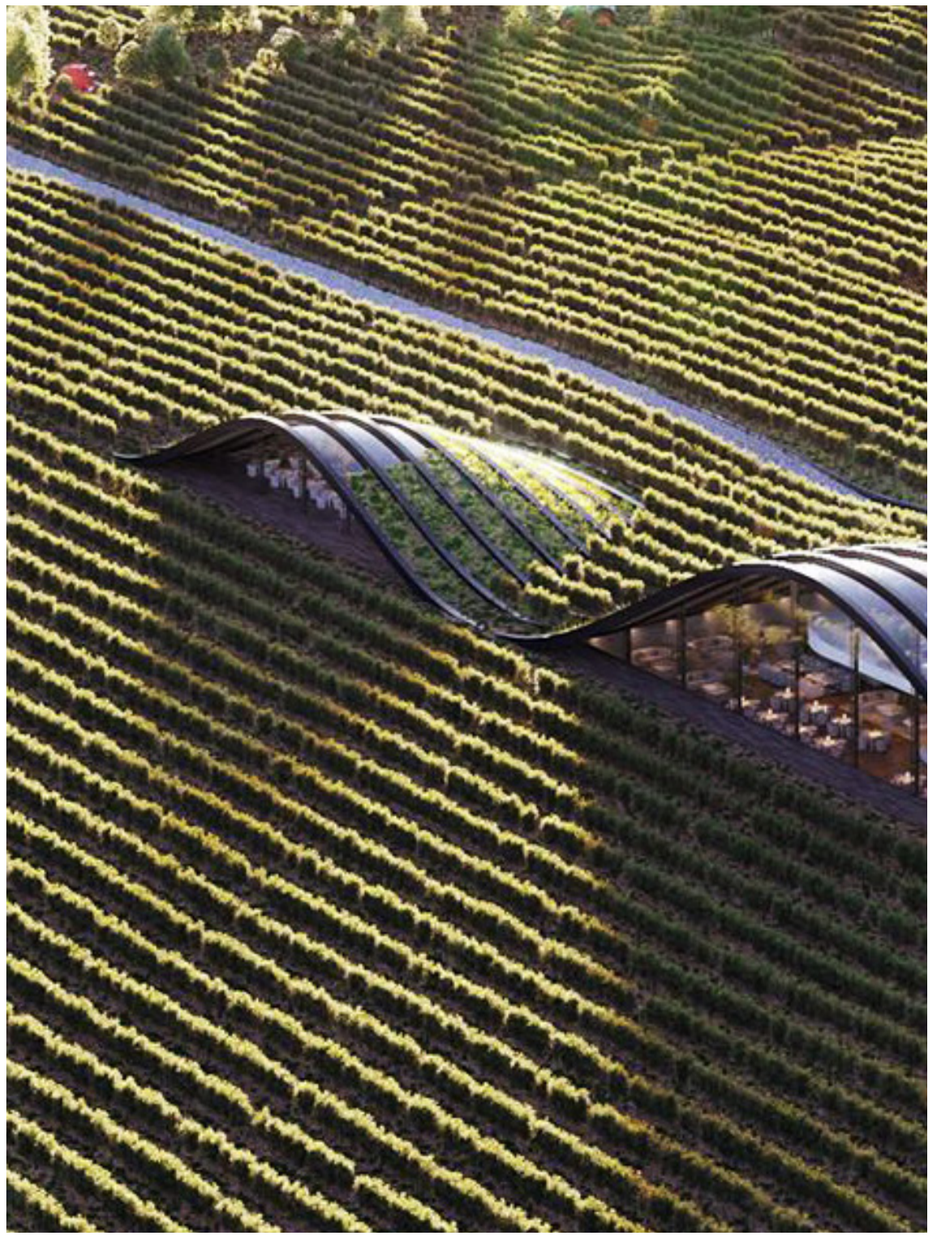


Figure 20: Green connection,*Public Gardens,Kahketi, Georgia, (Visualization: michael archviz, X Architect)*

Connection With Natural Systems

The stronger the connection of a place with natural systems is the easier it is for users to be aware of natural cycles and seasonal transitions. Thus, this experience is more in nature and is relaxing and healing. When you glance out the window, you can feel the natural cycle with the turning of the seasons (Browning et al., 2014).

Another system may be more complex, such as simulating rain events, rainwater harvesting systems, and biological swamps. One of the studies that can be done may be the integration of processes such as rainwater capture and purification into the landscape. Another may be the use of materials whose form and function change due to shading. Gaining solar energy and being able to use wind energy are also important. Preservation of natural features of the land, such as sand dunes, side roads, etc. (Browning et al., 2014).

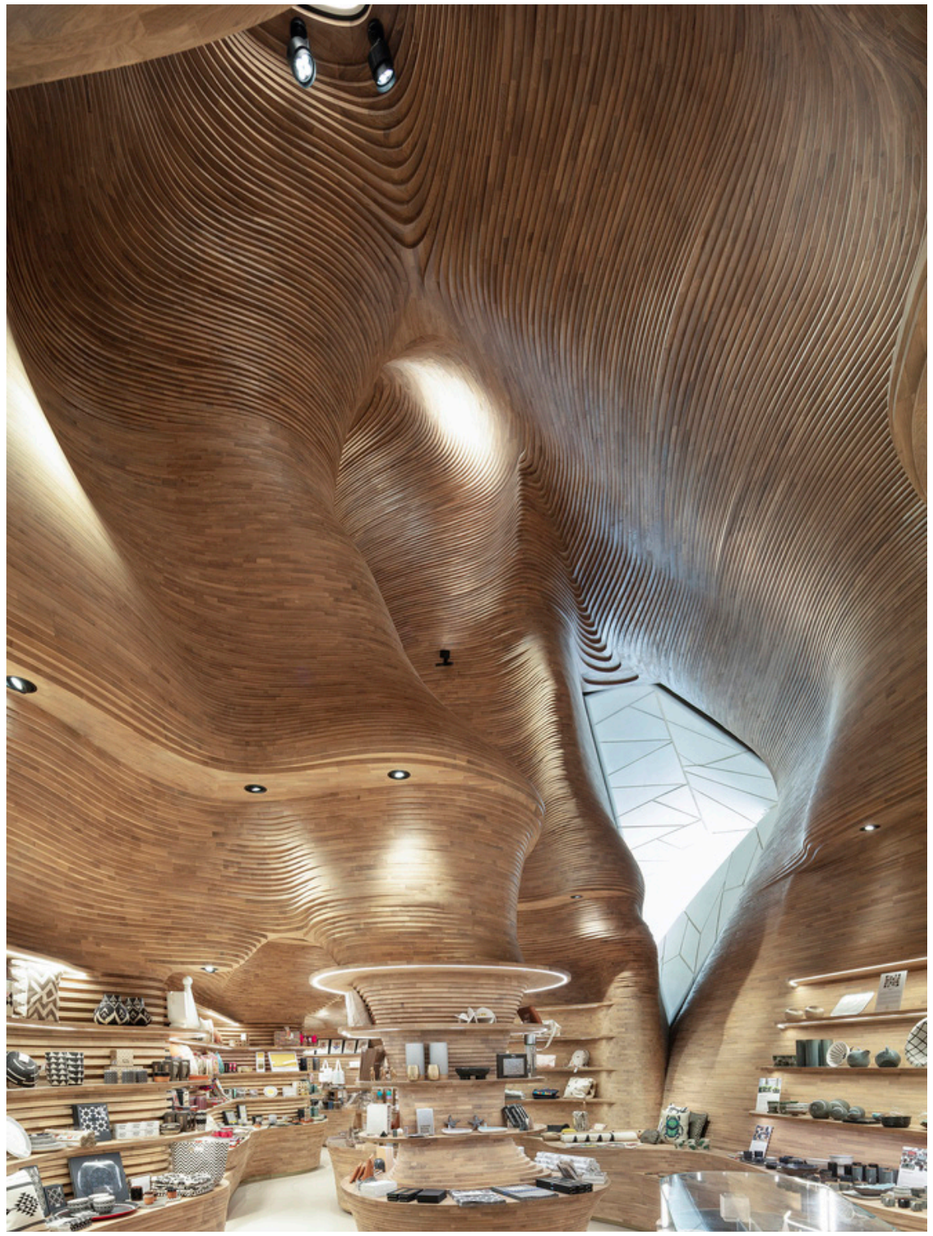


Figure 21: National Museum Of Qatar Shop Interiors , *Koichi Takada Architects (Photographs:Tom Ferguson Photography, Oscar Rialubin)*

3.3.2 Natural Analogs

Biomorphic Forms & Patterns

Biomorphic forms and patterns have been found to have an effect on reducing stress and increasing concentration because they occur in focus (Joye, 2007).

The interesting thing is that we are aware that there is a trend towards bioformic forms, but the scientific formula behind this is not yet known. Even though our brain knows that these forms and objects are not alive, it perceives them as things that bear traces of life and begins to establish a connection with them (Vessel, 2012).

Nothing in nature is in perfect pain; that is, there is no pain like pain. For example, 137.5 golden bitterness is accepted, and this is the bitterness of some flowers (Thompson, D'Arcy W, 1917).

Working with this mathematical order has turned into an architectural expression of arrangements and proportions. This actually allows users to connect with nature without losing sight of architecture's relationship with nature. In this case, architecture creates a bridge rather than a limitation (Zhong et al.,2022).

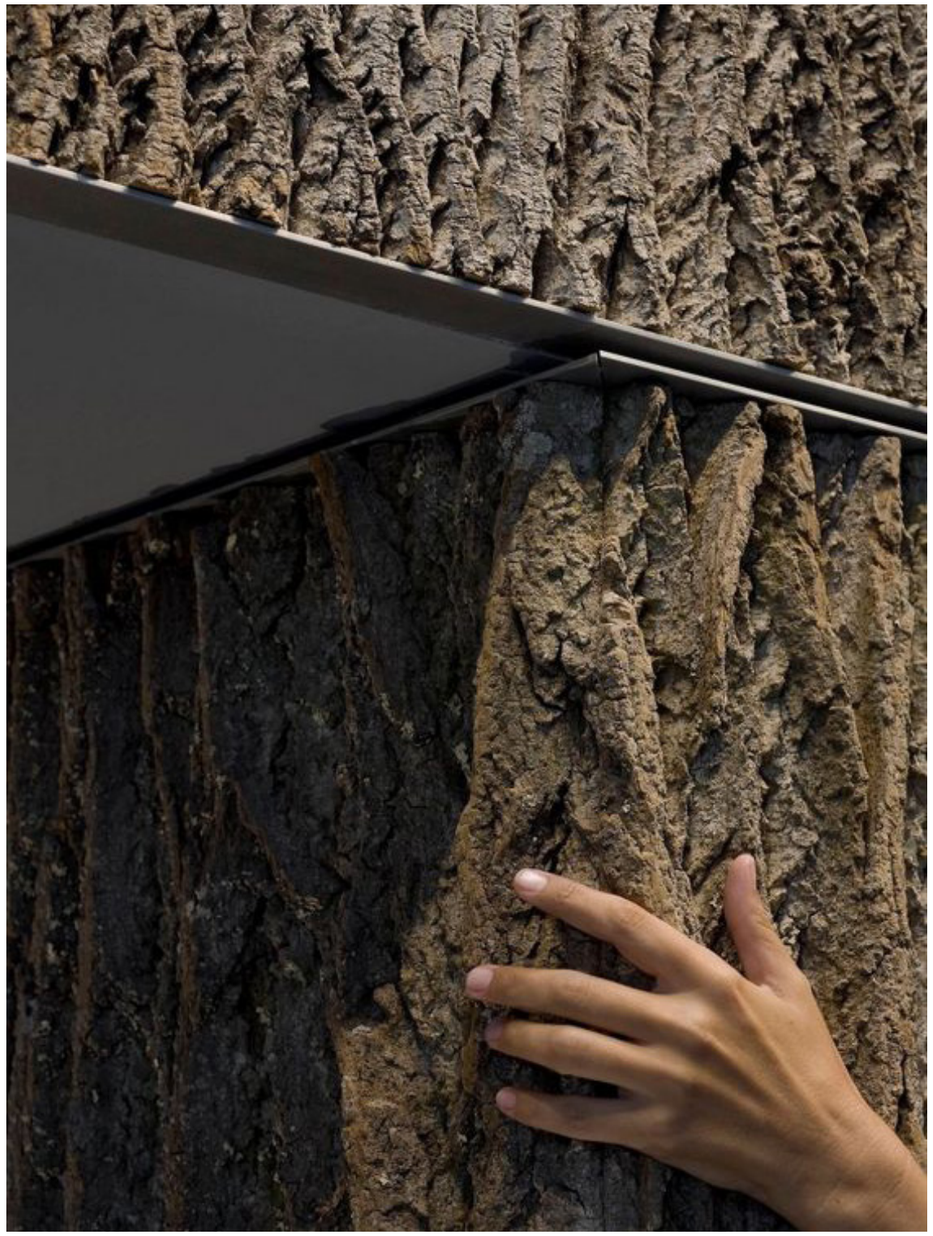


Figure 22: Touch, (*Credits: https://barkhouse.com/natural-bark-wood-products/poplar-bark-panel-wall-coverings)*

Material Connection with Nature

According to a study, by creating differences in the proportion of wood materials used in interior spaces, the effects on users' heart rates, blood sugar, and brain activities were calculated according to this changing segment. Researchers have observed that in the area with medium-level wood coating, approximately 45%, it creates a feeling of relaxation in users, significantly reduces diastolic blood pressure, and exhibits significant balance on heart rate. This material can be used where relief is desired (Tsunetsugu et al., 2007).

An analysis of four experiments examined the effect of the color green on human psychology's functioning. It was concluded that the creativity performance of the participants increased when they watched the green color before performing a task, but there was no change in analytical performance (Lichtenfeld et al., 2012).
However, people can distinguish the variations, that is, the shades of green, in most color categories (Painter, 2014).

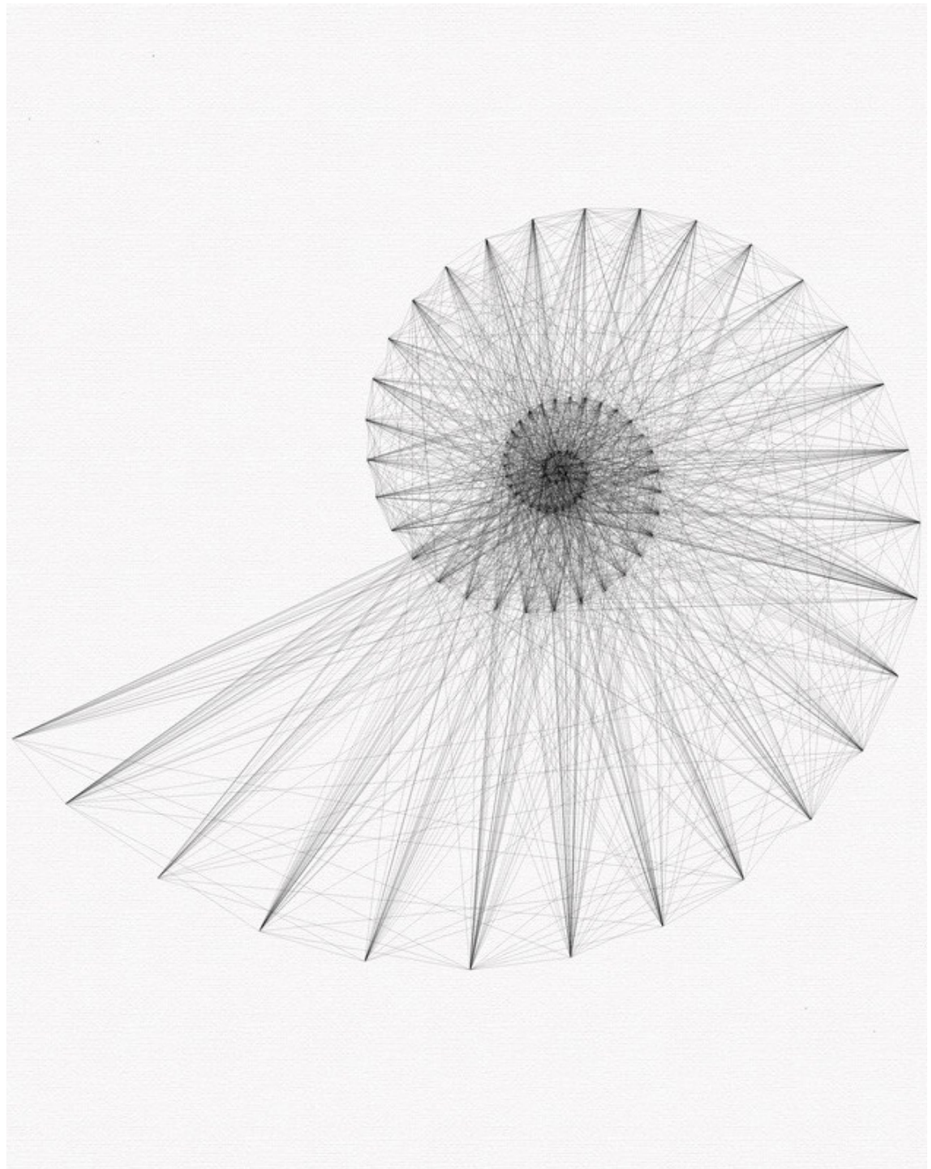


Figure 23: Fibonacci Spirals, *studies of Fibonacci spirals, Pencil and ink on paper, various sizes,(Fredrik Skåtar, 2012)*

Complexity and Order

The complexity within the order plays an important role in perceiving the design flow of nature, in fact, in research on repeating geometries, fractals in art and architecture, like a replica of it (Salingaros, 2012; Hägerhäll et al., 2008).

Although studies have repeatedly verified connections between fractal shapes in nature and those in art and architecture (Joye, 2007), there are differing views on which dimension of a fractal is optimal for producing a positive health response, whether a best-case scenario exists and whether a ratio of this type is even essential to identify as a design metric or rules. Nikos Salingaros analyzed a number of these views with remarkable detail, noting that the range of optimal fractal dimensions (D=1.3-1.8) differs based on the application (Salingaros et al., 2000).

Scaling inherent in the basic design is an element that creates order and interest in fractal formation and has a stress-reducing effect (Salingaros et al., 2000).

At both ends of the spectrum, it has been noticed that non-fractal and high-dimensional fractal artworks induce stress in people (Hägerhäll et al., 2008).

As an example, symptoms such as nausea and dizziness, which are frequently encountered in an office in Mississippi, are associated with insufficient air flow, but the overly complex patterns and flooring and seating fabrics used in the interior cause the surfaces to be perceived as moving while walking in the space, thus causing excessive visual stimulus perception problems determined that it is (Heerwagen, 2014).

Similarly, the Fibonacci series (0,1,2,3,5,8,13,21,34..) is used in many sequences of elements existing in nature. The issue is the distance between plant leaves, flower leaves, etc. The golden ratio comes from here (1:1.618), the arrangement of the seeds inside the sunflower and their growth with spiral turns, like seashells(Browning et al., 2014).

Figure 24: Pocket Park at Home4IT, *Campus Roche Kaiseraugst, (Bryum Architects)*

3.3.3 Nature Of the Space

Prospect

From an evolutionary psychology perspective, a space with a good state of expectation makes one feel open and accessible. When alone, it gives a feeling of being safe in an unknown place (Heerwagen, J.H. & G.H. Orians, 1993).

This pattern has been developed based on evolutionary psychology and architectural and cultural anthropological analyses. It has been suggested that as comfort improves, perceived sensitivities such as boredom and stress decrease (Grahn, P. & U.K. Stigsdotter, 2010).

While searching for an answer to the question of why people prefer certain visual landscapes, which started with Jay Appleton's Experience of Landscape study in 1975, it was concluded that our viewing preferences. That are signals that we choose according to reference points that will benefit us for survival and that this may be signals that will awaken hope for the future based on our roots from the past (Appleton J., 1996).

According to the Savanna Hypothesis, a landscape in an open land, with animals and plants living in the shade of trees, with water and floral elements, may be preferred because this landscape gives us the information that it is full of evidence of life here (Heerwagen & Orians, 1986)

Figure 25: UCCA Dune Art Museum,*Open Architecture, (Photographs:Qingshan Wu, Nan Ni)*

Refuge

The need for shelter creates a feeling of protection in the individual and is a place of retreat from primary duties, that is, a place of rest. It can be alone or with a small group. This area may have different spatial characteristics than other environments around it. In this way, the individual can feel protected without separation (Browning et al., 2014).

In previous studies, the shelter model caused the heart rate to decrease due to the decrease in blood pressure in the individual, thus enabling healing and reducing stress. Another effects of shelter reducing mental fatigue. It has positive effects in improving the perception of attention and refocusing it (Grahn, P. & U.K. Stigsdotter, 2010) (Wang & Taylor, 2006)(Petherick, 2000).

In small-sized green areas within the city, the ability to contain the space and its spatial features that lead to restoration is more important than its size (Nordh et al., 2009).

Trees have become preferred places in larger park areas as they provide shelter (Ruddlell & Hammitt, 1987).

Figure 26: Megapark, *Architects: Architectkidd, (Photographs:Wworkspace, Panoramic Studio, Ketsiree Wongwan)*

Mystery

The mystery is the promise of more knowledge that encourages one to go deeper into exploring a partially hidden area, pushing one to investigate further (Browning et al., 2014).

The mystery pattern in evolutionary psychology is based on two basic needs of humans: one is to understand, and the other is to discover (Browning et al., 2014).

The feeling of mystery creates pleasure reactions in the human brain (Browning et al., 2014).

A good mystery situation lacks a sense of dread; the circumstances that distinguish between wonder (i.e., fear) and enjoyment center around the optical level of the field. Unpleasant shocks have been demonstrated to result from a clouded view with a narrow depth of field, whereas more visual access with a medium (20 ft) to high (100 ft) length of field is preferable (Herzog & Bryce, 2007).

A successful mystery circumstance may also be conveyed by obscuring the outer limits and part of the focal bound (i.e., room, construction, landscape, as well as another data source), appealing to the visitor to anticipate that subject's entire size to explore the area further (Ikemi, 2005).

Figure 27: Stone 27, *Benjamin Langholz, (https://www.benjaminlangholz.com/#/stone-27-marin/)*

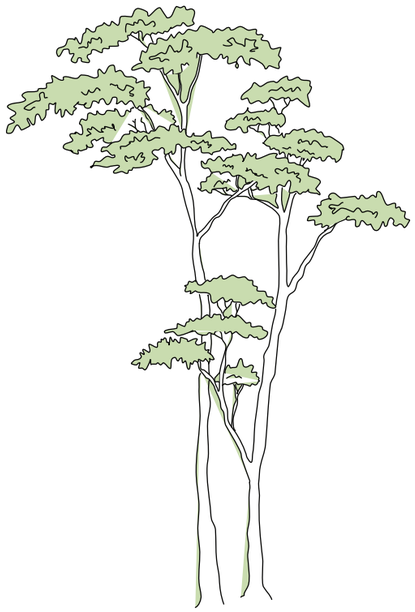
Risk / Peril

An environment with a favorable Risk/Peril condition can be thrilling, and with an underlying threat, it might even feel a bit naughty or deviant. It gives a sense that it could be risky yet captivating, worth investigating, and potentially hard to resist (Browning et al., 2014).

Origins of the risk pattern can be produced by an acquired or biophobic reaction set off by an imminent danger. However, this danger is inactive and cannot inflict harm due to a reliable safety factor. The key distinction between Risk/Peril and fear lies in the degree of perceived threat and control (Rapee, 1997).

Being conscious of a manageable risk can foster positive experiences that trigger potent dopamine or pleasure reactions (van den Berg, A.E. & M. ter Heijne, 2005). These experiences contribute to the formation of risk evaluation during childhood. In adults, brief bursts of dopamine enhance motivation, memory, problem-solving abilities, and fight-or-flight reactions (Kohno et al., 2013). On the other hand, prolonged exposure to intense Risk/Peril situations may result in excessive dopamine production, which is associated with depression and mood disorders (Buraei, 2014; Kandel et al., 2013).

A successful mystery circumstance may also be conveyed by obscuring the outer limits and part of the focal bound (i.e., room, construction, landscape, as well as another data source), appealing to the visitor to anticipate that subject's entire size to explore the area further (Ikemi, 2005).



CHAPTER 4

Case Studies About of Nature, Space and Employees

Introduction

The content of this section collected with the aim of elucidating previous scientific studies on the impact of spaces and public spaces on people's psychology and the positive and negative effects this has on today's modern human figure. These studies, collected under four main headings, helped to evaluate the effects on human psychology on a broader scale : Works Stress Level, Restoration Theory, Mood Change, Biophilic Design in Public Space. Each research study was examined interms of methodology and material (the part where the techniques used in the analysis are explained), results (the numerical conclusion of the analysis), and conclusion (interpretation of the data obtained).
Four different articles were selected in order to better understand the relationship between space and employee stress, which is the main subject of the thesis. In studies on stress reduction, data were collected based on users' use of open spaces, duration of use, activities performed, characteristics of the spaces used, and changes in people's stress levels. With restoration theory, it was emphasized that employees could leave their offices and access open areas in order to empty their minds (Maric et.al, 2021).
In addition, another study presented research comparing the brain activities of people living in rural areas and people living in the city center (Largo-Wight et. al, 1974). By comparing the activities done outdoors and indoors, it was concluded that activities done in open areas have a greater effect on the mental restoration of the brain (Pei-Yi Weng & Yen-Cheng Chiang, 2014). The next topic is business mode change. In the research here, it has been concluded that green areas have positive changes in the human mood, with studies showing that they increase the endocrine hormone and reduce the stress hormone (Gladwell et. al, 2013).In the researchhere, it has been concluded that green areas have positive changes in the human mood,with studies showing that they increase the endocrine hormone and reduce the stresshormone. In a research conducted among people living in England, a relationship wasestablished between the happiness levels of people living in rural and urban areas byasking daily questions to people living in different parts of England, thanks to an applicationdownloaded to their phones (MacKerron&Mourato, 2013). This is followed by a research on streets designed in accordance with biophilic design conditions in many different places around the world. These researches and scientific studies have been compiled in order to shed light on the project part, which is the next step of the thesis.

4.0 Case Studies About Importance of Nature Space And Office Workers

4.1 Works Stress Level

The Effects of Open Space On Reducing Workplace Stress

Greenspace Ecotherapy Interventions: The Stress-Reduction Potential of Green Micro-Breaks

Integrating Nature Connection And Mind-Body Skills

Healthy Workplaces: The Effects of Nature Contact At Work On Employee Stress And Health

4.2 Restoration Theory

From restorative environments to restoration in work

Psychological Restoration through Indoor and Outdoor Leisure Activities

4.3 Mood Change

The Great Outdoors: How A Green Exercise Environment Can Benefit All

Happiness is Greater in Natural Environments

4.4 Biophilic Design in Public Space

Seeking Parks, Plazas, And Spaces

Biophilic streets: a design framework for creating multiple urban benefits

4.1 Works Stress Level

4.1.1 The Effects of Open Space on Reducing Workplace Stress

The article is authored by Jelena Maric, Djukic Aleksandra, Branislav Antonic, Danilo Furundzic, and Vladimir Parezanin from the Faculty of Architecture, University of Belgrade (Maric, Aleksandra, Antonic, Furundzic, & Parezanin, 2021).

According to the report, working individuals devote around 54% of their waking hours to work. Work-related stress is inescapable and can have a negative impact on employee health and business performance. The study contends that open space within the office environment might have a favorable impact on decreasing overall stress levels in all types of users (Maric, Aleksandra, Antonic, Furundzic, & Parezanin, 2021).

The empirical research in this study is based on a single case study of Business Park "Airport city" in Belgrade, Serbia. The primary focus is on a survey done with 235 participants using a questionnaire to investigate the relationship between job stress and workplace settings. The questionnaire results demonstrate that the frequency, duration, and activity of open space utilization increase the level of stress, but this is not related to their age or gender. Furthermore, final implications show that enhanced open space, such as anticipated vegetation, but also non-workplace urban design, as well as socialization and exercise amenities tailored to frequent and brief work breaks, might increase employees' overall well-being. They are new components in relatively undeveloped research on stress measurements and open space utilization characteristics in a specific (restricted) employment scenario (Maric, Aleksandra, Antonic, Furundzic, & Parezanin, 2021).

Methods and Materials

Workplace stress (WPS) is real, and it affects the majority of employees. In contrast, the Workplace environment (WPE) plays a crucial role in elevating and reducing the stress level (SL) of employees, and open space can help reduce work-related stress level.

These methods, self-report, and quantitative measures, were applied using a two-part questionnaire. While preparing the survey, it was divided into two parts. The first part (A) consists of questions prepared to measure the stress level, and the second part (B) is about the characteristics of these work environments.Three questions were about open space usage: frequency, duration, and activity; and one question about open space geographic features. The aim of the project was to investigate the link between overall WSL, open space utilization, and characteristics in a particular WPE.

Results

The findings suggest that 48% of male participants had low workplace stress, whereas 73% of female respondents have and high workplace stress. Female and senior employees are more likely to have a greater WSL. Nonetheless, when relevant statistics are compared with real preferences connected to WPE concerns, gender and age play no significant effect, although prior study found gender importance in the appraisal of the WSL.

Duration	*WSL*
Up to 10 mins	22.6%
From 15 to 30 min	44.3%
From 30 min to one hour	23.4%
More than 1 hour	9.8%

Activity	WSL
Watching from window	*17.4%*
Sitting and relaxing	*33.2%*
Eating,drinking,smoking	*31.1%*
Speaking with friends	*12.8%*
Engaging in phsical activity	*5.5%*

Spatial Characteristics	WSL
Natural landscape, greenery and vegetation	*31.3%*
Sunlight and fresh air	*19.7%*
Vistas,colors and sounds	*17.2%*
Aesthetics and architecture of buildings and restaurants	*6.9%*
Urban furniture, banks and pavements	*7.3%*
The urban design of gardens fountains and sculptures	*17.6%*

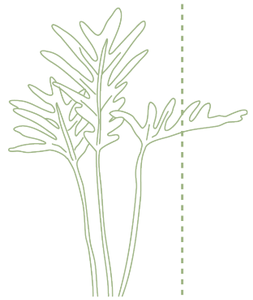


Figure 28: Representation of respondents' WSL within open space dimension–spatial characteristics *(Maric, Aleksandra, Antonic, Furundzic, & Parezanin, 2021)*

Conclusion

• The use and physical qualities of open space might have a considerable impact on employees' SL.

• Almost half of the respondents use open public spaces quite regularly, albeit usually in short intervals.

• The WSL steadily diminishes when the frequency and duration of outdoor activities increase.

• In contrast, responders with lower WSL might be more active in the same conditions, regardless of whether the activity is brain or physical.

• It is important to socialize with friends from the same profession because this way, concerns about the same issues can be shared.

• These areas are expected to have more activity areas for longer-term use. Such as socialization and exercise areas.

• Similarly, research of the same format can be carried out during summer days with extreme temperatures, to address the issue of climate crisis.

4.1.2 Greenspace Ecotherapy Interventions: The Stress-Reduction Potential of Green Micro-Breaks

This study is an article published in the journal Ecopsychology. The article is authored by Dorothy Ibes, Isabel Hirama, and Carolyn Schuyler from The College of William & Mary, Integrative Science Centre, Williamsburg, Virginia and Wildrock Nature Playscape and Discovery Centre, Charlottesville, Virginia (Ibes, Dorothy and Hirama, Isabel and Schuyler, Carolyn, 2018).

According to this study, students' and campus employees' interactions with the outdoors and their relationship with mental health were studied. Campus decision-makers recognize the need to provide warm, accessible spots for students to reduce stress and gain emotional self-care skills. It is aimed to make the green area, which is not used much on campus, useful with some interventions. With this study, some activities were determined to reduce stress levels and establish the mind-body relationship. The fact that these activities were short-term (1 and 5 minutes) increased users' participation in this test and ensured continuity. This intervention is called "RESET" (Release Everyday Stress and Enjoy Trails)(Ibes, Dorothy and Hirama, Isabel and Schuyler, Carolyn, 2018).

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Methods and Materials

The interventions were designed to be pop-up, temporary installations in public spaces. As such, all materials were low-cost, portable, and durable (i.e., not likely to be damaged by mild weather conditions). The first introductory sign (''Try this'') was placed at the edge of the major walking path to draw attention. The next sign invited participants to ''RESET your mind in sixty seconds.''

Figure 29: The interventions in Campus *(Ibes, Dorothy and Hirama, Isabel and Schuyler, Carolyn, 2018)*

Results

Some analysis and coding studies were carried out to monitor the effects of this small intervention in nature. According to the results, it was found to have a positive effect on psychological health in 96% of the participants. There were 558 volunteer participants for this study.

Conclusions

• Stress relief was the most common psychological effect of the interventions, reported by 82% of participants who mentioned some kind of psychological impact.
• The second most common impact (14%) included other positive impacts, such as improved effects or increased energy. Four percent of comments reflected a negative psychological impact. These included increased awareness of negative emotions such as loneliness or anger.
• 82% of the participants' comments were about relieving stress. Although no measurement is made on stress, this rate is very large and important.
•Since RESET is reasonably priced ($100) and has an easy-to-implement installation, it is possible to apply it in other places.

4.1.3 Healthy Workplaces: The Effects of Nature Contact At Work On Employee Stress And Health

The study was designed to examine the effects of nature contact experienced at work on employee stress and health. The article authered by Erin Largo-Wight, W. William Chen, Virginia Dodd, and Robert Weiler (Largo-Wight, E., Chen, W. W., Dodd, V., & Weiler, R., 1974).

The study found a significant association between nature contact and stress, as well as nature contact and general health complaints. The study was conducted among office staff at a southeastern university, with 503 participants taking part in a cross-sectional study. The researchers used a 16-item workplace environment questionnaire, the Nature Contact Questionnaire, to comprehensively measure nature contact at work for the first time. The Perceived Stress Questionnaire and 13 established health and behavioural items were used to assess the dependent variables, general perceived stress, stress-related health behaviours, and stress-related health outcomes.
As workday nature interaction increased, subjective stress and nonspecific health issues reduced. Higher nature-contact scores signified greater nature interaction at work, while lower perceived stress and health scores indicated less stress and fewer health issues.

Methods and Materials

To conduct this analysis, people serving on the office staff of a university were selected. People in this group were selected from 23 different categories, such as secretarial office clerks. People working in this category generally spend most of their time tied to a desk. First of all, the 16-item Nature Contact Questionnaire (NCQ) was used to determine the contact of the study participants with natural environments.

A second questionnaire, the Perceived Stress Questionnaire (PSQ), was then used to measure stress levels. These surveys were sent to users via e-mail and could be completed in approximately 10-15 minutes. For example, in order to understand their communication with nature, they were asked how often they went outdoors to take a break or questions were asked such as how many times a week do you listen to nature sounds to understand indirect nature contact.

And after some analysis techniques, the data were combined comparatively using statistics is a statistical software suite (SPSS).

Results

“Which forms or doses of nature enhance effectiveness, and which do not.” (Ibes, Dorothy and Hirama, Isabel and Schuyler, Carolyn, 2018).

The results of these analyses were that the greatest stress-reducing exposure method was found to be outdoor nature contact. Indirect nature contact, which is the least direct contact type was the method with the least positive effect on health. As the frequency of exposure of employees to open air increased, it became a method that deserved to receive more plus points in terms of improvement in health and stress levels.

Independent Variables	N	M	SD	t-Score
Low Nature Contact \\ Total	41	67.3	16.2	2.1
High Nature Contact \\ Total	60	60.5	16.2	
Low Nature Contact \\ Outdoor Subscale	85	68.0	17.8	3.1
High Nature Contact \\ Outdoor Subscale	58	59.2	15.7	
Low Nature Contact \\ Indoor Subscale	131	65.4	16.1	0.8
High Nature Contact \\ Indoor Subscale	52	63.1	17.1	
Low Nature Contact \\ Indirect Subscale	84	66.1	16.5	2.1
High Nature Contact \\ Indirect Subscale	46	60.1	16.6	

M = mean, SD = standard deviationap<0.05, bp<0.01 (two-tailed)
T- score is equivalent to the number of standard deviations away from the mean of the t-distribution.

Figure 30: Relationships between perceived stress and high vs. low nature contact at work among office staff *(Largo-Wight, E., Chen, W. W., Dodd, V., & Weiler, R., 1974)*

Conclusion

• The conclusion of the study is that nature contact is a healthy workplace exposure. Increasing nature engagement at work may provide an easily implemented population-based method to improving workplace health promotion activities. Future research should investigate the effectiveness of nature-contact workplace stress treatments.
• According to the research conducted in this study, it was revealed that there is an inverse relationship between stress and increased contact with nature.Perceived stress and nonspecific health issues reduced as workday nature interaction increased. Nature interaction appears to be a good working exposure, according to the data.
• The suggestions include promoting the preservation of pristine wilderness; incorporating wooded parks and green space into community design; maintaining healing gardens; cultivating and landscaping grounds for outdoor viewing; welcoming animals inside; providing a profusion of indoor potted plants nearby; lighting rooms with bright, natural sunlight; providing a clear view of nature outside; allowing outside air and sounds in; and displaying natural beauty.

4.2 Restoration Theory

4.2.1 From Restorative Environments to Restoration In Work

The article was authored by Kalevi Korpela, Jessica De Bloom, and Ulla Kinnunen from the Faculty of Social Sciences / Psychology at the University of Tampere, Finland (Korpela, Kalevi & Bloom, Jessica & Kinnunen, Ulla2014).
The review focuses on the effects of viewing or being physically active in the natural setting and the effects of indoor plants and window views on restoration and recovery. The authors discuss the conceptual similarity between recovery experiences and processes of perceived restorativeness. They also present evidence showing that outdoor natural environments are more efficient in producing restoration than outdoor built environments.
This article is based on the effects of physical features of indoor spaces (indoor plants, view from the window, etc.) on mental restoration and psychological healing. At the same time, evidence is presented showing that outdoor natural areas have more restoration properties than indoor and built areas.
According to the research, it is concluded that the stress level decreases as work breaks and exposure to open air increase. In addition, it has been revealed that plants in the office increase the concentration and creativity of employees (Korpela, Kalevi & Bloom, Jessica & Kinnunen, Ulla2014).
One of these studies is a study conducted in office environments in Denmark. (Lene Lottrup, Ulrika K. Stigsdotter, Henrik Meilby, Sus Sola Corazon, 2012)
It’s a big place with six different companies located in this office building. A survey was conducted with the employees of these offices, which have a high-quality green area. It was determined that 20 to 53% of the participants in this survey visit green areas more than once a week during the workday. Users who are encouraged to use green space by their colleagues or managers have 3 times higher use of green space than those who do not receive any incentives. Those who use green spaces for reasons such as calming down and being alone are almost twice as likely to spend time outdoors(Korpela, Kalevi & Bloom, Jessica & Kinnunen, Ulla2014).

The importance of interactions with natural environments outside of outdoor work

“Physical Recreation”

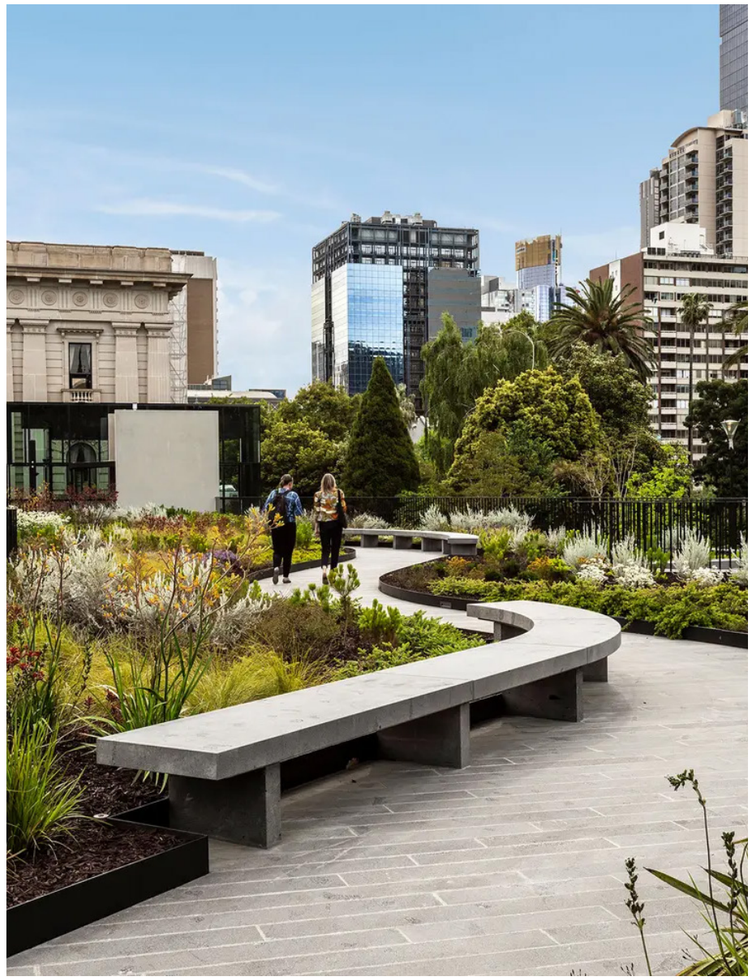

Figure 31: Victoria Parliament Green Roof *(Photo: Adam Gibson)*

Many studies have found that outdoor spaces and open air are more effective in the mental restoration of the individual than interventions performed indoors. To mention a few studies that prove this; epidemiological studies have stated that there is a positive relationship between increasing the amount of green space and decreasing disease rates (Maas J, Verheij RA, de Vries S, Spreeuwenberg P, Schellevis FG, Groenewegen PP, 2009)and death rates (Farfan-Portet MI, Popham F, Mitchell R, Swine C, Lorant V, 2010). Moreover, an experimental study showed that physiological attention and emotional stress improved in green areas (Bowler, 2010).In a study conducted on the accessibility of natural places in the immediate vicinity, it was suggested that natural places reduce people’s stress levels and regulate their mood. (Korpela KM, Ylén M, Tyrväinen L, Silvennoinen H, 2010).In an analysis conducted on adults, natural environments such as parks, gardens and beaches constituted 50-60% of the most preferred places and became favourite places. This test was also conducted in Finland, USA, Ireland, Senegal and Estonia (Korpela, K., & Hartig, T. , 1996).

In a study in which the functional magnetic resonance map of brain activity was obtained, when the participants were shown photographs of natural and constructed natural environments after a stressful situation, it was concluded that natural environments have a high restorative power, with different areas of the brain becoming active. (Martinez-Soto, Joel & Gonzales-Santos, Leopoldo & Pasaye, Erick & Barrios, Fernando, 2013).

It has been found and reported that walks in inner city parks or large forested areas lead to improvement in the restoration of directed attention, better focus, gain in emotional mood, decrease in blood pressure, acceleration of heart rate and decrease in salivary cortisol. (Hartig, T., Mang, M., & Evans, G. W., 1991).

With 25 studies conducted, in natural or built indoor-outdoor environments two health and well-being indicators, meta-analysis revealed that the most consistent evidence was related to emotional outcomes (Bowler, 2010).When the initial mood state was compared with the mood state as a result of activities performed in natural environments, an increase in positive moods was detected instead of emotional states such as anger, sadness, anxiety, and fatigue. In addition, in a more detailed examination, this mood change was determined by personal characteristics (age, income, free time, gender, etc.) It has been determined that it is not durable (Bowler, 2010).

It has been determined that low-effort physical activities performed in free time after work are more effective in restoring emotions. (Fritz, C., & Sonnentag, S. , 2005)

4.2.2 Psychological Restoration Through Indoor and Outdoor Leisure Activities

This survey was conducted by Yen-Cheng Chiang from National Chiayi University and Pei-Yi Weng from National Taiwan University (Pei-Yi Weng and Yen-Cheng Chiang, 2014).
The aim of this study was to compare the effects of activities that people usually do in their free time on feeling less anxious and on attention restoration. For this, five activities were selected and divided into indoor and outdoor. Thus, being indoors and outdoors could be compared. It was conducted among Taiwanese students (N = 203) who chose only one of these five activities.
According to statistics conducted by Taiwan's national statistics in 2005, Taiwanese people ranked it as the most common indoor activities:

- Watching TV (68.3%)
- Surfing the internet (11.3%)
- Chatting (8.1%)
- Listening to music or reading a book (5.7%)

The most preferred outdoor activities among Taiwanese are:

- Visiting your friends (33.4%)
- Walking (18.4%)
- Exercising and playing ball games (15.7%) (15.7%)
- Going to the cinema (12.7%)

However, since visits to friends can occur both indoors and outdoors, they were not included in this research. Additionally, gardening activity was included in this study because it requires more interaction with this natural environment. It was added to this study since gardening affects physical and psychological well-being.

Methods and Materials

203 people partecipated this survey. Females made up 103 (50.7%) of the total, with ages ranging from 18 to 26 years (M = 19.7 years, SD = 1.25). The number of people allocated to each activity ranged between 37 and 48. The test analysis result for samples from varied activities revealed no significant gender difference.
The Necker Cube Pattern Control (NCPC) test was developed to measure a person's ability to direct mental effort. It uses a wire-frame cube named after the Swiss crystallographer Louis Necker, who observed that cubic shapes repeatedly reverse their perceived orientation. The Necker cube used in this test may be viewed in two distinct view. During prolonged viewing (more than a few seconds), the cube spontaneously reverses its orientation, with first one of the larger squares appearing to be closest to the observer and then, sometimes suddenly, the other. In the test, the participant observes how many times the cube randomly reverses. First, a count is made of how many times the cube randomly flips over. On a second count, the number of turns is counted again, this time trying to maintain a perspective, i.e., controlling the number of times the cube turns. A higher attentional capacity is reflected in the ability to control the revolutions.
Anxiety is a person's reaction to the stress level when he realizes it, so anxiety can be considered a type of stress. The State-Trait Anxiety Inventory (STAI) 20-item inventory was used to measure this condition. (Chung, Long, 1984)

The tests made on between April and June therefore the weather conditions were available for outdoor activities. All the test were conducted in the afternoon this provide to participations accumulated a certain level of fatigue. Before NCPC and State Anxiety Inventory test all participants attended at least 2 hours class.

Results

Two group were compared with statistical test. It is frequently used in hypothesis testing to assess whether a procedure or treatment effects the population of interest or if two groups are different from one another. (T-test, 2023).

The results show that chatting (t=5.55) and walking (t=6.10) have significant effect on reducing stress. From attention restoration theory perspective chatting (t=5.12), walking (t=5.37) and gardening (t=5.19). The number of reversals on the Necker cube pattern control test reduced. Chatting indoor has a medium effect on attention restoration at the same time walking and gardening have large effect. Physical exercise enabled people to restore their attention. Surfing on the internet doesn't have any significant effect on attention restoration theory.

Chatting with close friends reduces anxiety and restores attention.

Walking with friends reduces anxiety and restores attention.

Gardening only restores attention.

Surfing in the internet is not helpful for anxiety reduction or attention restoration.

Exercising is not helpful for anxiety reduction or attention restoration.

Conclusions

When compared to indoor activities to outdoor activities, outdoor activities can better recover people's attention. This conclusion is consistent with Hug, Hartig, Hansmann, Seeland, and Hornung (2009), as well as hypothesis of study, which implies that outdoor leisure activities promote attention restoration more than indoor activities. According to these studies, speaking in both indoor and outdoor settings might promote psychological wellness.

Variance Analysis of the Effects of Activitivies on Anxiety	*Pretest (M)*	*Posttest (M)*	*t Value*
Surfing the Internet	*40.27*	*11.77*	*1.57*
Chatting	*42.51*	*9.72*	*5.55**
Walking	*44.74*	*11.07*	*6.10**
Excercising	*39.03*	*10.50*	*1.10*
Gardening	*41.00*	*10.85*	*1.72*

Variance Analysis of the Effects of Activitivies on Attention Restoration	*Pretest (M)*	*Posttest (M)*	*t Value*
Surfing the Internet	*5.31*	*3.41*	*1.36*
Chatting	*3.86*	*2.15*	*5.12**
Walking	*4.04*	*2.58*	*5.37**
Excercising	*4.13*	*2.05*	*1.65*
Gardening	*5.33*	*4.00*	*5.19**

Values (M) represents anxiety and attention restoration level.
t- test value examines whether there is a mean difference between two sample groups.

Figure 32: Variance Analysis of the Effects of Activities on Anxiety *(Pei-Yi Weng and Yen-Cheng Chiang, 2014).*

4.3 Mood Change

4.3.1 The Great Outdoors: How A Green Exercise Environment Can Benefit All

This arcticle authored by Valerie F Gladwell , Daniel K Brown, Carly Wood, Gavin R Sandercock, Jo L Barton from School of Biological Sciences, University of Essex, Colchester-Gladwell et. al, 2013).

Continuing trend of growing populations negatively affecting the delicate balance of nature, which had developed over millions of years before our evolutionary invasion. Our hunter-gatherer ancestors lived in natural outdoor environments for thousands of years, and this is hypothesized to give humans today an innate connection to nature (Gladwell et. al, 2013).

This review is about how the open air will motivate people to engage in physical activities, especially today, due to decreasing physical activities due to many reasons (31.1% of the physical population worldwide is physically inactive), which is contrary to human nature, and being confined to closed areas. With the digital revolution in the developed world, physical activities are increasing. It has shifted to homes instead of gyms, which are already indoors. With rapid urbanization, the number of quality green areas has been limited. There are physical obstacles in cities, so it is essential to make these areas accessible to everyone and to establish a relationship with nature in a safe environment.

Previous Researches

It has been observed that the first five minutes of green exercise provide many benefits on a person's self-esteem and mood (Barton J, Pretty J, 2010).

According to the comparison, post-exercise blood pressure returns to baseline values faster after exercise in rural environments than in urban environments (Pretty J, Peacock J, Sellens M, Griffin M, 2005).

Ulrich's early studies showed that there was a directly proportional relationship between exposure to nature and heart rate. However, it was confirmed that there was an increase in attention capacity and a lower heart rate after watching a stressful video followed by an increase in parasympathetic activity (Ulrich et. al,1991).

Hearth rate variability (HRV) is a positive thing that profoundly affects human health.

High HRV is an indicator of a healthy nervous system and also reduces the risk of cardiovascular disease. A study conducted in Japan showed a tendency for high HRV when tested using HRV analysis, which reflects parasympathetic activity, while sitting outside in a forest environment. This test was repeated in a controlled indoor environment. Increased parasympathetic activity increased heart rate (Park B et. al, 2007).

Endocrine markers adrenaline, neo adrenaline and cortisol, the stress hormone, decrease when interacting with nature. This suggests that exposure to nature affects two major stress systems, the sympathy-adrenal medullary and the hypothalamic-pituitary-adrenal axis (Li Q, 2010; Park B et. al, 2010).

Discussion

There is evidence in previous analysis studies showing the healing effect of nature on health and that green areas affect physical or mental well-being. However, the important point here is the characteristics of green areas. The levels of biodiversity in this area, careful management, quality and access to this area should be considered. In addition to the type and duration of physical activity, it is important to establish relationship with the environment which motivating opportunities for people.

Compared to exercises done outdoors exercises have many health benefits. Adequate vitamin D intake not only improves mental health but also has a synergistic effect on the physical sense. For example, it has been concluded that outdoor exercises are important for the rehabilitation or prevention of many diseases, including cardiovascular diseases (Ceci & Hassmen 1991).

Green areas, which provide security and socialization opportunities, may prevent people from using this area due to transportation difficulties or poorly designed disconnected roads. At the same time, in a neighbourhood with a high crime rate, the security threat reduces the use of these areas. This may cause children growing up here to live more disconnected from nature. There is a relationship between the level of participation and feeling safe (Ryan & Deci, 2000).

To summarize, exercising outdoors is a natural medicine to find solutions to health problems in developed countries. Some of the benefits that low-effort physical activities provide include reducing stress, restoring mental fatigue, and positively affecting mood. All these findings show that city parks have a great public service potential by increasing biochirality in order to make their use more attractive areas (Fulleret et al. 2007).

4.3.2 Happiness is Greater in Natural Environments

This arcticle authored by George MacKerron and Susana Mourato from Department of Economics, University of Sussex, UCL Bartlett Centre for Advanced Spatial Analysis (George MacKerron, Susana Mourato, 2013).

An innovative research method has been developed and implemented using a smart-phone app. This app randomly prompts participants to answer a short survey while simultaneously using GPS to record their geographical coordinates. This method has been used to gather over a million responses from more than 20,000 participants. By linking the GPS locations of responses with objective spatial data, a model was created to connect land cover with subjective well-being (SWB).The study found that partici-pants were significantly happier when they were outdoors in green or natural habitats compared to urban environments. These results remained consistent even when tested with various alternative models and specifications. This research adds to the growing body of evidence supporting a positive correlation between exposure to natural environ-ments in daily life and SWB. Scientists have sought both observational and experimental proof to understand the connection between physical or mental health and the natural surroundings.

Methods and Materials

Back-end server software was created to interact with the app, and a public website was set up to provide information to potential and actual respondents. The app is designed to be easily shared among friends and acquaintances, as its notifications can spark con-versations. Participants can download the Mappiness app for free, provide their con-sent to participate, and share basic demographic and health-related information. After registration, they receive random prompts during their daily lives at times they choose (default is twice a day between 08:00 and 22:00) and are asked to rate their happiness on a sliding scale. They are also asked about their company, location, and activity. As they respond, their exact location is determined by GPS. Each reaction is linked to three essential geographical and environmental variables via GPS data: broad habitat or land cover type, meteorological conditions, and daylight status. The primary focus is on land cover (green and blue space kinds). This research is based on 1,138,481 responses from 21,947 UK participants collected over a six-month period from the app's debut in mid-August 2010 and mid-February 2011.

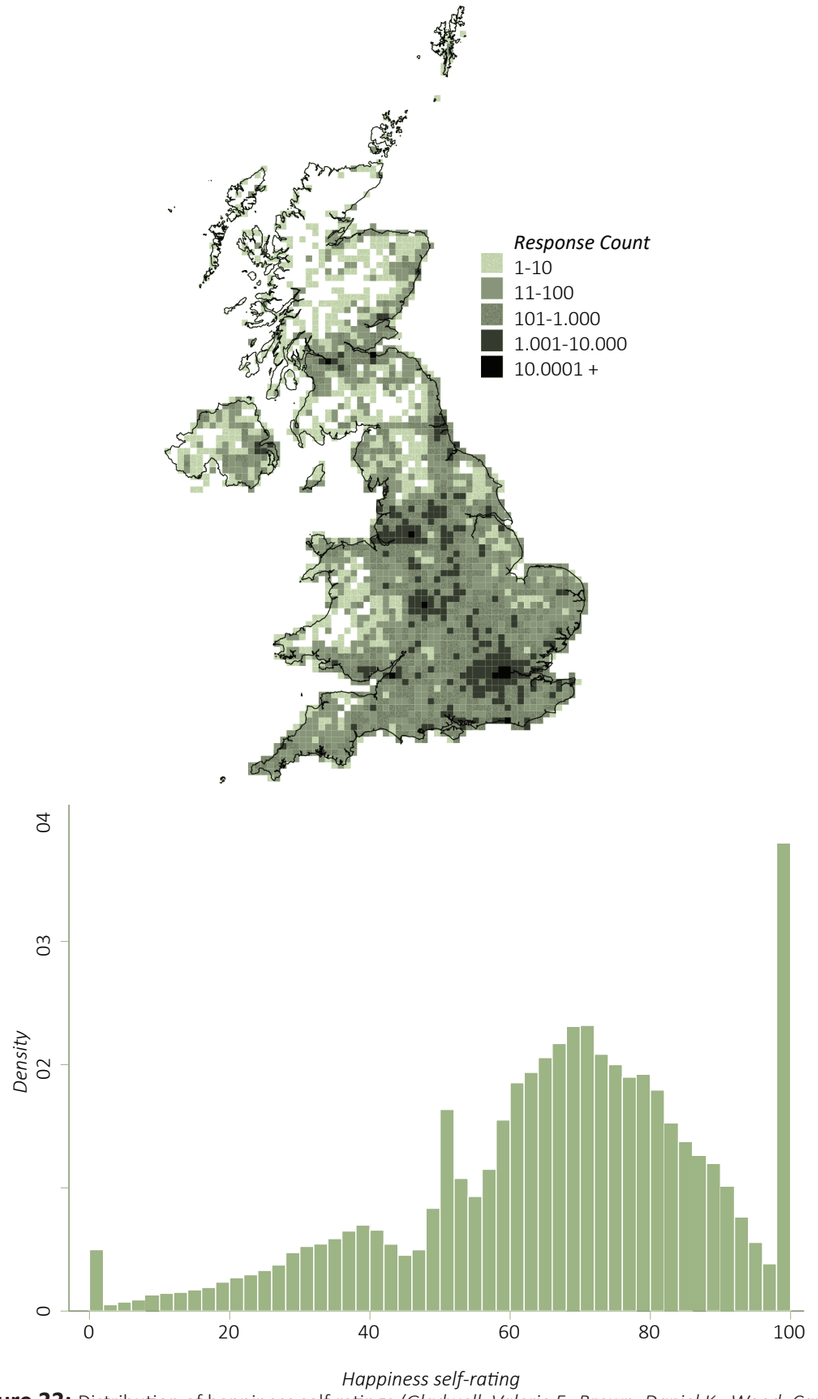

Figure 33: Distribution of happiness self-ratings *(Gladwell, Valerie F., Brown, Daniel K., Wood, Car-ly,Sandercock, Gavin R., Barton, Jo L., 2013).*

Results

The participants are quite youthful, with 66% under 35 and 95% under 50, compared to 29% and 56% in the UK adult population. A significant 78% of participants are employed and 13% are in full-time education, both groups being overrepresented compared to the UK adult population where the proportions are 57%. The gender ratio among participants is almost balanced at 55% male, slightly higher than the 49% in the UK adult population. All variables used in our analysis are binary (0/1), and all land cover type and weather variables interact with being outdoors. It's important to note that land cover, weather conditions, and countryside designation status are only considered in relation to being outdoors. Moreover, when participants are not outdoors, their location is less accurately determined by GPS, making the spatial data associated with these situations less reliable.

Conclusion

This research offers fresh insights into the connection between nature and subjective wellbeing. It reveals that participants are happier in natural settings, even after accounting for numerous potential influencing factors. The relationships we identify are statistically significant and of considerable size. These relationships are not skewed at the participant level (i.e., by correlations between types of locations and types of people) because this model is calculated solely from variations within individuals. Furthermore, it has taken into account a comprehensive range of potential influencing factors at the response to level of health activities. This is with the main idea that nature is a therapy area. The green areas should be made available to the public by making quality improvements.

4.4 Biophilic Design in Public Space

4.4.1 Seeking Parks, Plazas, And Spaces

This arcticle was authored by Sam Gochman from Terrapin Bright Green (Gochman, 2016).

Due to the chaos that occurs or accumulates as the population concentrates in cities, man's inherent tendency towards nature and the feeling of reaching out have gradually increased. A study conducted in the Manhattan region of New York, which has a dense working population, investigated what type of open spaces employees prefer during their lunch breaks. These areas consist of four parks: biophilic and non-biophilic areas. Data was obtained by interviewing users in randomly selected areas. This subject is an important expression of people's reactions to the environment they live in and the emotions and perception of space that places make people feel. Accordingly, it explains why people prefer the places they use daily and why they even risk walking further to reach these areas.

As a result of surveys conducted during the lunch hour in four different open areas, it was understood that participants walked more in Biophilic areas. However, the participants stated that they could walk a longer distance to enjoy more nature. People's desire to be in nature can be taken into consideration for urban planners and policy makers to re-evaluate these areas from the perspective of accessibility and being mentally restorative.

Biophilic interventions in cities, in general, produce a web-like structure of threads and nodes that have a significant influence on daily living by promoting personal and communal health and well-being across the city.People seeking a soothing getaway to nature throughout their workdays may be drawn to urban areas that use biophilic design elements.

Methods and Materials

Data was obtained from four different locations in downtown Manhattan. There are two biophilic spaces and two non-biophilic spaces.

•Biophilic Sites : Elevated Acre and Bowling Green

•Non-biophilic Sites: Broad Street and Pearl Street and Coenties Alley

Non-biophilic environments, which are frequent in metropolitan areas, are characterized as spaces absent of nature. They are frequently handy, quick ways to get to, and close to other places, giving for the flexibility that a hectic schedule may require. However, these locations are typically noisy, smoky, desolate, or non-restorative.

Data was gathered during the workweek at lunchtime (13:00-15:00) in favourable weather (from April 21, 2016, to May 19, 2016). Survey questions cover that:

1. Did you walk here from work on your lunch break?
2. Where do you work?
3. What do you like most about this space?
4. Is your main reason for sitting here because it is easy to get to or because of the (component of nature in space)?
5. If a space with less nature existed closer to your work, would you go there instead?

Google Maps was used to schedule the distance travelled to reach these areas. Distances are computed using the premise that a person walks one mile in 20 minutes. (The collected data were analysed in Excel and tested in the JMP Pro 12 program).

Results

Kruskal Wallis test was used for open field analysis and Wilcoxon test was used for users. The results of these tests, when viewed from a general perspective, show that people walk relatively short distances to reach a place, which emphasizes the importance of comfort. Secondly, when we look at these distributions on a land basis, we see that people walk from distant places to biophilic areas and tend to walk less to non-biophilic areas. Although proximity is an advantage for non-biophilic areas, biophilic but distant areas have the power to attract people. Thirdly, biophilic areas have the power to attract people. The presence of many offices and business centres around it has increased the comfort of use of these areas. In other words, comfort has somewhat overshadowed the greater scope of biophilic elements. Bowling Green has fewer biophilic elements than Elevated Acre. The maximum transportation distance for Elevated Acre is 1.3 miles, for Bowling Green it is 0.62 miles, Pearl Street and Coenties Alley is 0.6 miles and Broad Street is 0.52 miles. These regional groups did not differ significantly. However, it is still larger than the non-biophilic zone group .By representing the data, it has become a convenient method to see how much attraction the areas have with the starting point of the visitors and the route they create.

In addition to distance measurements, participant responses have been an important resource. 76% of the participants of biophilic spaces mentioned at least one biophilic element of the place that they liked. Some of them are as follows:

“Nature in the city” “Oasis” “Silent” “Zen” “Quick relief” “5 minutes extra walk was worth it.”

In the survey conducted in the biophilic area, 38 participants stated that the main reason for being in the biophilic area was nature, 16 of them stated that transportation was easy, and 46 of them stated that they were both.20% of visitors to biophilic areas walked more than a quarter mile, or 5 minutes, on their way there. However, only 14% of visitors to non-Biophilic areas walked more than a quarter mile.Overall, 81% of participants prefer to go further for a more biophilic experience.

Conclusions

Conclusion here is that biophilic areas are more attractive than non-biophilic areas. Accessibility of biophilic areas has a significant impact on the prosperity of a city. It was concluded that green areas or public areas create different perceptions in people depending on their typology and quality. Thus, it gained priority in its preferences. Biophilic and non-biophilic networks in cities show us what a restorative experience this area has. This study provides encouraging information for city planners and policy makers to discover the restorative power of nature and to conduct studies on it.

Figure 34: Broad Street *(Gochman, 2016)*

Figure 35: Bowling Green *(Gochman, 2016)*

Figure 36: Pearl Street & Coenties Alley *(Gochman, 2016)*

Figure 37: Elevated Acre *(Gochman, 2016)*

Figure 38: Maps show the work locations of all participants and the most direct routes to the sites in which they were interviewed. Sites are represented by stars. Green represents biophilic sites and orange represents non-biophilic sites *(Gochman, 2016).*

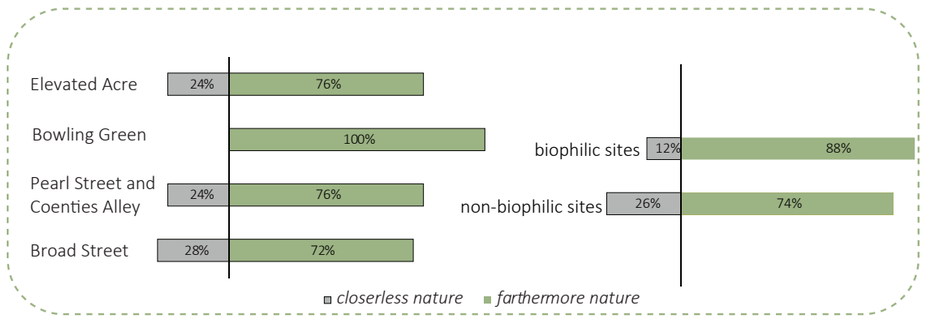

Figure 39: Maps show the work locations of all participants , the most direct routes to the sites and nature-distance balance by site *(Gochman, 2016).*

Figure 40: Map shows the reach of four sites (solid filled areas) in lower Manhattan. Radii indicate average distance walked to each site. Green represents biophilic sites: Elevated Acre and Bowling Green. Orange represents nonbiophilic sites: Pearl Street & Coenties Alley and Broad Street.*(Gochman, 2016).*

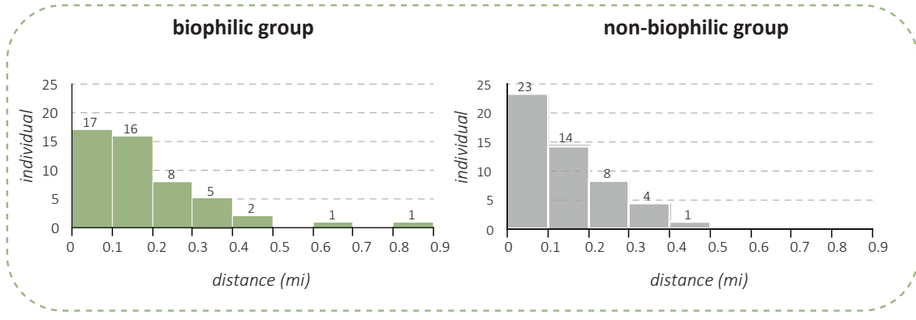

Figure 41: Histograms show the distributions of participants' walking distances across site groups (top) and across sites (bottom) *(Gochman, 2016).*

4.4.2 Biophilic streets: a design framework for creating multiple urban benefits

This arcticle was authored by Agata Cabanek, Maria Elena Zingoni de Baro, Peter Newman published on Sustain Earth (Cabanek, A., Zingoni de Baro, M.E. & Newman, P. , 2020).

This research paper presents how the concept of biophilic streets can serve as an entry point to biophilic urbanism by incorporating nature into innovative street designs, yielding a variety of economic, environmental, and social advantages. The paper introduces and assesses a theoretical biophilic streets design framework through the examination of four street revitalization initiatives from Vitoria-Gasteiz, Berkeley, Portland, and Melbourne. The framework shows that these case studies fulfill the primary design categories, which is promising as it suggests the potential for numerous additional benefits.

Streets have always been central to urban life since their inception, offering spaces for community engagement. The study aims to incorporate biophilic elements into the design of new streets and the refurbishment of existing ones to enhance the environmental benefits associated with streets. The paper addresses the need for a design framework that is informed by both theory and practice to facilitate more effective implementation of biophilic urbans(Cabanek, A., Zingoni de Baro, M.E. & Newman, P. , 2020).

The emerging concepts of biophilia, biophilic design, and biophilic urbanism focus primarily on human tendencies to connect with nature in urban environments like cities. Biophilic design seeks to reap the benefits of human-nature interaction within the contemporary built environment by integrating nature both internally and externally into buildings, infrastructure, and across urban spaces. It advocates for ecologically interconnected design solutions at various scales and facilitates the restoration of natural systems in urban settings (Söderlund, 2019).

Biophilic urbanism is presented as a novel planning and urban design strategy that aims to systematically incorporate nature into the urban fabric, sparking the potential to transform desolate urban spaces into areas that are restorative and life-enhancing. This is expected to result in more frequent interactions between people and nature, thereby strengthening their bond and increasing the likelihood that residents will preserve and protect urban green spaces. Some researchers argue that a connection to place is necessary to foster intimacy and responsibility towards nature and the living world

A brief history of streets

Urban designers, planners, and civil engineers have developed regulatory frameworks for streets to ensure efficiency, safety, and, most importantly, swift conveyance of both public and private traffic. However, the 20th-century modernist trend, which led to increased dependence on automobiles, resulted in rigid regulations focusing on efficiency and traffic control. This directly led to the separation of nature from urban ecologies, bioregions, and climate dynamics (Steiner et al., 2016).

The construction of dense networks of freeways and highways acted as barriers, causing the remaining urban natural areas to become fragmented and isolated. This also physically divided social neighborhoods, disrupting their social cohesion. Jane Jacobs reflected the characteristic features of the social fabric of the city in her design principles, as opposed to the design principles that prioritize the use of private vehicles in street design (Jacobs, 1961).

This has evolved into a strong advocacy for dense urbanism and street fabric as crucial elements of how cities generate wealth and opportunity. Urban designers like Jan Gehl criticized modernist planning ideologies for disregarding the value of historic streets by allowing cars to occupy every available space in cities. Gehl emphasizes that street-facing facades and city furniture have an important inviting power for people to use these streets. Thus, the walkability rate in the city increases (Gehl, 2010).

Gehl's 12 quality criteria (protection, comfort, delight, traffic planning, energy management, stromwater management, stromwater management, biodiversity, street furniture etc.) serve as a framework for this approach to street design, supplemented with a column showing how biophilic design interventions can enhance the pedestrian landscape and experience. The focus of urban streets is shifting from ensuring traffic movement efficiency to a more people-centered design that prioritizes pedestrians, followed by cyclists and transit, and finally, private motorized vehicles.

This approach better balances the needs of street users (with more emphasis on pedestrians) and supports the creation of quality spaces based on people and place considerations. It encourages the development of urban streets with appealing, healthful, livable, restorative settings and natural experiences at the doorstep for both residents and other street users inside increasingly densifying urban precincts via urban infill (Gehl, 2010).

Given that people spend eight to ten times more on streets compared to parks, the design of streets to support health and well-being should be considered. The six categories (traffic planning, energy management, stormwater management, biodiversity management, street furniture, activities and education) are derived from the intended purposes for which streets are designed and selection of biophilic elements (Gehl, 2010). Restoration works carried out on main streets generally gain a public space identity in order to increase social interaction in city life and increase walkability. Linear parks make these streets attractive for people. Natural elements (trees, grass, etc.) are among the design decisions that will affect traffic flow because they psychologically affect drivers, making them feel like they are going slower. The harmful effect of traffic is reduced. (Cabanek et al., 2020).

Analysis of Selected Streets

The Biophilic Streets Framework includes

- A former urban highway in Vitoria-Gasteiz, Spain;
- The street renewal project in Downtown Berkeley
- SW Montgomery Green Street in Portland, United States;
- The Green Your Lane project in Melbourne, Australia.

These represent various types of biophilic streets based on their hierarchy and functions.

Gasteiz Hiribidea in Vitoria-Gasteiz, Spain

Vitoria-Gasteiz, the capital of the Basque Country, has long been dedicated to sustainable urban development principles. In 2013, Vitoria-Gasteiz became part of a group of biophilic cities, showcasing successful projects and interventions that fulfilled the biophilic urbanism agenda (Beatley, 2010).

This area, which used to be a major eight-lane highway, has been completely revitalized and has become an exemplary model for other cities. While the stream used to flow under the streets, it now flows along the pavement and has been transformed with two bicycle paths, wide sidewalks, and a grass-covered tram line with these naturalized design principles. Combined with the vast greenery of the Palace of Europe, this stream creates a biodiversity hotspot in the city center and is home to over 70 species of butterflies(Beatley, 2016). Green areas in cities are not only parks and gardens, they also create a new green network within the city by greening the main roads and boulevards in the city (Cabanek, A., Zingoni de Baro, M.E. & Newman, P., 2020).

Figure 42: The transformation of a street in Vitoria-Gasteiz (https://www.reddit.com/r/fuckcars/comments/v59y2l/the_transformation_of_a_street_in_vitoriagasteiz/?rdt=51950).

Figure 43: Downtown Berkeley, United States *(Google Earth Photography)*

Downtown Berkeley, United States

The objective of the street renewal project in Downtown Berkeley was to retain the standard functions of a street while adding ecological features in a unique way within a limited budget. In 2012, the City of Berkeley launched The Street & Open Space Improvement Plan (SOSIP) to present a shared vision for the future of Downtown Berkeley's public realm (City of Berkeley. Downtown Streets & Open Space Improvement Plan, 2012).

Several sustainability goals were established, featuring biophilic attributes and experiences. The primary goals of the major initiatives were walkability, placemaking, public life, sustainability, health, and comfort. (Kellert, 2008). The input gained during community discussions helped shape the project's focus: public life and the provision of space for a wide range of social, cultural, commercial events that engage all residents and visitors. To meet walkable city standards, the city council considered improvements supporting car-free living. One answer was to create more accessible transportation alternatives. To make streets more attractive, traffic lane widths were reduced, sidewalks were widened, and bicycle lanes were introduced. The biophilic feature was designed to create more area for planting buffers between pedestrians and vehicles. To treat rainfall run-off, some streets employed bio-retention swales and rain gardens with riparian landscaping, which improved watershed conditions. Living walls and roofs installed on buildings bordering the streets provided green infrastructure services and served as aesthetic features, enhancing the Downtown's image as an eco-destination(Cabanek et al., 2020).

Figure 44: Montgomery Street in Portland *(NNA Landscape Architecture)*

SW Montgomery Street in Portland, United States

The aim of this project build community culture, improve the pedestrian experience, and showcase sustainability efforts in the city's downtown area. Street design goals included creating a pedestrian-centered streetscape that included a variety of green infrastructure solutions such as rainwater planters and wetlands. On university campuses, students are encouraged to participate in monitoring the performance of green infrastructure. Public education about the corridor through informational signage was incorporated into the design to encourage local citizen participation. The project also included the installation of green walls and roofs on the new development building. Rainwater from the new building's façade was channeled into rainwater planters, demonstrating an innovative stormwater management option(Cabanek, A., Zingoni de Baro, M.E. & Newman, P. , 2020).

Figure 45: Guildford Lane after greening, *(Photo by David Hanna Photography for the City of Melbourne, December 2022)*

Green Lanes in Melbourne, Australia

In this project, vertical gardens, agricultural areas, forests, and parks for public use were used for greening. In addition, using boxes for flower pots on the facades of rain gardens in the physical environment has been one of the interventons that will support the green area. Challenging biophilic design elements, such as the water element in the area, were not taken into account. The vision for revitalizing the lanes was to convert them from waste areas into usable public spaces. The rejuvenated lanes provide pleasant walkways and encourage people to spend time outdoors and participate in social activities. Several economic benefits are anticipated from activating the lanes: increased property values, increased usable green outdoor spaces, extended lifespan of permeable surfaces, and savings on heating and cooling (Cabanek et al., 2020).

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	Gasteiz Hiribidea, Vitoria-Gasteiz, Spain	*Downtown in Berkeley, California, USA*	*SW Montgomery Street, Portland, Oregon, USA*	*Green Lanes, Melbourne, Victoria,Australia*
Traffic planning	• prioritizing pedestrians and cyclists; • enhancing facilities for transit; • slowing traffic	• prioritizing pedestrians and cyclists; • enhancing walkability standards; • reducing existing traffic lanes; • lowered traffic speed.	• prioritizing pedestrians and cyclist (kerb-less paving); • narrowing existing traffic lanes; • lowered traffic speed; • sections of the street closed to traffic.	• limited traffic (local only) • shared space between pedestrian and vehicles.
Energy management	• energy reduction due to ecological runoff treatment; • insulation capabilities of gree walls and roofs systems; • heat island effect mitigation by tree canopies, landscaping and waterbodies.	• energy reduction due to • ecological runoff treatment; • insulation capabilities of green walls and roofs systems; • heat island effect mitigation by tree canopies, landscaping and waterbodies.	• energy reduction dueto ecological runofftreatment; • insulation capabilities of green walls and roofs systems; • air temperature regulation through landscaping.	• energy reduction through ‘green insulation’; • heat island effect mitigation-through landscaping and miniature raingardens
Biodiversity management	• retention in underground cisterns; • Infiltration via permeable surfaces • purification using bio-filters (plants); recycling via green wall and roof systems; • bio-filtration through daylighted stream.	• retention in underground cisterns; • Infiltration via permeable surfaces; • retention and bio-filtration through swales, raingardens; • purification using bio-filters (plants); • recycling via green wall and roof systems; • bio-filtration through daylighted-stream.	• retention in underground cisterns; • Infiltration via permeable surfaces • purification using bio-filters (plants); recycling via green wall and roof systems; • bio-filtration through daylighted stream.	• Infiltration via permeable surfaces; • retention and bio-filtration through raingardens; • recycling via green wall systems.
Biodiversity management	• green walls, roof and livingstream designed for biodiversityenhancement and ecologicalrestoration; • daylighted and restored stream with riparian plants provide habitats for wildlife and facilitate species migration.	• green walls designed for biodiversity enhancement and ecological restoration; • daylighted and restored stream with riparian plants providehabitats for wildlife and facilitate species migration.	• green walls, roof and livingstream designed for biodiversityenhancement and ecologicalrestoration; • daylighted and restored stream with riparian plants provide habitats for wildlife and facilitate species migration.	• green walls, planters, miniature raingardens designed for biodiversity enhancement and ecological restoration; • habitats for wildlife and facilitat species migration.
Street furniture	• integrated street furniture; treepits and sittings expressing ecological sensitivity;	• parklets in parking spaces; • natural buffer between sidewalks and traffic; • public art supporting environmental awareness; • permeable paving facilitatins rainwater infiltration.	• integrated street furniture; treepits and sittings expressing ecological sensitivity;	• planter-boxes with irrigation systems; • green wall system hanging baskets and miniature raingardens; • permeable paving facilitating rainwater infiltration.
Activity and education	• activity features for kids:sculptures, water features; • informative design of green walls and roofs; • interpretive plates and signs exposed ecological systems.	• interactive play equipment; • interpretive plates and signs; • exposed ecological systems; • parklets and temporary installations.	• activity features for kids:sculptures, water features; • informative design of green walls and roofs; • interpretive plates and signs exposed ecological systems.	• green infrastructure serves educational and research purposes.

Figure 46: Six quality criteria of Gehl *(Gehl, 2010).*

Conclusions

In this research, it was aimed to improve the use of biophilic elements in the streets and to cause positive effects on these streets. Integrating trees, parks, linear gardens, rain gardens and city monillaries increases the usability of these landscapes and provides extra functionality. These streets, located in four different locations, climates and urban features in the analysis study, showed that biophilic elements can be included in the streets and create significant results.

This is expected to provide a broader perspective on the importance of roadways in cities. Biophilic urbanism is emerging as a key policy issue for providing actual advantages to cities and their residents. This study proposes that changing urban streets into biophilic streets might bring a new dimension to biophilic urbanism. The notion of a biophilic street incorporates the concepts of Jane Jacobs and Jan Gehl, who have proved that people-oriented streets improve a community's economic and social well-being by incorporating environmental techniques into the functional design of streets.

CHAPTER 5

Project Proposal
Torino, Centro

5.1 Analysis

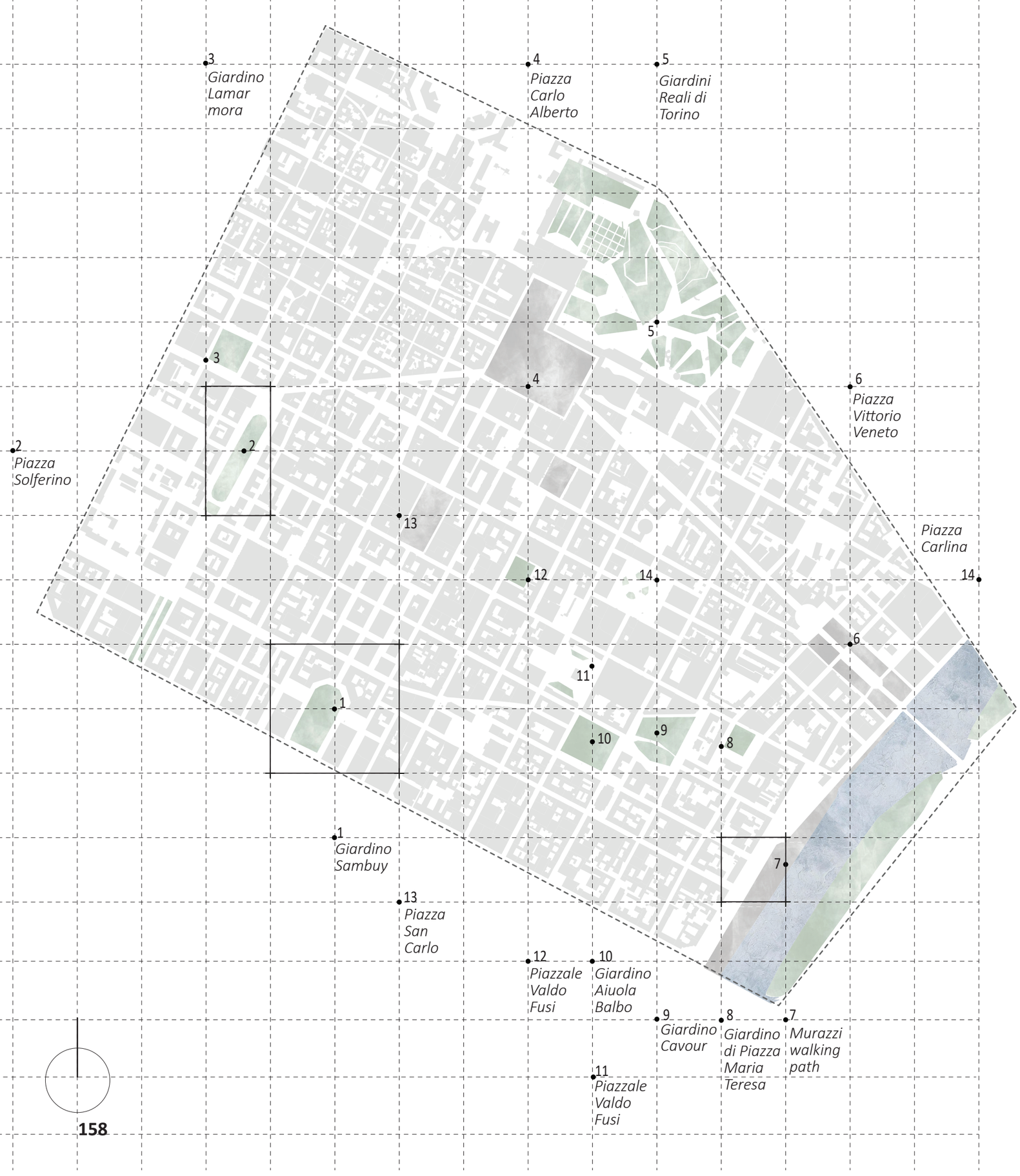
The analyses were first carried out in order to get to know Turin's central area in a large scale. In these analyses, the existing public spaces were identified by using tool of open street map. These public spaces were divided into hard ground and soft ground. Squares are mostly made up of hard surfaces *(pg.: 158-159)*. Office and shop locations in these areas were marked, in order to analyse areas the employees gathered the most *(pg.: 160-161)*. The reason for choosing office and shop buildings is that these people use them every day and need to go out for lunch. Accordingly, three different areas were selected. The three areas have different characteristics, for example Giardino Sambuy is in the heart of the city close to many public transport services but smaller than Piazza Solferino, Piazza Solferino uses hard surfaces instead of green space, while Murazzi differs from both of these areas in that it has a water feature.

These areas were chosen because they have a high number of potential employees and the areas are at least 15 minutes away from each other. In order to understand the gravitational attraction of these three areas, a further analysis was carried out at 5 min and 15 min distances *(pg.: 162-165).*

The second part of the analysis was to examine this area on a smaller scale. Firstly, an attempt was made to identify the area. For this purpose, all three areas were visited at lunchtime (13.00-15.00). In this way, it was analysed whether these areas are preferred for lunch or not or which users usually prefer them. In this study, items such as accessibility around the area, availability (open day or night), the number of people eating lunch, the material used on the ground (asphalt green area ratio), benches, fountains, potable water fountains and the number of entrances were examined. The potential advantages and existing problems of these areas were identified by conducting a photography analysis obtained during the site survey *(pg.: 166-177)*.

As a result of all these analyses, different strategies have been developed that can be applied to all three areas. These strategies are based on the evidence-based studies presented since the beginning of this thesis. At this point, the theoretical knowledge is put into practice. Four different main strategies were identified.

The project proposal part, which is the implementation part of the strategies, aims to allow these three areas to evolve into a better state without losing their different identities. A breathing point in the centre of the city, away from too many stimuli, taking advantage of the different characteristics of nature, which will be especially good for the mental health of working people, mental recovery, lower stress levels and mood elevation.



Location | Turin Centre

Public Spaces

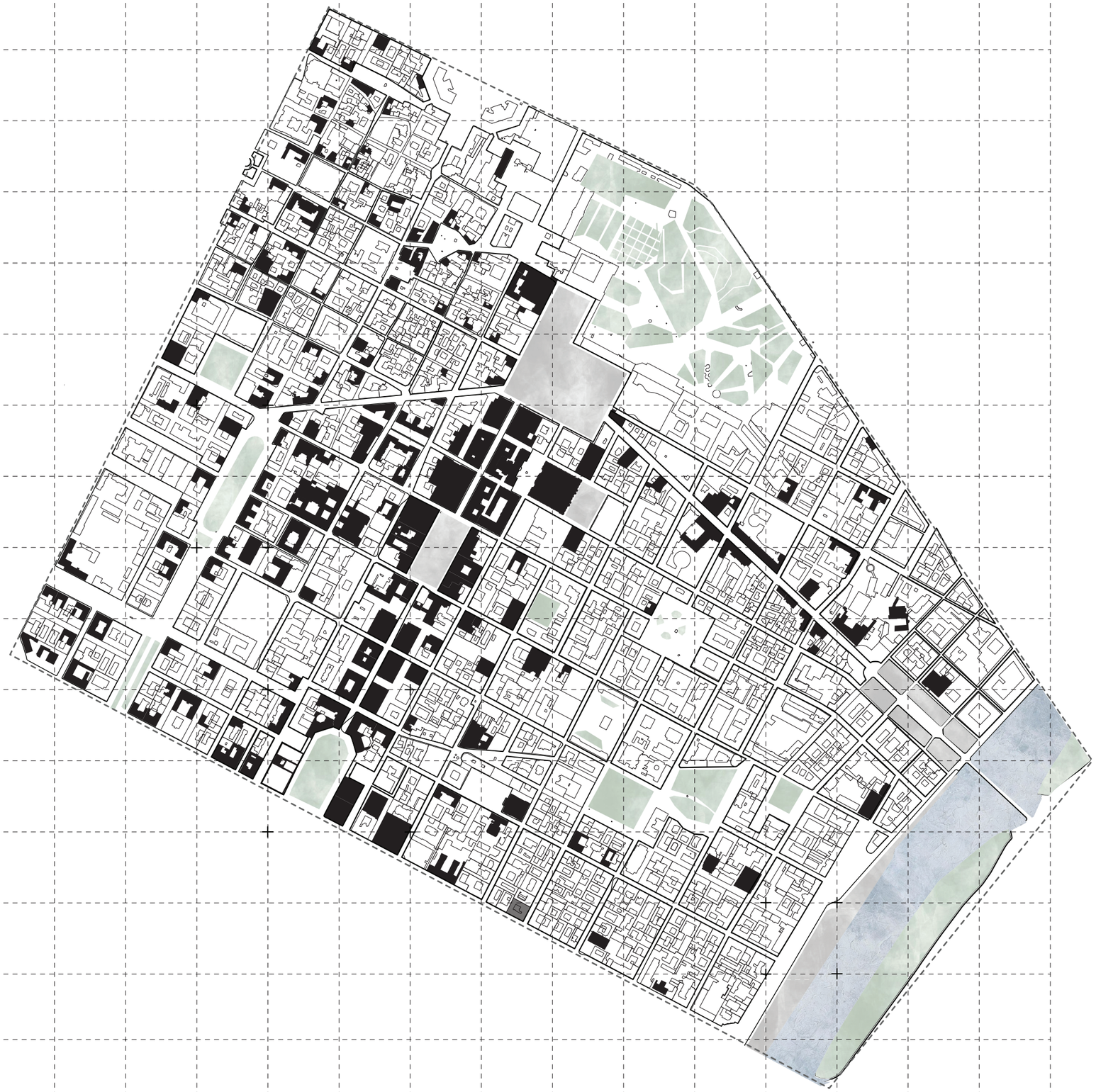
Piazza (Squares)

Selected Areas

Giardino Sambuy
Piazza Solferino
Murazzi Walking Path

These are three areas located in the center of Turin, with a minimum walking distance of 15 minutes between them. The reasons for choosing these areas are primarily due to their distinct characteristics. The first area,Giardino Sambuy, although quite accessible, is observed to be unused by the intended employees. The second area is Piazza Solferino, which has a high usage potential due to its proximity to many workplaces. The third area is Murazzi, located by the Po River, and is the closest area to the water element, one of the advantages of biophilic design. I have identified these three different areas as project areas because they have a lot of potential for workers and are very suitable for use during lunch breaks throughout the day.

soft ground *hard ground* *river*



Location | Turin Centre

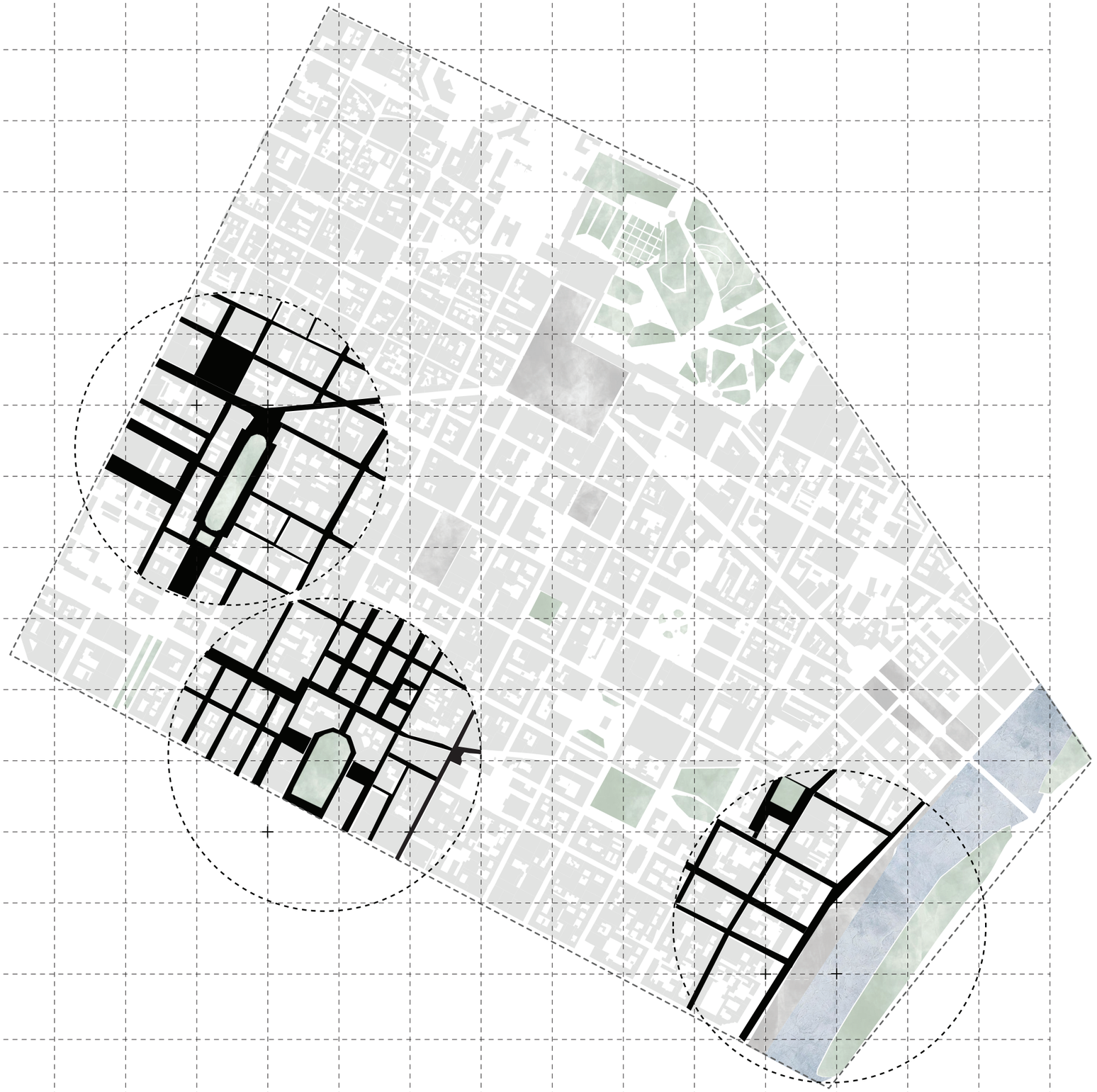
Offices&Shops
Employees

Selected Areas
Giardino Sambuy
Piazza Solferino
Murazzi Walking Path

Generally, the employees who go out for lunch are those who work in the office and those who work in the shop. That's why, by marking the places where office buildings and shops are located, I tried to show where working people are generally concentrated and the usability of the surrounding area.
(In this research, openstreet map application was used to access the data)

Offices & Shops

soft ground *hard ground* *river*



Location | Turin Centre

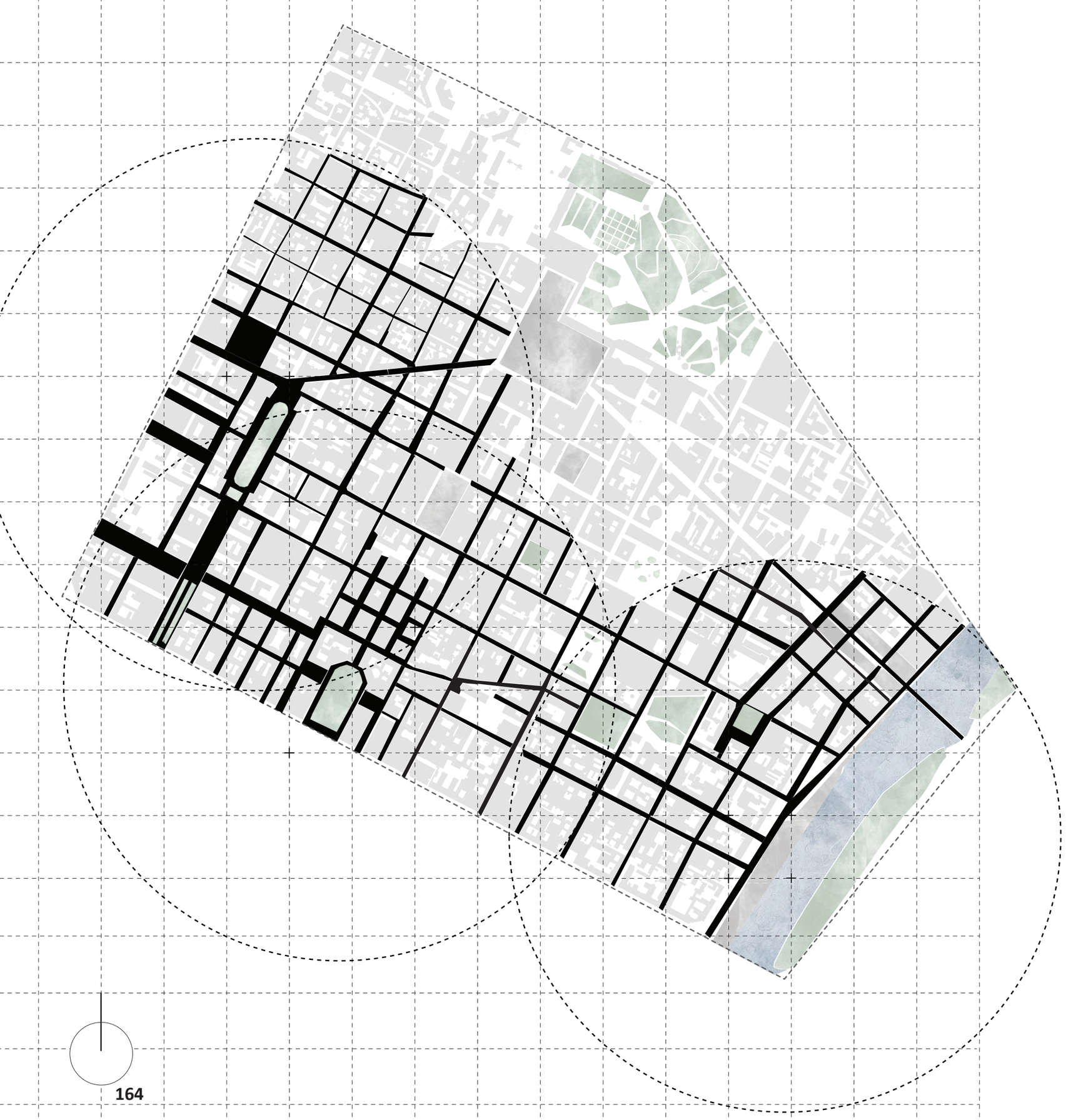
Distances
walkable places

Selected Areas
Giardino Sambuy
Piazza Solferino
Murazzi Walking Path

By marking the streets within a 5-minute walk, wanted to convey to people the charm of these three areas.
Considering previous case studies, areas within walking distance of most people have proven to be an attractive factor.
This made it possible to understand the potential gravity of these regions.
(The choice of this analysis is based on the case study "Seeking Parks, Plazas, And Spaces"mentioned in the previous chapter)

5 min walking
Avarage speed : 1.38 meter/second
Adult persons

soft ground *hard ground* *river*



Location | Turin Centre

Distances
walkable places

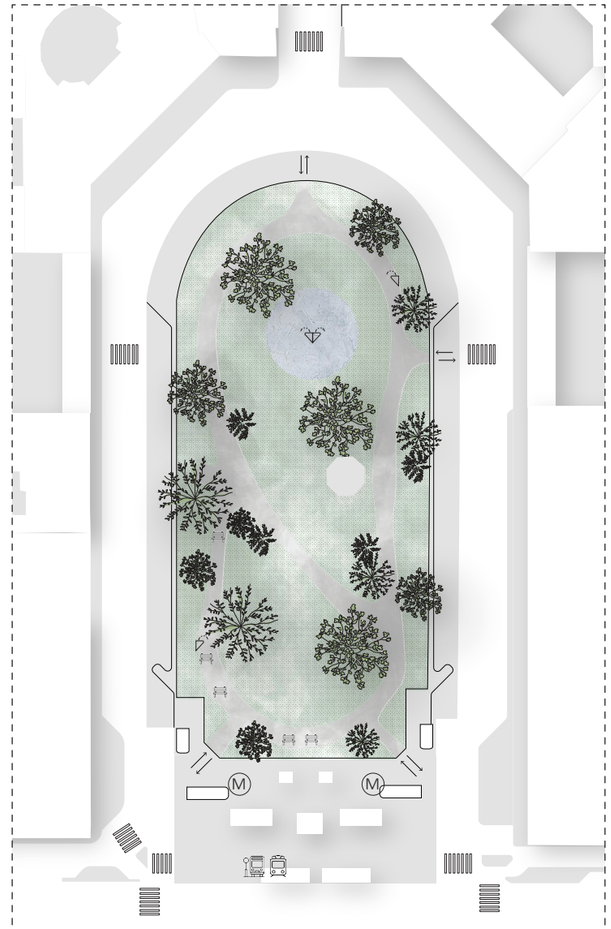
Selected Areas
Giardino Sambuy
Piazza Solferino
Murazzi Walking Path

By marking the streets within a 10-minute walk, wanted to convey to people the charm of these three areas.
Considering previous case studies, areas within walking distance of most people have proven to be an attractive factor.
This made it possible to understand the potential gravity of these regions.
(The choice of this analysis is based on the case study "Seeking Parks, Plazas, And Spaces"mentioned in the previous chapter)

10 min walking
Avarage speed : 1.38 meter/second
Adult persons

soft ground *hard ground* *river*

Giardino Sambuy



Transportation ..... Ⓜ

Availability ..... Day

Lunch ..... 2-3 people

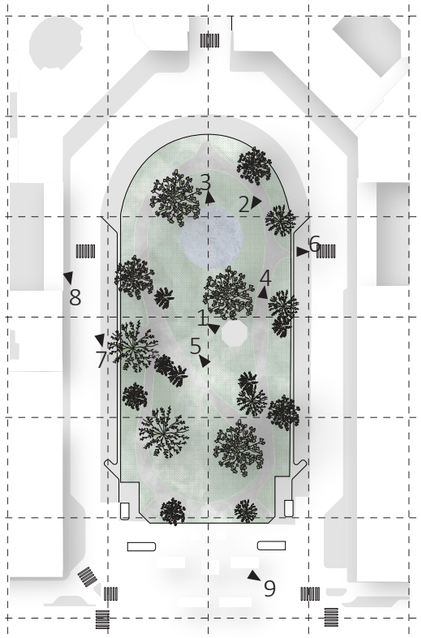
Grass-Asphalt .....

Bench x4

Potable Fountains x2

Fountains x1

Entrances x4



Existing problems

1.
Not using existing areas and leaving them vacant

2.
The fact that the users are mostly homeless makes this an unpreferred area

3.
The existing water feature is not well-maintained

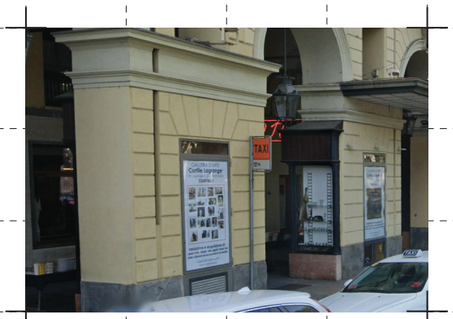
4.
Not having enough activity space

5.
Useless benches

6.
Since the park is surrounded by iron bars, an undesirable area is created

Potential Advantages

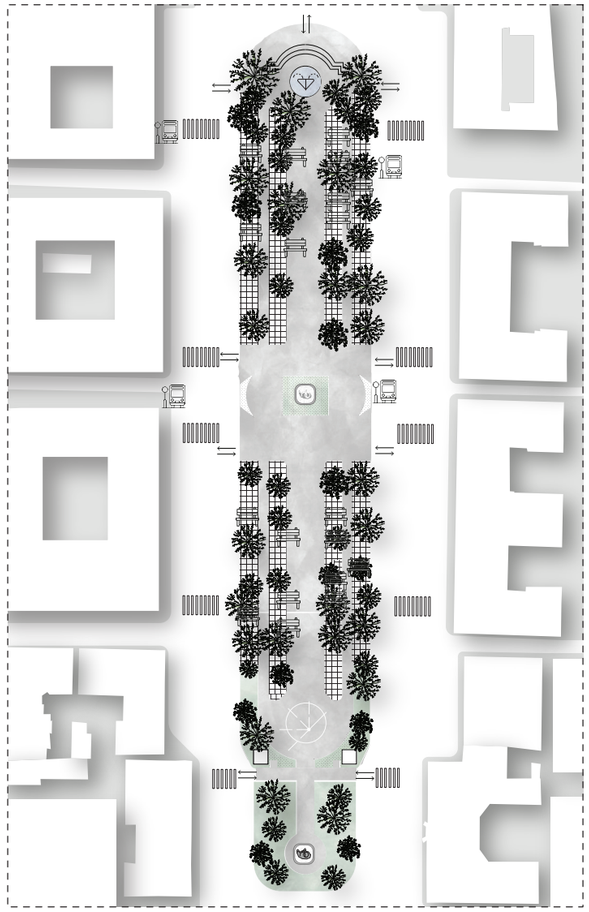
7.
A small breathing space in the middle of dense construction



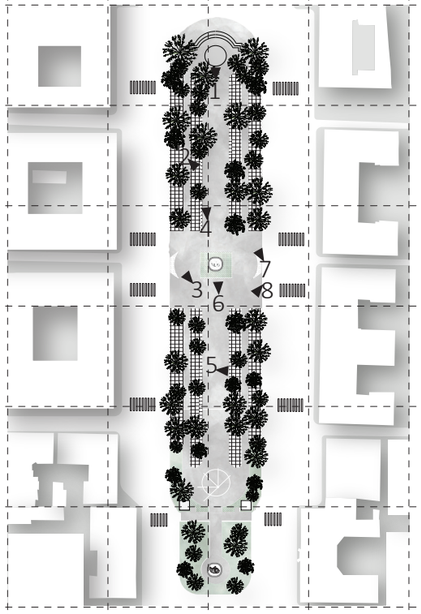
8.
The existence of an area around it that serves many employees

9.
Close to many public transportation

Piazza Solferino



Transportation	
Availability	7/24
Lunch	3-5 people
Grass-Asphalt	
Bench	x20
Potable Fountains	x0
Fountains	x1
Entrances	open access

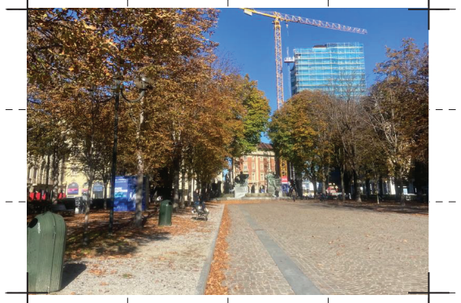


Existing problems

1.
Fountain is not well maintened

2.
Benches are not usefull for lunch

3.
Indirect relationship with greens



4.
Not having enough activity space

Potential Advantages

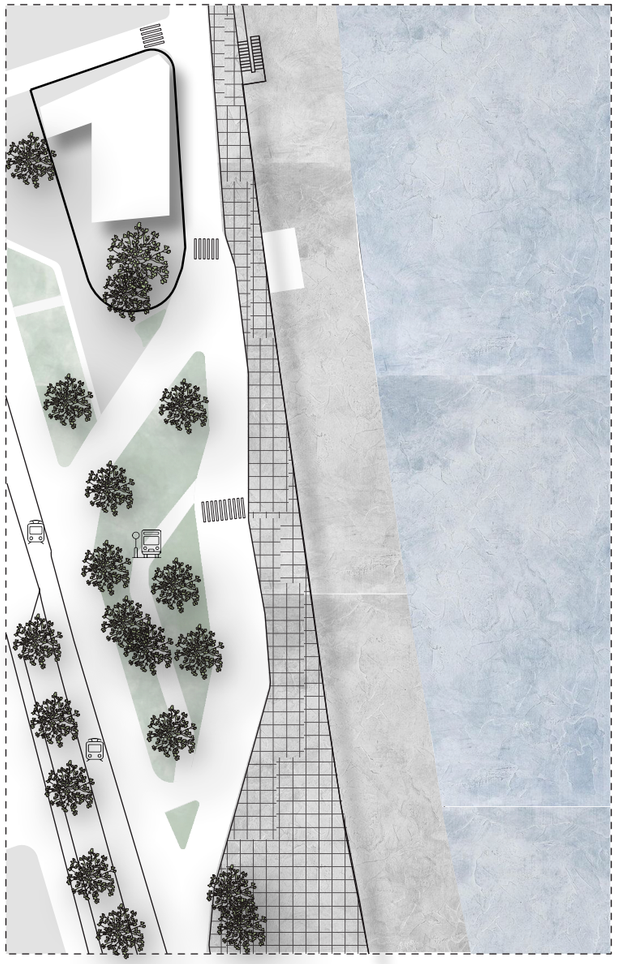
5.
The fact that the park is accessible throughout its length makes entry easier

6.
The existence of an area around it that serves many employees

7.
The length of the park allows the pedesrtians pass trough it

8.
The fact that the park is spread over a large area provides space for different activities to be carried out

Murazzi



Transportation .....

Availability 7/24

Lunch ..... 0 people

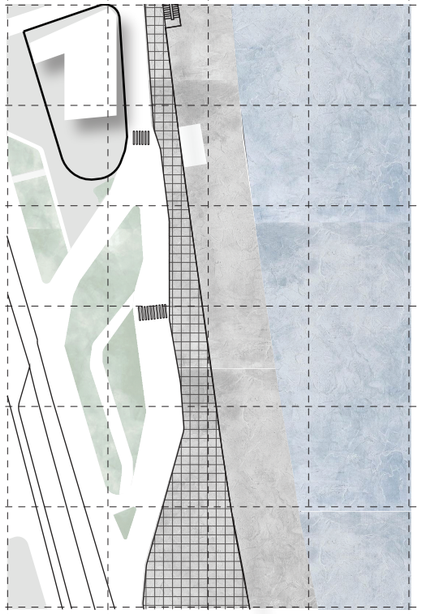
Grass-Asphalt .....

Bench x0

Potable Fountains x0

Fountains x0

Entrances ..... open access



Existing problems

1.
Hard Ground

2.
No benches for sitting

3.
No potable water

4.
Not having enough activities

Potential Advantages

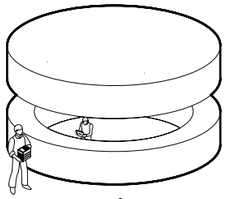
5.
Restrptaive effect of river view

6.
Easy access from road

7.
A wide pedestrian way

8.
Higher than flood level

5.2 Strategies

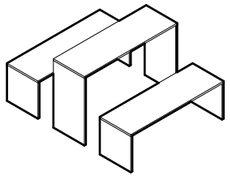


1

Maintenance

Using Existing Potential for Lunch & Cooking areas

Maintaining Fountains

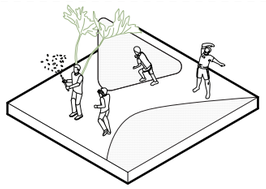


2

Urban Furniture

Lunch

Phsycial Activities

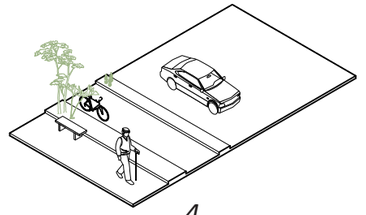


3

Make The Place Attractive

Creating meeting areas

open-air activities

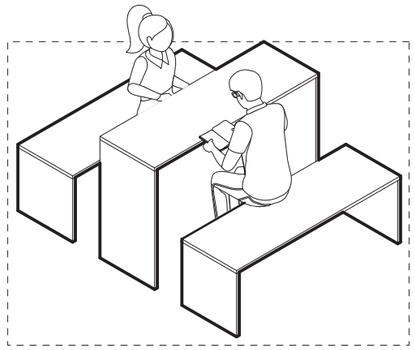


4

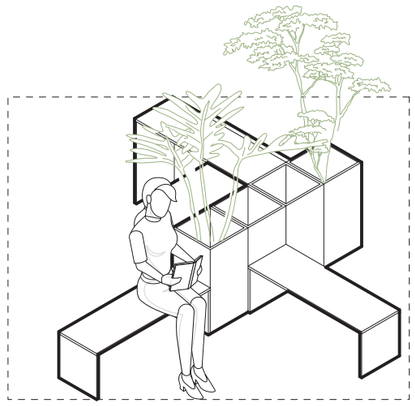
Delimitation

Pedestrian zone Planting

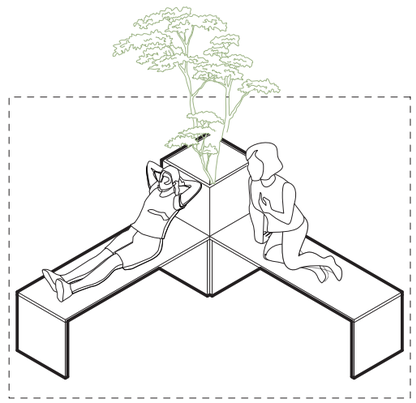
Bike Facility



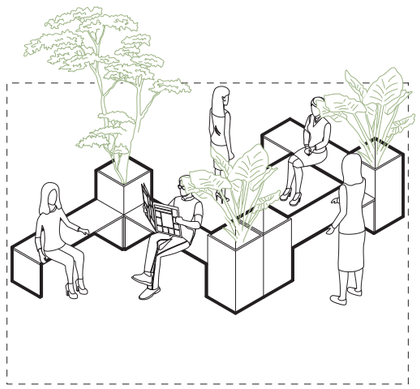
Lunch



Individual
For one



Close Friends



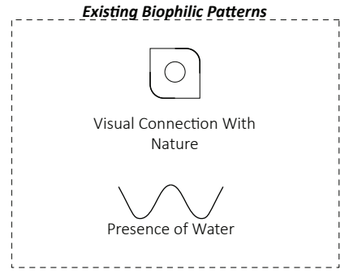
Networking

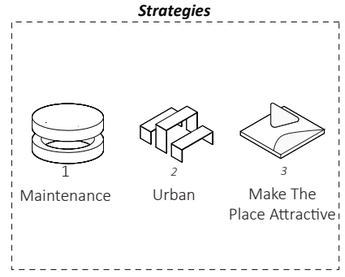
5.3 Proposals

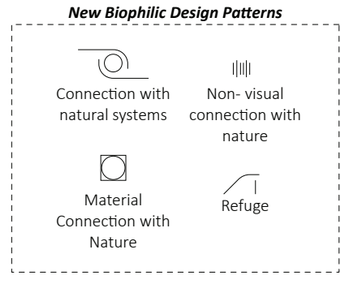
Project proposal-Giardino Sambuy

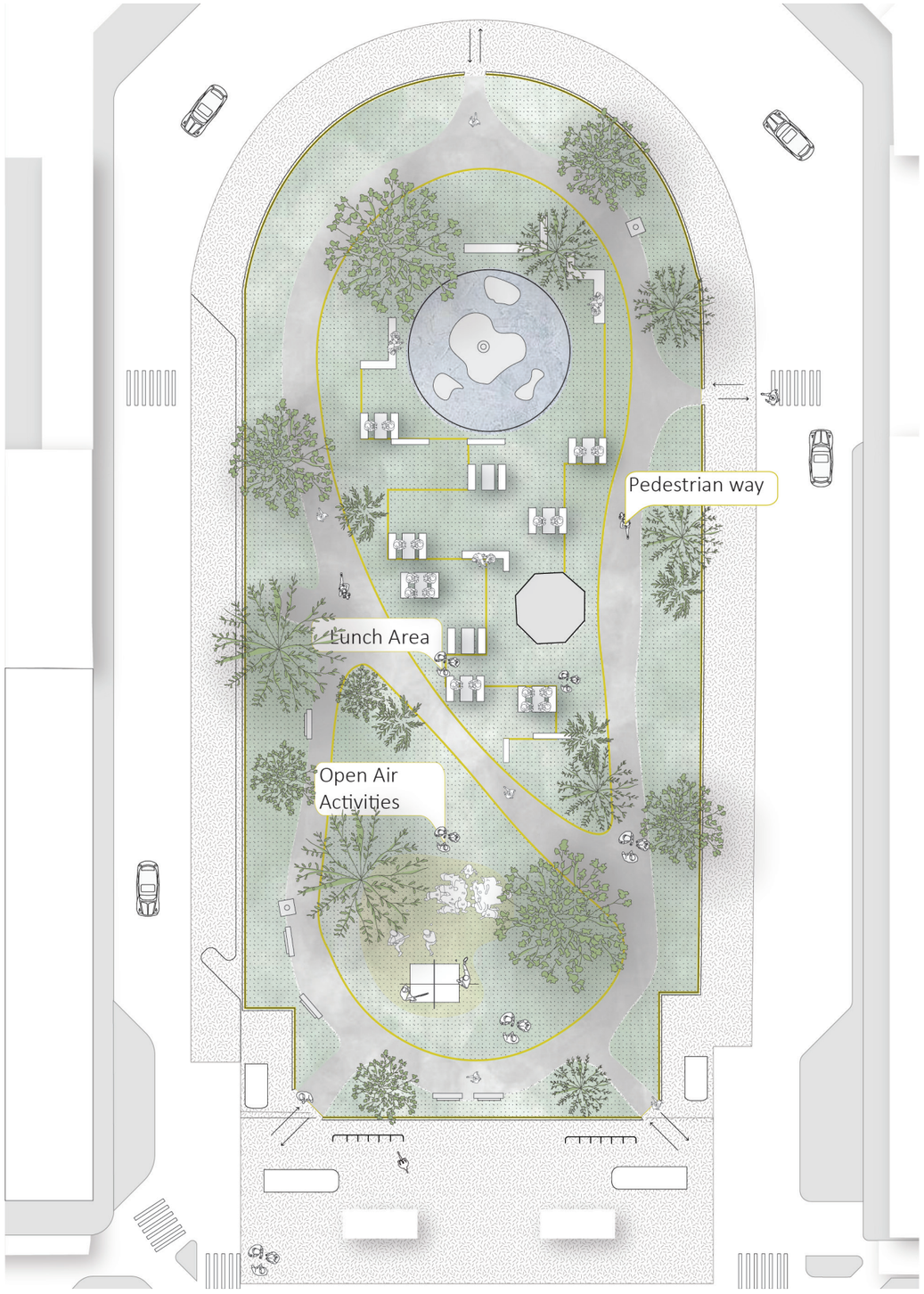
This is one of the busiest neighbourhoods in Turin's Centro district. This is mainly because it's so close to the Porta Nuova railway station. It is the first place where tourists are greeted. At the same time, there are a lot of heavily used shops, stores and some offices around it. At this busy point of the city, it has some biophilic features such as visual contact with nature and the presence of water.

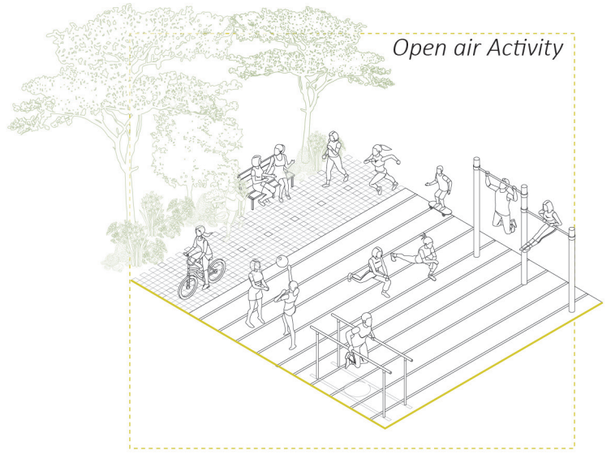
However, it is used by too many homeless people, which may cause people to perceive it as unsafe, causing it to be used below its potential. The aim of this proposal is to make it more attractive and make it a place where not only working people but also tourists can have lunch and spend time comfortably. Reducing the "physical barrier" with the outside (Connection with natural systems), activating the water fountain and spreading the sound of water throughout the area (Non- visual connection with nature, Presence of water), preserving the inadequate benches but adding new urban furniture useful for eating lunch (Material Connection with Nature, Refuge), and by placing a platform on the grass area with small interventions, a number of outdoor activities in this area add more biophilic features to this area and add many functions. In this way, it is aimed to use this area more efficiently.

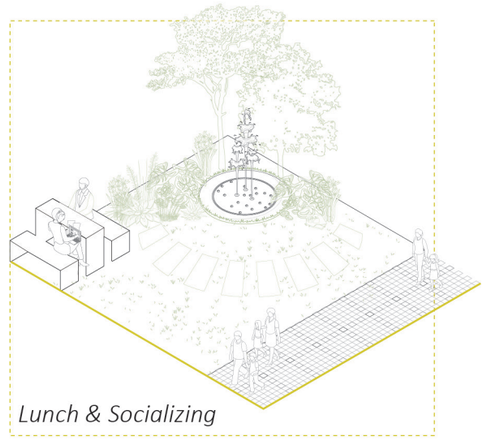


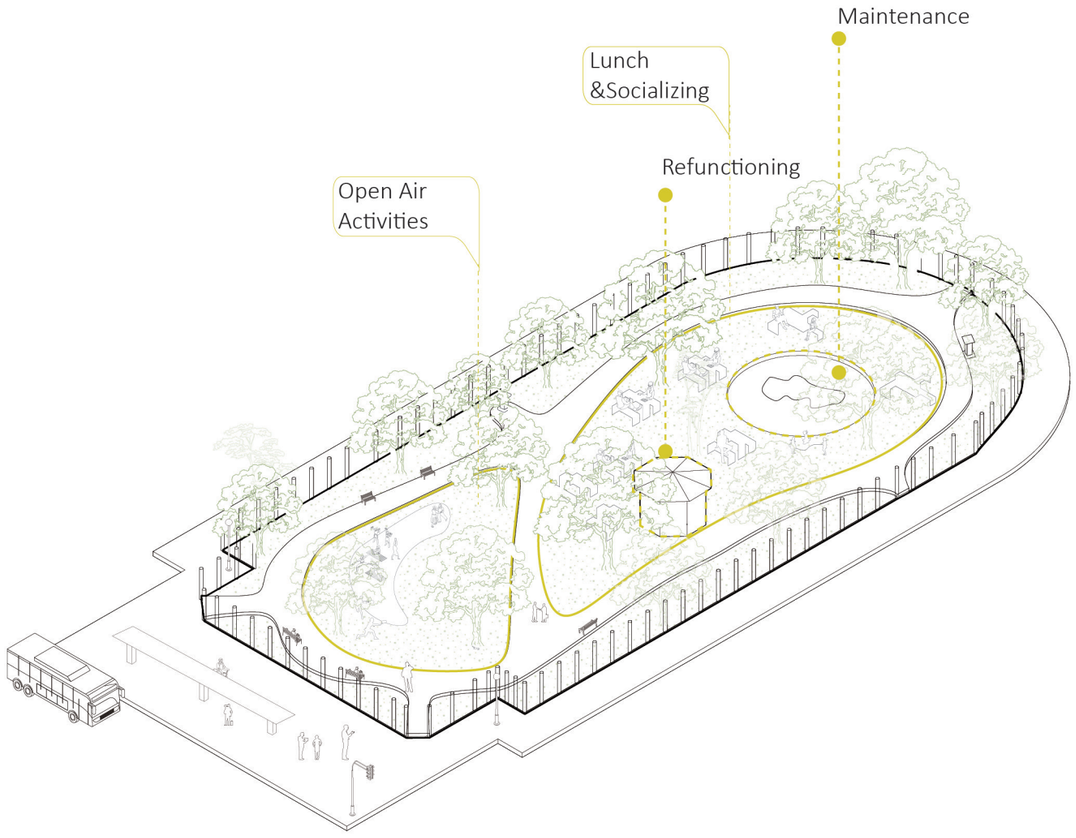





Pedestrian way
Lunch Area
Open Air
Activities


Open air Activity


Lunch & Socializing


Maintenance
Lunch
&Socializing
Refunctioning
Open Air
Activities

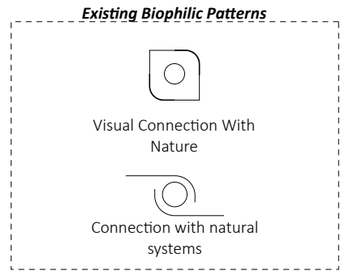
Project proposal-Piazza Solferino

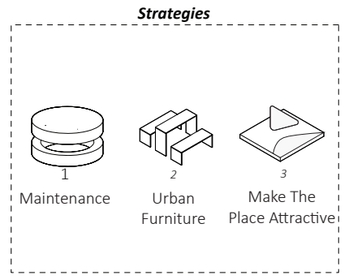
This area is located in the north of the centre in a quieter area with more housing and offices. The fact that the square is wide open and not enclosed by any iron railings increases the accessibility of this area. As a result of the field trips I made in the afternoon, it was analysed that this area is generally used as a gathering place by office workers at this time. The people using the benches are usually single people. Large groups prefer to stand. Because the benches are far away from each other and do not face each other, it is not possible for large groups to sit and socialise. The fact that it is a 250 m long square makes it preferable for walking. Trees provide shade to the area where the benches are located, but the cobblestone floors provide an indirect contact with the green in this area (visual connection with nature, connection with natural systems).

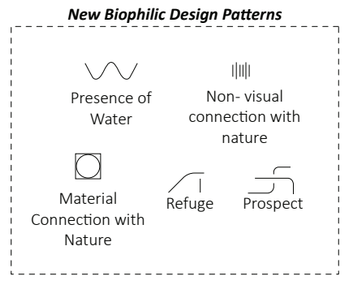
North of the garden, this area can be transformed into a restorative environment where the sound of water can be heard, while the ground to the south is conceived as a place that provides more active movement such as sports activities, outdoor activities (presence of water).

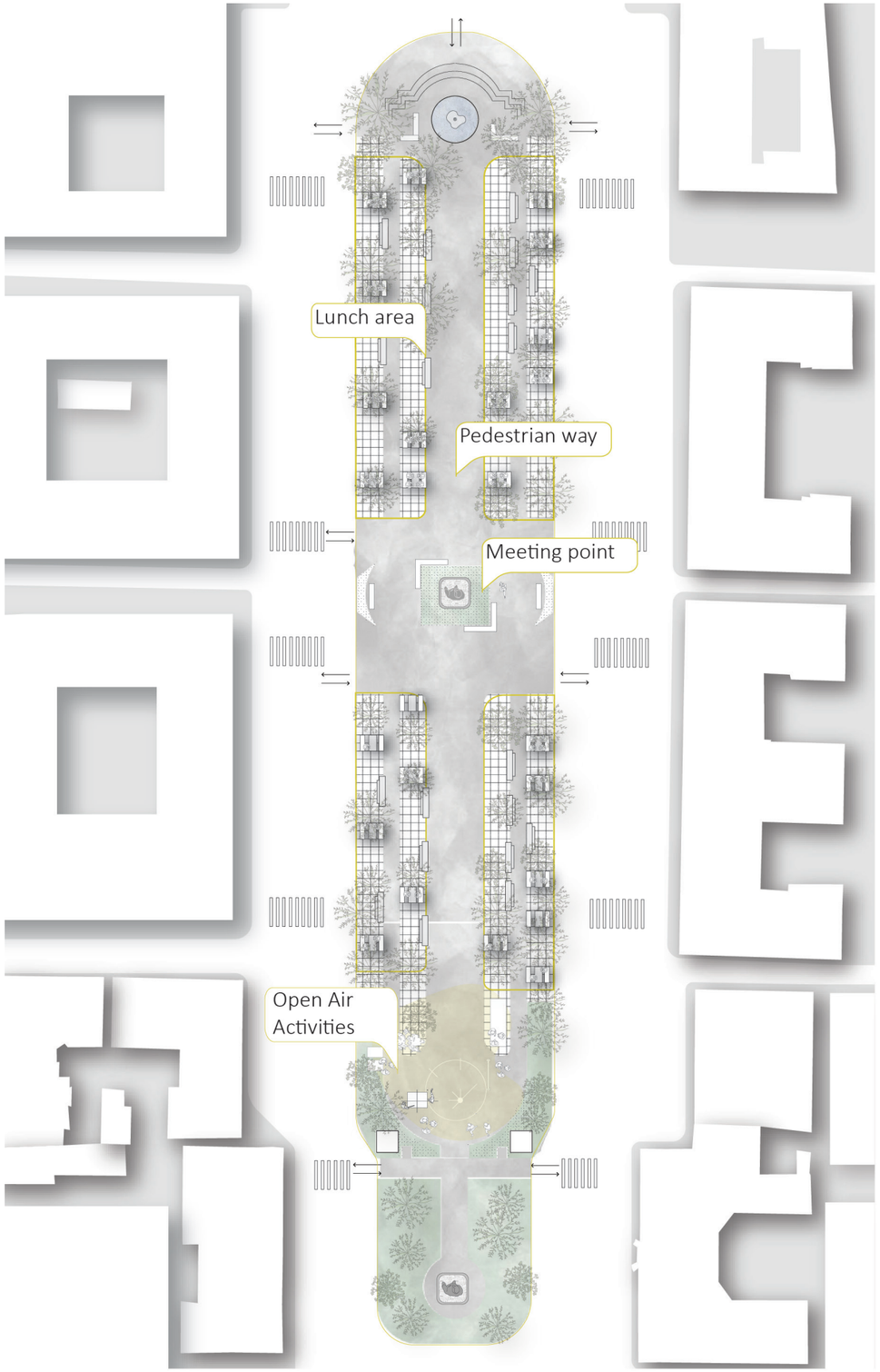
For the seating and the lunch area, under the trees to the left and right. It will support the bars already located between every 2-3 trees and at the same time it will enable larger groups to eat together (material Connection with nature, Refuge).

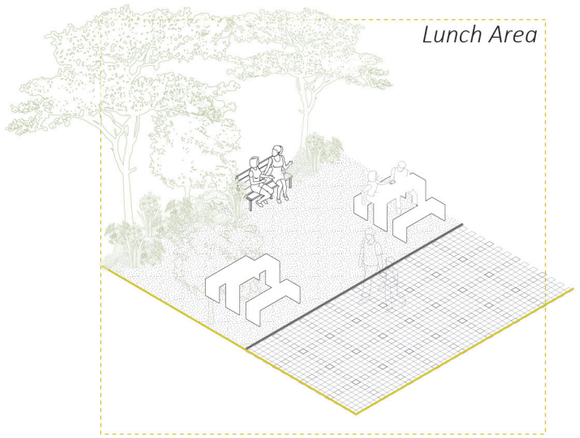
The fact that this area is a square, leaving the central area empty, is a respected feature of my project proposal. This area is intended for uninterrupted walks, cycling and also as a gathering space (prospect).

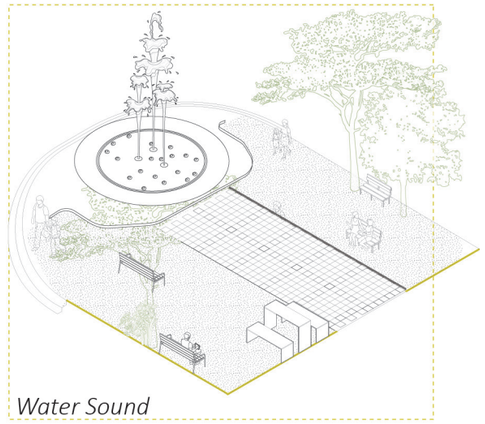


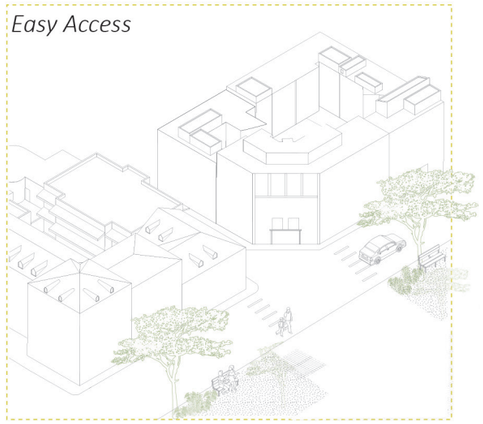


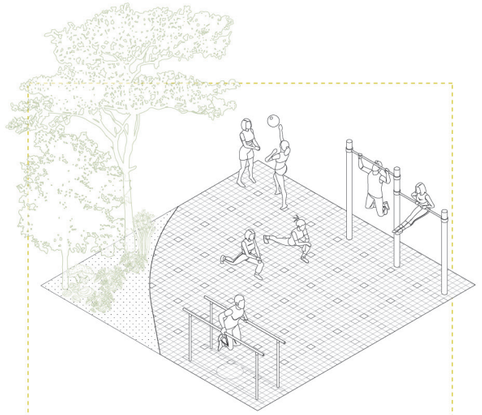


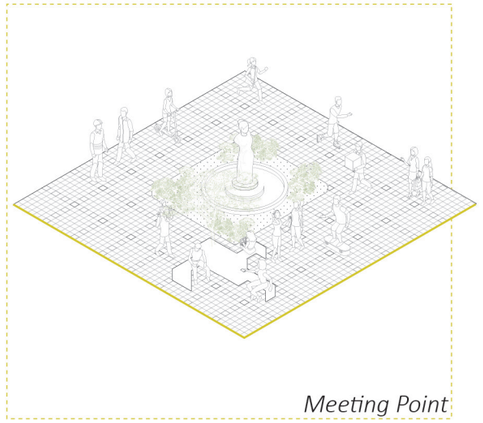

Lunch area
Pedestrian way
Meeting point
Open Air
Activities


Lunch Area


Water Sound


Easy Access


Open Air Activities


Meeting Point

Project proposal-Murazzi

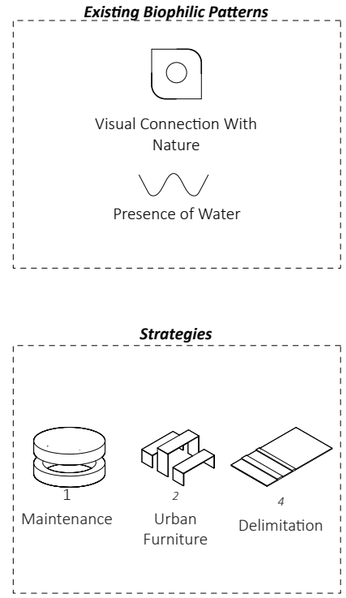
The name originates from the imposing embankments (walls) built in the 19th century to protect the city from river flooding. The upper level road leads down to the edge of the river. This area is nowadays used by the younger generation at night. The upper level walkway, on the other hand, is rarely used and has fallen below its potential. You can walk along it during the day. However, there is no area for sitting, eating and spending time. The view of the river has given this area a different motif (Visual Connection with Nature, Presence of Water).

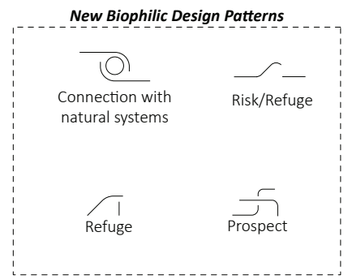
In order for this area to be used actively, it is intended to be transformed into a gathering area rather than a transit point, but at the same time to respond to opportunities such as walking and cycling. Areas where people can sit and spend time in the afternoon hours and at the same time stay in visual communication with the river have been determined.

While this area determines its own boundaries, the opposite of the bicycle path that continues from the side road but has been cut off and the area of the walking path have been demarcated with boundaries. In this way, people can visually identify what kind of activities they can do in which area. These transformations have been designed in such a way that it is possible to do this without changing the historical texture of this area (Prospect, Refuge).

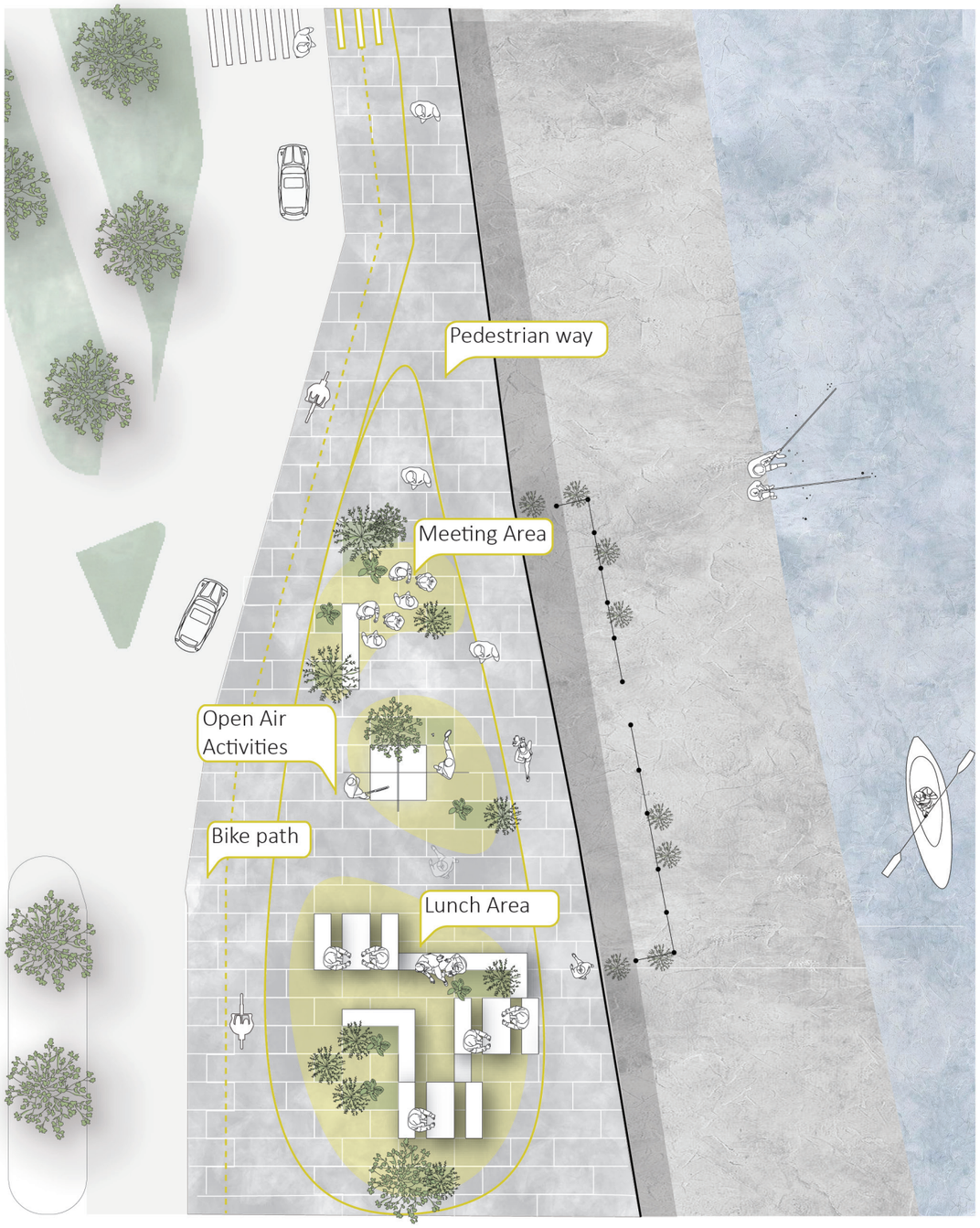
At the same time, the green area that continues across the road provides continuity thanks to the large planters to be placed here. Thus, green plants were added into the pots which designed for urban furniture, in this area to increase the diversity of the area (Connection with Natural Systems).

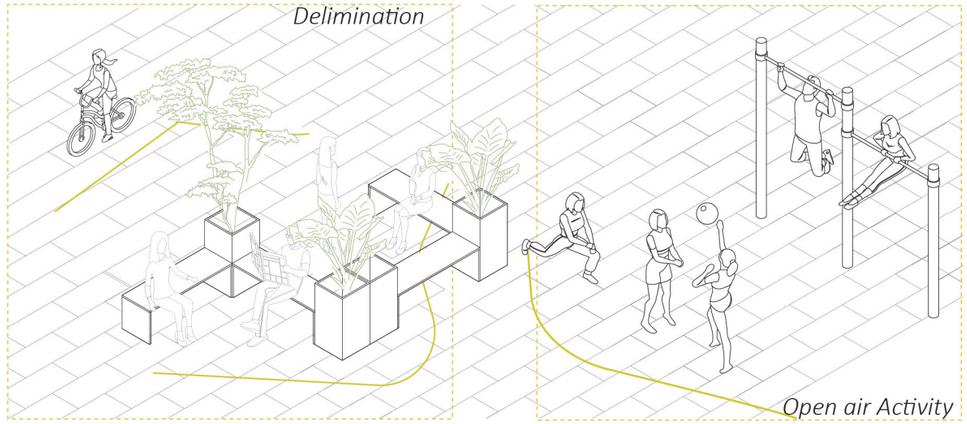
Activity areas have been added to increase the time spent in this area (risk/peril).

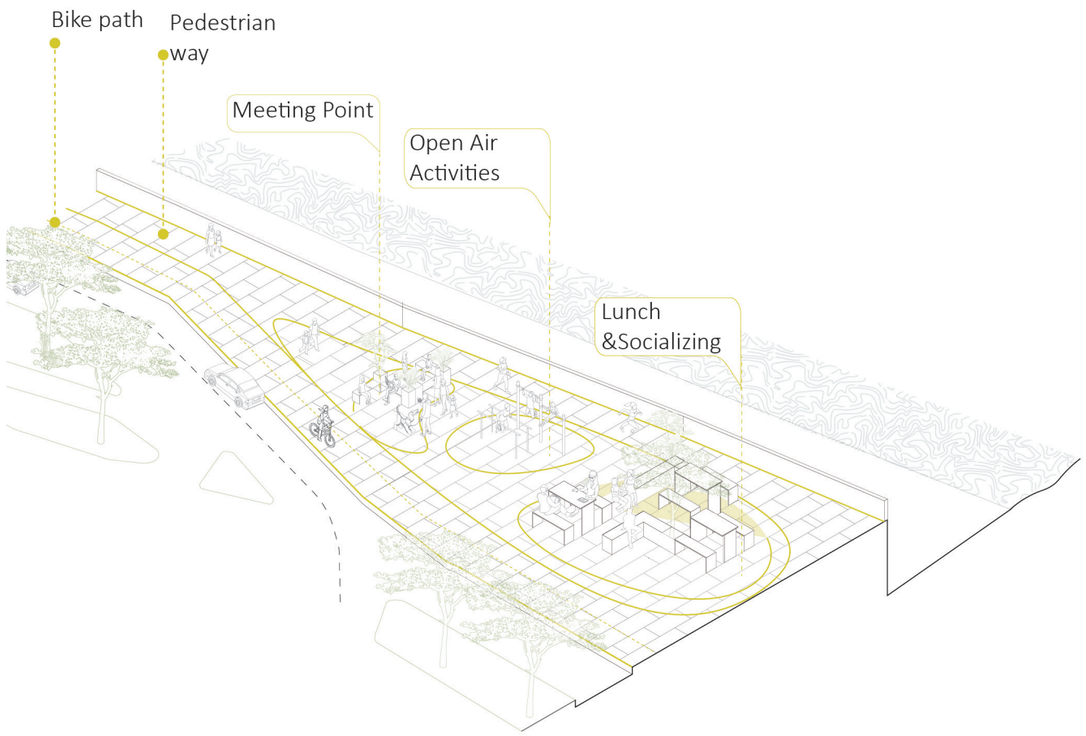




Project proposals-Murazzi







Conclusion

The thesis started with a problem:
“44% of employees worldwide reported feeling an abundance of stress the day before. This is the second year in a row that worker stress has hit new highs. Employee stress, on the other hand, has been on the rise for more than a decade. Many factors influence stress.” (Gallup, 2023).

This problem is a problem of today's modern world, which is changing very rapidly. The way people live has changed a lot from the past to the present. In order to analyze today's problem, it was necessary to understand the way communities lived in the past, how communities were formed, and what opportunities they had. With the change in the built environment and the beginning of urbanization, it may be concluded that there is a break with nature and that architecture is a wall between nature and man. However, architecture should create a bridge between nature and man. The desire to go to nature and return to nature, which comes from the evolutionary nature of man, has formed the foundations of biophilic design; as I mentioned in previous research, man needs nature. Therefore, when I studied biophilic design in-depth, I found evidence that the 14 patterns that make up these design principles actually have a great physiological and psychological effect on human psychology and perception. The common result of all the studies and researches analysed in the thesis is that breaks in open spaces are more effective in the human stress recovery process than in indoor environments. In fact, this situation shows us the importance of the indoor environment as well as the importance of the spatial quality of not only the working areas but also the areas where people spend time when they take a break. In this case, in today's metropolitan conditions, it is unthinkable that the capacity and quality of the work done by an employee after a lunch break in the city, among exhaust fumes or among the crowd, is the same as the quality of the work done after a walk in a green area. This situation should make us rethink the relationship between the environment and human psychology of the buildings we design in accordance with their life and functions.

All this information, theories, and evidence formed the strategies of the project proposal. I chose the city center of Turin for the project proposal because there is a higher concentration of office workers. Although there are parks and gardens where employees can spend time during their breaks, most parks, gardens, and other public spaces are used by tourists and homeless people. I wanted to think of the improvement of these areas as the points that attract people here. Since I assumed that working people would use this area, especially during lunchtime, I developed strategies for appropriate urban furniture, exposure to green space, open space activities that would make this area more attractive, and the development of existing potential. Thus, I applied and intervened in these three different areas according to their needs based on the evidenced results obtained from the previous studies on human psychology and the environment. Through these strategies, the main aim is to create points of attraction, which I aim to make people prefer these areas even if they are far away and to experience the feeling of improvement and change of mood that it creates in them by differentiating them from other parks and gardens.It is aimed to select the locations of the three areas at distant points from each other and as a result of the healing of these areas, these areas will turn into a centre of attraction. In this way, people can experience the relaxing and healing effect of these fields by coming from a greater distance. In other words, distance is actually not an obstacle to come to this area, but the healing effect of this area increases the gravitational force of this area. With small interventions, realistic solutions have been implemented to improve and transform these areas without much difficulty in the budget.

In order to ensure financial sustainability in the next step, it may be more useful to calculate the unit price of this modular seating system with m^2 calculation and thus to determine the revenue in advance for the next application.

While this is promising for the city center, it also raises some issues that need to be further improved and worked on. In future work, once this area has been improved, a survey could be carried out to find out the differences in the experience of visitors to these project areas compared to other areas (non-biophilic areas). In this way, the effects on stress restoration, which is the aim of this study, can be more deeply understood.

In order to better understand the restorative power of nature, this rehabilitation project could be replicated and analysed in more densely populated metropolises. In this way, the effect of restorative environments in relieving stress and mental fatigue, which more people need, can be read more clearly.

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