

Parameterized Comfort in Physical Spaces

Research Team

Szekeres Gréta

Sohith Vishnu Sai Yachamaneni

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Pécsi Tudományegyetem
Műszaki és Informatikai Kar
Belsőépítészeti, Alkalmazott és Kreatív Design Tanszék
Villamos Hálózatok Tanszék

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Készítette: Szekeres Gréta
Évfolyam: 2. évfolyam

Készítette: Sohith Vishnu Sai Yachamaneni
Évfolyam: 4. évfolyam

Belső konzulens: Prof. Dr. Borsos Ágnes DLA habil.
Beosztása: építész, egyetemi docens, tanszékvezető

Belső konzulens: Kisander Zsolt
Beosztása: tanársegéd, mb. tanszékvezető

Pécs

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ABSTRACT

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Keywords: interior design, simulation technology, well-being, ai

Within the framework of a design task, our objective was to create an ideal office environment that utilizes interior design tools to support and promote mental and physical health. This focus is particularly significant, as employees spend at least 40 hours per week at their workplace, and research indicates that approximately 85–90% of this time is spent indoors. The project aims to develop a model that optimizes spatial utilization within the interior of a specific office building by precisely determining the spatial requirements of necessary modules. Furthermore, the model seeks to identify functional needs and spatial relationships that can reduce employees' health risks and foster efficient and productive work through an office environment designed with these goals in mind. Additionally, the research program aims to identify and define interior design tools that positively influence employees' physical health, mental well-being, and workplace performance. We use Facebook's AI Habitat simulator/lab to create agents that navigate spaces with sensors to predict better office environments.

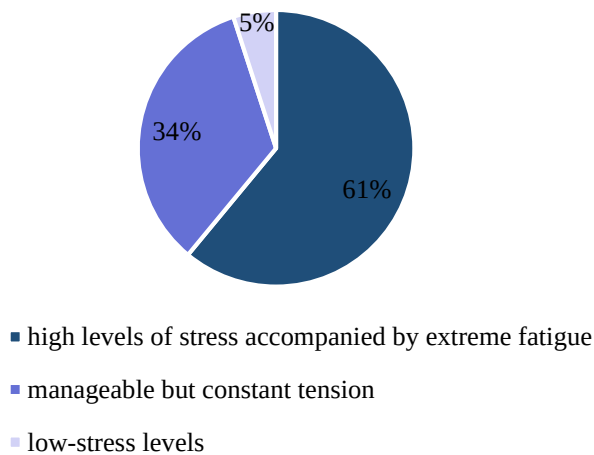
Table of Contents

1. Introduction.....	5
1.1. Background and Relevance of the Research.....	5
1.2. Objectives of the Research.....	6
2. Literature Review	7
2.1. The Relationship Between Physical Space and Psychological Well-Being	7
2.2. The Impact of the Workplace Environment on Health and Productivity.....	8
2.3. Optimizing Space Utilization in Office Design	8
3. Methodology	10
3.1. Research Framework	10
3.2. Spatial Analysis Methods	10
3.3. The Role of AI-Based Agents in Office Design Simulations	10
3.4. Tools and Technology	11
3.4.1. Facebook AI Habitat Simulator	11
3.4.2. AI Environment Engine	12
4. Development of the Office Model	16
4.1. Spatial Requirements of Office Modules.....	16
4.2. Zoning and the Psychological Impacts of Functions	18
4.3. Modular Space Utilization and Ergonomic Design	20
5. Validation and Practical Applications	22
5.1. Optimized Space Configurations	22
5.2. Current Issues in Environmental Design	22
6. Presentation of Measurement Results	24
6.1. Results and Analysis.....	24
7. Conclusion	26
7.1. Summary of Key Findings.....	26
7.2. Contribution to Interior Architecture and Workplace Health	27
8. Summary	29
Acknowledgements.....	30
References.....	31
List of figures.....	34

1. Introduction

1.1. Background and Relevance of the Research

Within the framework of a design project, our objective was to create an ideal office environment that promotes and supports mental and physical health through interior design solutions. Employees spend at least 40 hours per week in their workplaces, and surveys conducted by Leesman reveal that, on average, 85-90% of this time is spent indoors. Consequently, it is imperative to devote significant attention to the physical environment of office spaces, as their characteristics play a crucial role in determining how employees feel.



*1.1. Figure ComPsych Stress Pulse Report
(own figure, based on (ComPsych, 2017))*

Furthermore, the parameters of Indoor Environmental Quality (IEQ) have a substantial impact on an individual's well-being, and thereby, their productivity. However, workplace stress and the perception of monotony remain persistent challenges affecting employees' daily lives. According to the ComPsych Stress Pulse Report, 61% of individuals report experiencing high levels of stress accompanied by extreme fatigue, 34% report manageable but constant tension, and only 5% experience low-stress levels. These studies highlight widespread issues that justify the primary focus of the program. (1.1. Figure) (ComPsych, 2017)

1.2.Objectives of the Research

The research aims to develop an optimization model culminating in an interior design plan that advances the design process to a higher level through measurable outcomes. This process emphasizes user-centricity by addressing user needs and prioritizing the well-being of employees. The program's goal is to identify interior design tools that positively influence employees' physical health, mental well-being, and workplace performance.

The primary objective is to enhance comfort and reduce health risks in built environments. Responsible design principles focus on creating a symbiosis between users and their environment, rendering comfort a measurable value within constructed spaces. Using a specific office building as a case study, we conduct surveys to examine the functional requirements and correlations that assist employees in mitigating health risks, while exploring how office environments can support productive work.

Based on the research findings, we aim to establish interior design principles and solutions that significantly improve employees' physical health and mental well-being. A healthy environment not only enhances employees' performance and efficiency but also strengthens workplace culture and fosters loyalty. The design solutions developed during the research incorporate sustainable and energy-efficient practices, reducing environmental impact and supporting sustainable development. These findings and solutions can also be applied to other communal spaces, thereby improving societal quality of life on a broader scale and promoting social responsibility.

2. Literature Review

2.1. The Relationship Between Physical Space and Psychological Well-Being

The historical analysis of spatial usage and functionality reveals that following the Industrial Revolution, functionality became the primary focus of spatial design, often at the expense of psychological and emotional considerations. However, in recent decades, design processes have increasingly emphasized the well-being and emotional needs of users, recognizing their importance in shaping spatial experiences and human interactions.

However, integrating environmental psychology into design principles remains challenging, as this process is still not fully developed. However, examining the parallel between physical space and psychological well-being is paramount, as people spend a significant part of their lives in enclosed spaces and the built environment directly affects their mental and physical health. Research in this area contributes to our understanding of the factors that influence the design of spaces that promote well-being, reduce stress, and support positive psychological and social interactions. Mental well-being can be influenced by sensory factors such as color, lighting, and spatial proportions. Empirical studies provide support that natural light positively influences mood and enhances productivity, while the appropriate use of color can promote the perception of warmth in space and can promote communication and social interactions. These findings point to the fact that architecture has a significant impact on people's emotional and psychological states, and goes beyond the creation of physical structures. (Harrouk, 2020). Knowledge from the field of environmental psychology can aid in designing harmonious and functionally effective spaces that better align with users' needs. However, the practical application of scientific research within design processes still requires further development. Architects bear the responsibility of integrating these psychological and emotional factors into their work, addressing the complex and multifaceted needs of users.

2.2.The Impact of the Workplace Environment on Health and Productivity

The positive correlation between employee well-being and organizational performance is increasingly supported by scientific evidence. A study by Harvard Business School confirms that a 10% increase in employee well-being can result in approximately a 10% rise in productivity, yielding substantial economic benefits. This finding underscores that well-being is not only significant from a humanitarian perspective but also offers measurable economic advantages that directly enhance corporate competitiveness and efficiency (Dr. Krekel, dátum nélk.). Efforts to improve employee well-being can be structured around three main pillars: strengthening social connections, tailoring job roles to individual needs, and improving work-life balance. Furthermore, research highlights the importance of consistently and systematically measuring employee well-being. Such data is crucial for a comprehensive evaluation of productivity and organizational performance. In addition, research led by the Harvard T.H. Chan School of Public Health emphasizes the critical role of office air quality in employees' cognitive performance and productivity. The study identified a relationship between higher levels of PM2.5 (particulate matter) and CO2 (carbon dioxide) slower response times and reduced accuracy. This suggests a correlation between poor air quality, working memory, and concentration. The global nature of the problem is highlighted by the fact that the office workers in the study come from different geographical locations (e.g. China, USA, Thailand)

2.3.Optimizing Space Utilization in Office Design

Effective management of office space is now essential for the productivity of organizations, for promoting collaboration, and for improving and maintaining employee wellbeing. Office space optimization is based on three principles. The first is space planning, which involves the functional design of premises to support organizational needs and employee activities. The second allows the use of tools that contribute to the design process by analyzing space utilization data. The third is space monitoring, which continuously monitors and evaluates current usage patterns to ensure the sustainability and adaptability of the optimization process

(Holloway, dátum nélk.). These principles contribute in an integrated way to a more efficient and adaptive office environment design. In addition to increasing operational efficiency, office space optimization also aims to promote employee satisfaction and organizational agility through a data-driven and adaptive approach. Optimized working environments provide an inspiring and people-centric workplace, all in a sustainable way, contributing to the long-term competitiveness of the organization.

2.4.Integration of Technology into Interior Design

The integration of technology into interior design is a new way to improve design outcomes, while also providing an opportunity to develop the discipline. The combination of traditional and new technologies brings a new dimension to the conceptualization and design processes. Technologies that allow designers to collect data on space use, energy consumption, and user behavior provide a feedback loop for layout and optimization. It is essential to prioritize comfort, accessibility, and occupational health during the design process, as this will enable improvements in user experience and overall satisfaction. The use of such technologies supports flexible responses to dynamic environments and facilitates rapid response to changing needs. AI Habitat enables the simulation of interactions through a photorealistic 3D environment. This tool offers an innovative opportunity for designers and researchers alike to take a new approach to developing solutions for space optimization, furniture layout, ergonomic improvements, and energy efficiency. The simulator will be of outstanding value in promoting the development of intelligent sensors, modeling autonomous systems, and creating interiors based on human needs. It supports user satisfaction and organizational efficiency and emphasizes the importance of creating healthy and productive office environments.

3. Methodology

3.1. Research Framework

The project aims to develop a model that optimizes the use of space in an office space by accurately determining the space requirements of the modules needed. In addition, to identify functional needs and spatial relationships that promote efficient and productive work while reducing health risks for workers through an office environment that is designed to meet these principles. The research program also aims to identify and define interior design tools that positively impact workers' physical health, mental well-being, and workplace performance. By integrating these aspects in a holistic approach, the framework is designed to contribute to more efficient and user-centered workspaces.

3.2. Spatial Analysis Methods

The research involves different subjects exploring an enclosed space through a 3D model that collects data on navigation paths and feedback. Based on the resulting 2D model, their trajectories, and input, we optimize the spatial layout. To validate the concept, we utilize the AI Habitat platform, a simulation tool developed by Facebook for AI research. AI Habitat includes a simulator and a laboratory component that facilitate the modeling of spatial interactions and agent behaviors. This capability supports the refinement of the design process by providing insights into how users interact with and experience the space.

3.3. The Role of AI-Based Agents in Office Design Simulations

In recent years, advancements in artificial intelligence and simulation technologies have revolutionized how we design and interact with physical spaces. Tools like Facebook AI Habitat [1] and reinforcement learning algorithms have opened the door to creating environments that adapt dynamically to their occupants, enhancing comfort, efficiency, and sustainability[6]. This field, often referred to as Embodied AI in Environmental Optimization, focuses on designing systems where virtual agents interact with simulated spaces to predict and optimize real-world scenarios. These systems have applications in: Architecture and Interior Design: Simulating

and refining layouts before construction [8]. Smart Cities: Optimizing navigation and resource use in urban spaces[9]. Workplace Productivity: Designing office environments to reduce stress and increase[10].

The increasing complexity of modern spaces, coupled with demands for sustainability and human-centered design, has made traditional design approaches insufficient. By combining real-world data and simulation-driven AI, researchers can explore innovative solutions to problems such as space inefficiency, discomfort, and energy waste.

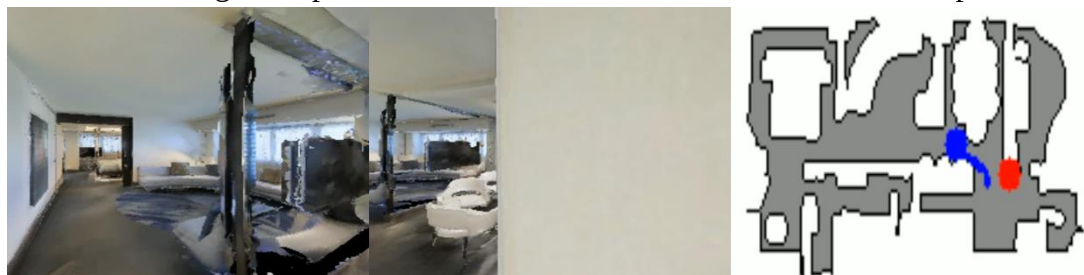
3.4.Tools and Technology

3.4.1. Facebook AI Habitat Simulator

We are suggesting on the use of the Facebook AI Habitat simulator for the simulation of the closed spaces for the optimization of the space in different ways. Facebook AI Habitat Simulator and Lab: Habitat is a simulation platform for research in Embodied AI. AI Habitat enables training of such embodied AI agents (virtual robots and egocentric assistants) in a highly photo realistic & efficient 3D simulator, before transferring the learned skills to reality.

How can this help in closed space planning and designing?

Lets assume you create a office design and you wanted to see how easy for the staff to navigate around the space in different scenarios like with Full capacity or with a certain number of employees, and you want them to perform some tasks and interact with in this simulation, basically a simulating a real office situations, which can be done using AI habitat. Our initial idea was to use AI habitat agents to navigate the designed space with different sensors and with results attain from the agent we use them to rearrange the space's furniture and other elements of the closed space.



3.1. Figure
Agent 1 view, Agent 2 view, Blue Agent 1, Red Agent 2 position

3.4.2. AI Environment Engine

We propose an AI Environment Engine designed to take various inputs and dynamically optimize or reshuffle spaces to enhance usability and comfort. Our concept is to integrate the subject from Habitat into the machine, allowing it to be updated as input to the simulations. The aim is to systematically improve the level of comfort in interiors. Integration of Comfort and Well-being in Models

Comfort can be assessed by several parameters:

1. Visual comfort: it can be analyzed through factors such as contrast, brightness, and visual attractiveness in different areas, all via the RGB output.
2. Accessibility: the ease of movement and movement between rooms can be measured, including changes in occupancy and activity levels.
3. Thermal comfort: track changes in temperature in different zones by fitting the subject with a thermal sensor, thus identifying areas that are not comfortable.

This comprehensive approach allows the AI Environment Engine to assess and adjust various aspects of an environment, ensuring a higher level of comfort for its users. The goal of the AI Environment engine is optimize the three parameters to it optimal level.

1. With the Visual comfort, the AI Environment Engine suggest the different placement of light, windows and other light source.
2. With the Accessibility, the AI Environment Engine suggest the different placement of the furniture and layout of the rooms, based on the path taken by the Agents.
3. With the Thermal comfort, the AI Environment Engine suggest the possible discomfort zones for the users of the space.

You can thinking why a Engine and why not just a AI model, the problem with AI model is a single, trained algorithm mostly trained for a specific purpose, while models are specifically designed for task-specific, but when it comes to Engine, we will be able to integrate multiple models, provides molecularity and Run

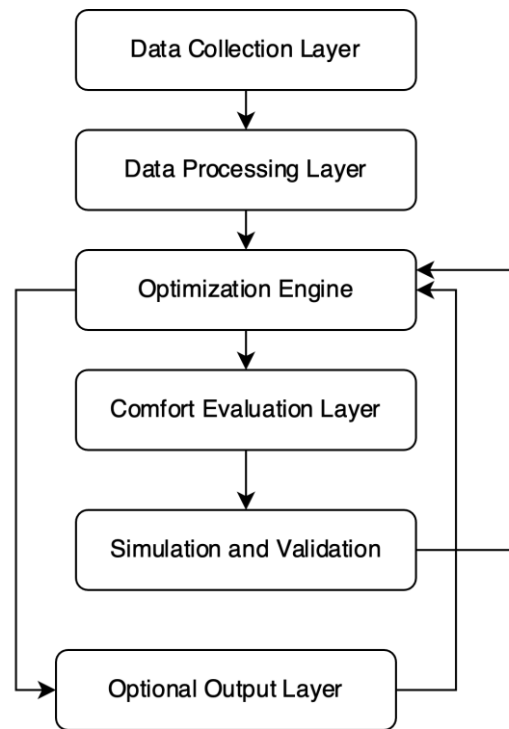
continuously like a pipeline adjust in real-time, which makes the simulations realistic and changes were seen in real-time.

The goal of AI Environment Engine should be modular, scalable and designed to work in real-time interaction with sensors and simulation tools like AI habitat in our case. We are gonna suggest the following high level text for the architecture. (3.2. Figure)

1. Data Collection module: This module is responsible for all the data collection, RGB Camera Data, Thermal data, proximity and occupancy data.
2. Data Processing module: This module is responsible for Noise filtering, calibration of sensor data and data normalization.
3. Comfort Evaluation module: The module assess the “comfort” of the space based on predefined parameters:
 - Visual Comfort Model: Processes lighting conditions and visual distractions using RGB data.
 - Thermal Comfort Model: Focuses on temperature distribution and air quality metrics.
 - Accessibility and Flow Model: Examines movement patterns and spatial efficiency based on navigation maps.

- Custom Metrics: Other factors such as noise levels and the possibility of incorporating different ergonomic layouts.

4. Optimization Engine: Starts with a default setting that, given a predefined set of knowledge, allows it to work efficiently from the start. It shows dynamic change as simulation results and user feedback improve. It offers the potential to optimize the spatial layout and settings while remaining open to continuous refinement



3.2. Figure AI Environment Engine Architecture

5. Simulation and Validation module: Simulation space, feeds outputs from the optimization engine into Habitat’s embodied agent for testing. Agent Feedback Loop, The agent navigates the simulated environment to validate comfort improvements and detect any usability issues. Validation Metrics, Compares simulated results with real-world data to fine-tune models.
 6. Feedback loop: Learning from data, Updates the engine based on the comfort level and feedback from the designer on the updated changes.
 7. An Optional User Feedback layer: This layer is a optional one as the feedback from the user only comes when the design processed to real-world implementation. IoT Device Integration (Optional): Receives output data and if required adjust in real-time based on the user feedback
- Movable partitions or smart furniture for layout changes.
 - HVAC systems (temperature adjustments, air quality improvements).

- Lighting systems (brightness, color temperature).

Condition: This is activated only when the system is deployed in a physical space equipped with compatible IoT devices.

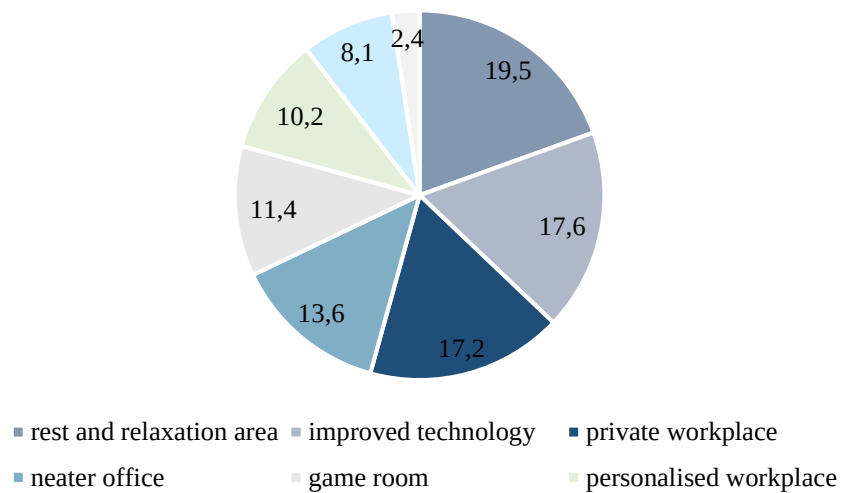
User Feedback Mechanism (Optional): Provides a mobile/desktop interface for getting feedback in different areas to refine the engine's models further. Allowing manual overrides or approval for suggested changes if the IoT devices are controlled by the Engine in real time.

4. Development of the Office Model

4.1. Spatial Requirements of Office Modules

Initially, we categorized the functions into three groups: those that are currently efficient, those that are less effective, and those that are absent. The necessary spaces were identified based on their alignment with the project's objectives:

- Visual Comfort
- Acoustic comfort
- Thermal comfort
- Employees' physical, cognitive, and emotional well-being
- Private spaces
- Communal spaces
- Spaces supporting diverse work styles
- Accessibility
- Consistency and functional appropriateness
- Flexibility and adaptability
- Spatial efficiency



4.1. Figure productivity improvement factors identified by workers
(own figure, based on (ComPsych, 2017))

The specification of functions was further informed by research findings. According to Compsych reports, employees identified key factors that enhance productivity, which informed our design. (4.1. Figure) (ComPsych, 2017)

Primary and secondary functions were designated for each floor level. Vertical circulation was facilitated by strategically placing levels with similar functions farther apart, encouraging employee movement. The placement of functions also directed perspectives, either outward or inward, depending on activity requirements. For creative activities, an outward perspective proved beneficial, stimulating creativity and enhancing visual comfort. Acoustic comfort increased vertically, in alignment with reduced urban noise at higher levels. Noise-intensive tasks were allocated to lower, clustered levels, thereby improving the performance of concentration-intensive activities. Separation measures were implemented to prevent visitors from accessing private employee areas while maintaining easy accessibility. Both primary and secondary functions were emphasized on various levels of the office. To promote movement and circulation, diverse room types with distinct features were developed across different floors.

For this study, we selected the fourth floor, which serves as a quiet office space, as the primary focus of our analysis and further investigations. The quiet workspace prioritizes concentration and minimizes distractions. It is connected to noisier environments via a mini lounge, serving as an informal meeting point and arrival zone. This space is both functional and welcoming, providing a setting for brief conversations. Additionally, enclosed phone booths were integrated to preserve silence and provide private areas for conversations.



4.2. Figure level 4 floor plan
(own figure)

In this case, the corridor is an element that facilitates horizontal circulation, offering a pathway to the meeting area, while also motivating employees to move due to its design. It is a visual space-divider element, which, due to the different functions on the level, does not require full wall partitions, thus providing an open space experience.(4.2. Figure)

Based on this concept, the modules and their minimum spatial requirements were defined. (4.3. Figure)

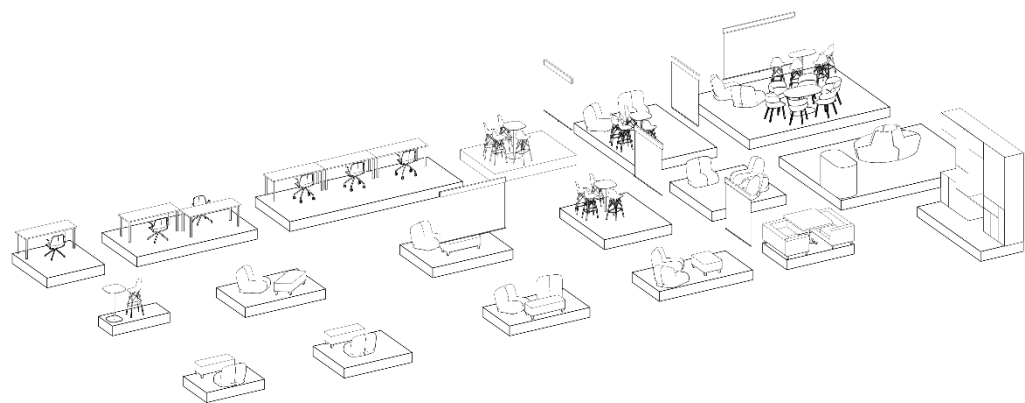
Function	Minimum Spatial Requirements
one-person workstation	5 m ²
two-person workstation	10 m ²
three-person workstation	15 m ²
meeting (S)	7,1 m ²
meeting (M)	12,5 m ²
meeting (L)	21,5 m ²
meeting point (XS)	5,8 m ²
meeting point (S)	6,6 m ²
meeting point (M)	7,6 m ²
project room (S)	5,4 m ²
project room (M)	6,4 m ²
phone box	2 m ²
lockers	6,7 m ²
lounge, alternative workplace	4,1 m ²
lounge (S)	22 m ²

4.3. Figure Minimum Spatial Requirements
(own figure)

4.2.Zoning and the Psychological Impacts of Functions

The definition and optimal arrangement of functional zones serve as a fundamental goal in interior design, serving the different needs of users and striking a balance between silence, collaboration, and socializing. The quiet spaces provide a place for undisturbed concentration and relaxation. It provides space for group work in

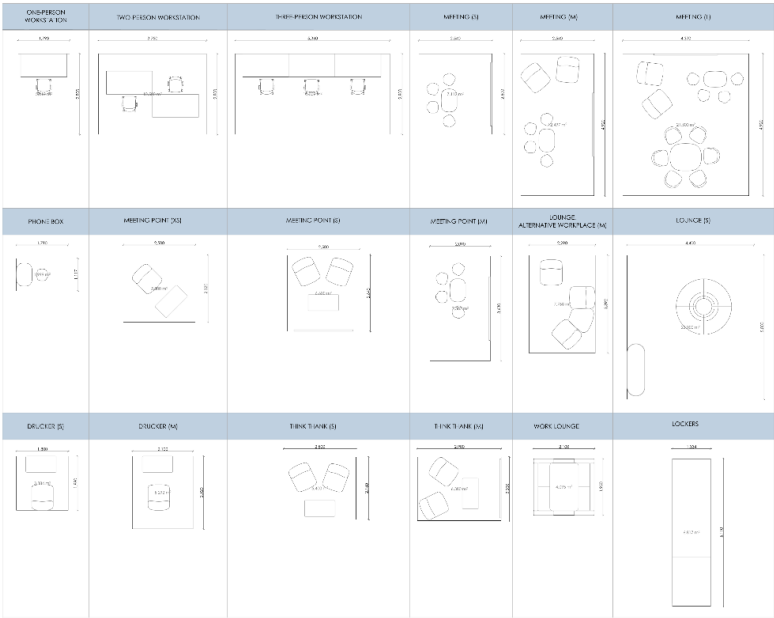
individual and demarcated spaces, complete with telephone booths, which provide an opportunity for private conversations in an undisturbed environment.



4.4. Figure axonometric modules
(own figure)

Collaborative zones provide spaces for teamwork, brainstorming, and creative collaboration, such as meeting rooms or open multi-person workstations.

Informal meeting spaces provide a place for spontaneous conversations and social interactions, such as lounge spaces and rest areas. (4.4. Figure)(4.5. Figure)

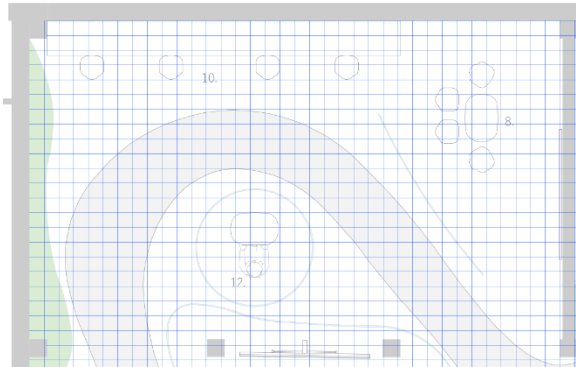


4.5. Figure modules space requirements 2d illustration
(own figure)

The modules on the floor are designed using minimum space requirements and a 25 cm x 25 cm grid system.

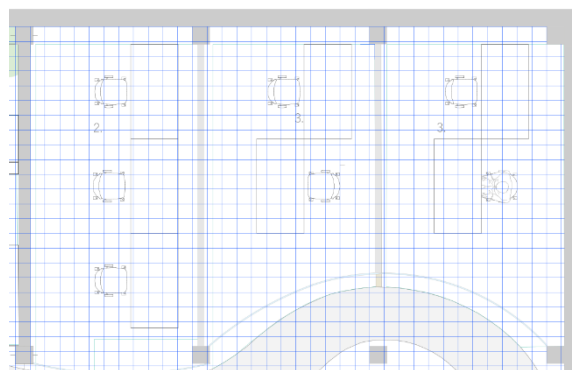
4.3.Modular Space Utilization and Ergonomic Design

The use of 25 cm x 25 cm grids is a key tool in office design, helping to optimize space utilization and create precise modular layouts. Advanced office design aims to enhance productivity and sustainability and promote employee well-being. In architectural design, the use of the 25 cm x 25 cm grid system serves as a pre-emptive measurement tool and offers several key benefits.



4.6. Figure 25 cm x 25 cm grid integration to the design
(own figure)

Space utilization: the 25 cm grid supports the precise placement of architectural elements and furniture, which contributes to maximum space utilization. The grid aligns with human body proportions while providing a functionally optimal layout, making it highly effective in various workplace environments (Anon., 2024).



4.7. Figure 25 cm x 25 cm grid integration to the design
(own figure)

Ergonomic Design: This grid system contributes to the development of ergonomic layouts by considering the movement and comfort needs of individuals in workplace settings. The 25 cm grid is commonly used in offices and communal spaces as it facilitates precise and comfortable space usage (Short, 2016).

Sustainability: Accurate grid layouts support the efficient use of materials and resources, reducing waste, particularly during the design phase. This is especially important in sustainable architectural projects as it helps minimize environmental impact (Brown, dátum nélk.). Therefore, the 25 x 25 cm grid not only ensures functionality and sustainability but also aids in the ergonomic design of spaces, making it an ideal tool for planning offices and communal areas. (4.6. *Figure*)(4.7. *Figure*)

5. Validation and Practical Applications

5.1.Optimized Space Configurations

Spaciv aims to efficiently utilize resources and create sustainable, functional environments that align with user needs, contributing to the optimization of real estate usage, cost reduction, and the enhancement of productivity and employee well-being. The company combines data-driven modeling technologies with design processes to support the development and implementation of workplace strategies. Spaciv is an innovative platform that revolutionizes the creation and execution of workplace strategies through the application of data-driven approaches. By optimizing space utilization, reducing costs, and improving employee experiences, it aids in the creation of sustainable work environments. Its solutions include space and experience optimization, detailed analysis of user needs, simulation creation, and the development of customized space programming strategies. It offers flexible and adaptive solutions for individual projects and ongoing support processes, contributing to the increased efficiency and sustainability of modern work environments (spaciv, dátum nélk.).

5.2.Current Issues in Environmental Design

Challenges in Space Planning

1. Static Models and Inefficient Space Utilization:

Many buildings and urban areas suffer from underutilized spaces due to traditional design methods that fail to adapt to dynamic conditions. This includes changing occupancy levels and user preferences [11].

2. Poor Comfort Levels:

AI has been used to improve thermal and visual comfort by dynamically adjusting building systems like HVAC and lighting. For instance, research shows that AI-based HVAC systems can predict occupancy and environmental changes, reducing energy inefficiencies while maintaining occupant comfort[12].

Emerging AI Solutions:

1. Simulation-Driven Design:

AI Habitat enables simulations of real-world scenarios, allowing architects to optimize spatial designs before construction. Studies have shown that such simulation tools are crucial for validating layout designs and navigation efficiency[1].

2. Data-Driven Adaptation:

Research highlights the use of dynamic models that integrate occupant behavior and environmental data for real-time space management. AI systems employing neural networks or Gaussian processes are particularly effective in adjusting spatial layouts to user needs[13]

6. Presentation of Measurement Results

6.1. Results and Analysis

What did we achieve and still in progress?

We were able to successfully initialize a multi agent exploration where the agents will be able to explore around in a example 3D scan of a room provided by the dataset of AI habitat. At the moment we are able to achieve 3 different visual output from the agent within the scene an RGB, Segmentation output and depth output. But the problem lies in the custom 3D design, as the agents use a navigation mesh also called as navmesh to point them with in a map and we use this navmesh to create a 2D top down map to see where the agents are navigating.



6.1. Figure designed space axonometry
(own figure)

As navmesh are primarily made in Unity3D, as i was successful to bake a navmesh to the designed map most of the exporters from unity to obj,glb (as unity doesn't support this type of exporting) are not exporting this navmesh, where is AI habitat is not detecting the navmesh, which cause the problem of agent placement and navigation within the space. Also without these data, its hard to continue forward. The move forward is to try to develop custom exporters for unity or add the functionality to read the unity package to the AI habitat, can move the research forward. (6.1. Figure)

How AI Habitat Enhances the Engine

Simulated Training: Habitat's ability to simulate indoor navigation and interaction allows testing of the engine in a variety of configurations before deployment.

Behavior Prediction: Training models within Habitat could predict how users will interact with dynamic spaces.

Scalability: Test environments of various scales (from single rooms to entire buildings) for robustness.

Results & Expected Outcomes

Improved Comfort: Dynamic adjustments to space based on real-time needs (e.g., light dimming for relaxation or noise reduction for focus).

Energy Efficiency: Optimizing resource usage by predicting when and where changes are needed.

User-Centric Designs: Spaces that evolve with the user's lifestyle and preferences.

Productivity Boost: Reduced cognitive load from distractions like uncomfortable lighting or poor temperature regulation.

7. Conclusion

7.1. Summary of Key Findings

The main findings of this thesis focus on the interior design of a productive, health-promoting, user-centered office. The research highlights the direct effects of the office environment on employees' physical and mental health and productivity. The research aims to identify interior design tools and develop solutions that support employee health, comfort, and work efficiency measurably, taking into account sustainability and energy efficiency. It also emphasizes the key importance of Indoor Environment Quality (IEQ) parameters, as light, air quality, and acoustic comfort contribute to a sense of well-being. From the sources of contemporary research, we can conclude the importance of the psychological impact of physical spaces, since factors such as light, color, spatial proportions, etc. have a major impact on people's well-being. The research emphasizes that better air quality, ergonomic design, and the use of space tailored to the needs of workers, in addition to reducing stress, improve cognitive performance and overall efficiency.



*7.1. Figure interior design plan visualisation
(own figure)*

It presents how we can take design processes to a new level by integrating technology into design, through space use analysis and modeling user behavior. The use of technology and the simulation platform points to the key finding that by applying them we can make more informed design decisions that are better adapted to user needs. The use of AI systems offers an opportunity to measure and optimize comfort parameters, both in terms of visual comfort, accessibility, and thermal comfort. The focus of the research is on sustainability and efficiency and provides an alternative solution to a pathway to energy efficiency and cost reduction. The

research demonstrates that AI-based design approaches can significantly support the efficiency of modern workplaces and community spaces, contributing to sustainability and comfort, while optimizing the use of space and contributing to a more sustainable and liveable future. Together, AI-enabled systems and traditional methods add a new dimension to interior design, striking a balance between technological innovation and human-centered design. (7.1. Figure)

7.2. Contribution to Interior Architecture and Workplace Health

The results of this research will make a significant contribution to the development of interior design and the improvement of occupational health, as it will bring interior design closer to the findings of environmental psychology and ergonomics, which will help it to respond to people's psychological and emotional needs while taking into account aesthetic and functional aspects. The use of AI Habitat and similar tools, in addition to increasing space efficiency, facilitates accurate and pre-planned conceptualization according to human needs. Using measurable values in design processes is an important aspect of promoting comfort, adaptability, and health. Integrating sustainable design into interior design contributes to creating more environmentally friendly and time-resistant solutions.



7.2. Figure interior design plan visualisation
(own figure)

Emphasizing the contribution to health in the workplace is essential, the research highlights the potential to support physical health and describes the importance of acoustic, visual, and thermal comfort, and its direct impact on employees, which can reduce health risks. The provision of zones with different functions supports

mental well-being, for example, personalized workspaces help to reduce stress, improve creativity, and increase satisfaction, and an appropriate proportion of quiet zones and social spaces promote mental regeneration. Creating a healthy working environment enhances performance by improving productivity, and modeling this pattern in other community spaces contributes to social well-being and enhances the quality of life in the community. (7.2. *Figure*)

8. Summary

This thesis aims to present the possibilities of optimizing an office environment with interior design tools that support the mental and physical health of employees and increase productivity. The relevance of the research is justified by the conclusions drawn from the research results, according to which work-related stress and monotony pose a serious challenge to maintaining the quality of life of employees. The research aims to develop an optimization model that takes design processes to a new level using both traditional and new methods and knows the importance of balancing the two methods. After all, it is important to emphasize that the application of innovative methods based on AI is useful if architects have already created the parameters that allow the application of the technology later. The structure of the process explains that the use of AI-based methods does not replace the architect's task, but simply an extra mode, thus providing data for the architect to work with concluding. The focus of the thesis is to increase the comfort of employees and reduce health risks. In addition to applying a user-centered approach, it emphasizes the importance of sustainable and energy-efficient solutions. The data-driven approach examined through the example of an office building helps to refine the functional layout and ergonomics of modules. It makes key findings on the application of modular design, ergonomics, and AI-based design systems to architectural design, where an important approach to research is that the tools used not only optimize space use and promote the health, well-being, and productivity of users but also contribute to a more sustainable and liveable future through their methods. The research aims to contribute to the design of office spaces with a novel approach, highlighting the close relationship between health, comfort, and efficiency, going beyond aspects of aesthetics and functionality. The results not only support the development of specific office space used in the research but also formulate principles that can be applied from a broader perspective, thus laying the foundation for a more humane workplace culture, all through the promotion of sustainable behavior and social responsibility. The long-term use of design solutions formulated through analysis, as well as the novel combination of scientific knowledge and practical design, create value in the design of the future office by strengthening the synergy between interior design and occupational health and setting a new standard for integrated solutions.

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List of figures

1.1. Figure ComPsych Stress Pulse Report (own figure, based on (ComPsych, 2017)).....	5
3.1. Figure Agent 1 view, Agent 2 view, Blue Agent 1, Red Agent 2 position.....	11
3.2. Figure AI Environment Engine Architecture.....	14
4.1. Figure productivity improvement factors identified by workers (own figure, based on (ComPsych, 2017))	16
4.2. Figure level 4 floor plan (own figure).....	17
4.3. Figure Minimum Spatial Requirements (own figure).....	18
4.4. Figure axonometric modules (own figure)	19
4.5. Figure modules space requirements 2d illustration (own figure).....	19
4.6. Figure 25 cm x 25 cm grid integration to the design (own figure)	20
4.7. Figure 25 cm x 25 cm grid integration to the design (own figure)	20
6.1. Figure designed space axonometry (own figure).....	24
7.1. Figure interior design plan visualisation (own figure).....	26
7.2. Figure interior design plan visualisation (own figure).....	27