DYNAMIC OFFICES

WORKPLACE DESIGN FOR INDIVIDUAL AUTONOMY

by

Ernest Lee

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Master of Architecture

Waterloo, Ontario, Canada, 2024
© Ernest Lee 2024

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

The hybrid work model, whereby workers divider their time between working remotely and in the office, has become more prevalent through recent years, largely accelerated by the COVID-19 pandemic. In contrast to the conventional way of working where all employees come into the office everyday, employees have more flexibility in their schedule on how, when, and where they want to work enabling them to optimize their productivity. Reducing the number of staff in the office when implementing the hybrid office approach can result in under-utilized spaces as the office infrastructure remains designed to accommodate a larger workforce. As a result, there is an opportunity for businesses to work in a smaller office footprint, reducing the number of supporting spaces and enabling them to be repurposed for highly collaborative program. Furthermore, a hot desk system—where employees share and use any available workstation—can be implemented to optimize space utilization. However, the implementation of hot desks leads to a disconnect between the user and the workspace. Staff members will not arrive to the office to use the same personal desk every time. The lack of consistency requires employees to adapt to spaces that are available on a given day. As the space is shared, occupants lose control of their environment and become unable to customize it according to their preferences.

This thesis explores how a shared workplace can be designed to make use of the efficiencies of the hot desk model as implemented in response to a hybrid work environment while allowing the space to feel personal and familiar by leveraging qualities from design that is both flexible and adaptable. The exploration is carried out through design exercises exploring three scales of intervention. An existing building is selected and reimagined to accommodate multiple tenants operating on hybrid schedules with attention to space optimization and shared programming. At the intermediate scale, a modular system-based approach to floorplan layouts is introduced, allowing the space to be reconfigured while maintaining design cohesion and accommodate constant changes occurring within an organization. At the smallest scale, a workstation with automated reconfigurable elements is designed to provide familiarity and personalization within a hot desk system approach. These interventions are unified through a carefully balanced integration of technology that enhances user experience while providing valuable insight into how the space is performing. These interventions extend beyond the scope of efficiency; it improves the experience of those working in the space which leads to enhanced productivity, collaboration, and a stimulating working environment.

ACKNOWLEDGEMENTS

To Maya Przybylski, my thesis supervisor, thank you for your guidance. I am grateful for your insights and support in helping me complete the thesis.

To Rick Andrighetti, my committee member, thank you for your thoughtful feedback and suggestions throughout this process.

To John McMinn, my internal reader, thank you for your careful review and for the insightful discussions during my final defence.

To Kristin Schreiner, my external reader, thank you for your engagement and thought-provoking discussion during my final defence.

TABLE OF CONTENTS

LIST OF FIGURES x
INTRODUCTION 1

1 - HYBRIDITY 5
- 1.0 Hybrid Working Model 7
- 1.1 Hybrid Implementations 10
- 1.2 What Hybrid Work Solves 14
- 1.3 Moving Towards Shared Offices 17
- 1.4 Hot Desks 20

2 - OFFICE LAYOUT 27
- 2.0 Open Office 29
- 2.1 Closed Office 36
- 2.2 Return to Open Office 39
- 2.3 Office Neighbourhoods 41

3 - USER 51
3.0 Familiarity & Personalization 53
3.1 Agency in Place & Space Making 60
3.2 Habits and ROutine 66
3.3 Automation 69

4 - DESIGN 73
4.0 Site and Context 77
4.1 Distribution of Spaces 80
4.2 Layout and Modularity 84
4.3 Adapting to Change 149
4.4 Workstation Design 158
4.5 User Experience 168
4.6 Prototype 178

CONCLUSION 187
BIBLIOGRAPHY 190

LIST OF FIGURES

All images are created by the author,
except where otherwise noted.

11 **Fig. 1.1.1** Diagram of different methods of implementing hybrid work with varying levels of flexibility given to the staff member.

18 **Fig. 1.3.1** Illustration of the result to reducing the in-person workforce of an office space by 30%.

21 **Fig. 1.4.1** Scenario 1 diagram of seat availability on a Monday of an example seat layout.

21 **Fig. 1.4.2** Scenario 1 diagram of seat selected on a Monday given what is available.

22 **Fig. 1.4.3** Scenario 2 diagram of seat availability on a Thursday of an example seat layout.

22 **Fig. 1.4.4** Scenario 2 diagram of seat selected on a Thursday given what is available.

23 **Fig. 1.4.5** Illustration of the chaos if a person sits at a different location in the office everyday for an extended period.

30 **Fig. 2.0.1** Photo of atrium at the Larkin Administrative Building, Buffalo, New York, 1906. Photo from Larkin Company Photograph Collection. “Larkin Administration Building, Buffalo, New York (1906)*,” accessed October 9, 2024, https://insideinside.org/project/larkin-adminstration-building-1906/.

30 **Fig. 2.0.2** Photo of typing department at the Larkin Administrative Building, Buffalo, New York, 1906. Photo from Larkin Company Photograph Collection.

32 **Fig. 2.0.3** Quickborner's office landscape plan. Drawing by Quickborner's team. Myerson, Jeremey, and Philip Ross. "Unworking: The Reinvention of the Modern Office,"

34 **Fig. 2.0.4** Partial floor plan of a Starbucks in Don Mills revealing subdivisions of the space created by users.

35 **Fig. 2.0.5** Partial plan of Toronto Public Library revealing subdivisions of the space created by users.

37 **Fig. 2.1.1** Action Office I Robert Propst, George Nelson, 1965. Dezeen. "The Office Cubicle: From Commercial Flop to Design Classic," February 1, 2015. https://www.dezeen.com/2015/02/01/office-cubicle-50th-birthday-herman-miller-robert-propst/.

37 **Fig. 2.1.2** Action Office II Robert Propst. Image from WSJ. Saval, Nikil. "A Brief History of the Dreaded Office Cubicle." Wall Street Journal, May 10, 2014, sec. Life and Style. http://online.wsj.com/article/SB10001424052702304885404579549800874319342.html.

38 **Fig. 2.1.3** Action Office II, Robert Propst. Image from Herman Miller Archives. "Action Office 1, Zeeland, Michigan (1964)*." Accessed October 9, 2024. https://insideinside.org/project/action-office-11964/.

40 **Fig. 2.2.1** Photograph of the Foster & Partners Headquarters in London. Photograph from Foster + Partners. “Voted ‘Most Admired Architect.’” Accessed October 20, 2024. https://www.fosterandpartners.com/news/foster-plus-partners-voted-most-admired-architect-ninth-year-in-a-row.

43 **Fig. 2.3.1** Interior photograph of Centraal Beheer Insurance Building. Photograph by Willem Diepraam, Aero Carto Aviodrome and Herman van Doorn from AHH. “AHH - Centraal Beheer Offices, Apeldoorn.” Accessed October 9, 2024. https://www.ahh.nl/index.php/en/projects2/12-utiliteitsbouw/85-centraal-beheer-offices-apeldoorn.

44 **Fig. 2.3.2** Illustration of working zones used in the Centraal Beheer Insurance Building by Herman Hertzberger. Drawings from AHH. “AHH - Centraal Beheer Offices, Apeldoorn.” Accessed October 9, 2024. https://www.ahh.nl/index.php/en/projects2/12-utiliteitsbouw/85-centraal-beheer-offices-apeldoorn.

45 **Fig. 2.3.3** Airbnb Dublin Headquarters. Photography by Donal Murphy. Searer, Stephen. “Airbnb Offices - Dublin.” Office Snapshots, March 20, 2017. https://officesnapshots.com/2017/03/20/airbnb-offices-dublin/.

46 **Fig. 2.3.4** Green Room by Space Encounters. Photography by Peter Tijhuis. Levy, Natasha. “Space Encounters Uses Planted Partitions to Divide Synchroon’s Utrecht Office.” Dezeen, April 24, 2019. https://www.dezeen.com/2019/04/24/space-encounters-synchroon-utrecht-office/.

47 **Fig. 2.3.5** Macquarie Bank by Clive Wilkinson Architects. Photography by Shannon McGrath. Clive Wikinson Architects. “Clive Wilkinson Architects | Macquarie Group, One Shelley Street.” Accessed October 8, 2024. https://clivewilkinson.com/portfolio_page/macquarie-group-one-shelley-street/.

48 **Fig. 2.3.6** Level 6 floor plan of Macquarie Bank by Clive Wilkinson Architects. Drawing by Clive Wilkinson Architects. Clive Wikinson Architects. “Clive Wilkinson Architects | Macquarie Group, One Shelley Street.” Accessed October 8, 2024. https://clivewilkinson.com/portfolio_page/macquarie-group-one-shelley-street/.

55 **Fig. 3.0.1** Mobile desk organizer designed by Gustav. Photo from Gustav Concept. Gustav. “Travail hybride après le Corona.” Gustav Concept, August 20, 2024. https://gustavconcept.com/fr/bl ogs/news/hybrid-working-corona.

55 **Fig. 3.0.2** Mediated atmospheres with different atmoshperic scenes. Photo by Nan Zhao. Lab, MIT Media. “Mediated Atmosphere.” MIT MEDIA LAB (blog), July 18, 2018. https://medium.com/mit-media-lab/mediated-atmosphere-13a4a0b234dc.

57 **Fig. 3.0.3** Photograph of the atrium at the Edge designed by PLP Architecture. Photograph by Ronald Tilleman and Horizon Photoworks. PLP Architecture. “The Edge, Amsterdam, The Netherlands.” PLP Architecture (blog), September 8, 2022. https://plparchitecture.com/the-edge/.

62 **Fig. 3.1.1** Plan of Nikken Space Design showing the range of motion for the moveable desks.

64 **Fig. 3.1.2** Partions dividing space at Substracte Factory Ayase. Photo by Kenta Hasegawa. Aki Hamada. “Substrate Factory Ayase.” AHA | Aki Hamada Architects, June 28, 2021. https://aki-hamada.com/projects/substrate-factory-ayase/.

64 **Fig. 3.1.3** Partions pushed aside at Substrate Factory Ayase. Photo by Kenta Hasegawa. Aki Hamada. “Substrate Factory Ayase.” AHA | Aki Hamada Architects, June 28, 2021. https://aki-hamada.com/projects/substrate-factory-ayase/.

65 **Fig. 3.1.4** Photograph of reconfigurable meeting space in SOHO 3Q. Photo by CreatAR Images. HAN Shuangyu. “SOHO 3Q Chengdu Office / Superimpose Architecture | ArchDaily.” Accessed October 9, 2024. https://www.archdaily.com/929057/soho-3q-chengdu-superimpose-architecture.

78 **Fig. 4.0.1** Rear elevation of National Enterprise Group Headquarters. Photo by Morgan Sheff Photography. Morgan Sheff. “MORGAN SHEFF PHOTOGRAPHY.” Accessed October 9, 2024. https://morgansheffphotography.com/architecture-6.

78 **Fig. 4.0.2** Courtyard of National Enterprise Group Headquarters. Photo by Nick Merrick. Merrick, Nick. “Gallery of American Enterprise Group National Headquarters Renovation / BNIM - 1.” ArchDaily, n.d. https://www.archdaily.com/783730/american-enterprise-group-national-headquarters-renovation-bnim/56e5ffe0e58eceea1f0000cf-american-enterprise-group-national-headquarters-renovation-bnim-photo.

82 **Fig. 4.1.1** Perspective section with designation for sharing spaces between multiple tenants and the public.

85 **Fig. 4.2.1** Floor plan of level 1.

86 **Fig. 4.2.2** Rendering of cafeteria located on level 2.

87 **Fig. 4.2.3** Floor plan of level 2.

89 **Fig. 4.2.4** Typical floor plan of level 3, 4, 6, and 7 with modular grid overlaid.

90 **Fig. 4.2.5** Large grid layout.

90 **Fig. 4.2.6** Invalid configuration based on large grid rules.

90 **Fig. 4.2.7** Valid configuration based on large grid rules.

92 **Fig. 4.2.8** Small grid layout.

92 **Fig. 4.2.9** Invalid configuration based on small grid rules.

92 **Fig. 4.2.10** Valid configuration based on small grid rules.

94 **Fig. 4.2.11** Catalogue of modular blocks organized into their respective categories with their ratings of key criteria placed alongside as spider graphs.

96 **Fig. 4.2.12** Spider graph showing the Standard Workspace A's performance across key criteria.

97 **Fig. 4.2.13** Axonometric of Standard Workspace A.

97 **Fig. 4.2.14** Placement plan for Standard Workspace A.

98 **Fig. 4.2.15** Spider graph showing the Standard Workspace B's performance across key criteria.

99 **Fig. 4.2.16** Axonometric of Standard Workspace B.

99 **Fig. 4.2.17** Placement plan for Standard Workspace B.

100 **Fig. 4.2.18** Spider graph showing the Extended Workspace's performance across key criteria.

101 **Fig. 4.2.19** Axonometric of Extended Workspace.

101 **Fig. 4.2.20** Placement plan for Extended Workspace.

102 **Fig. 4.2.21** Spider graph showing the Extended Workspace's performance across key criteria.

103 **Fig. 4.2.22** Axonometric of Extended Workspace.

103 **Fig. 4.2.23** Placement plan for Extended Workspace.

104 **Fig. 4.2.24** Spider graph showing the Reconfigurable Workspace's performance across key criteria.

105 **Fig. 4.2.25** Axonometric of Reconfigurable Workspace.

105 **Fig. 4.2.26** Placement plan for Reconfigurable Workspace.

106 **Fig. 4.2.27** Spider graph showing the Group Office's performance across key criteria.

107 **Fig. 4.2.28** Axonometric of Group Office.

107 **Fig. 4.2.29** Placement plan for Group Office.

108 **Fig. 4.2.30** Spider graph showing the Individual Office's performance across key criteria.

109 **Fig. 4.2.31** Axonometric of Individual Office.

109 **Fig. 4.2.32** Placement plan for Individual Office.

110 **Fig. 4.2.33** Spider graph showing the Innovation Space's performance across key criteria.

111 **Fig. 4.2.34** Axonometric of Innovation Space.

111 **Fig. 4.2.35** Placement plan for Innovation Space.

112 **Fig. 4.2.36** Spider graph showing the Large Group Collab's performance across key criteria.

113 **Fig. 4.2.37** Axonometric of Large Group Collab.

113 **Fig. 4.2.38** Placement plan for Large Group Collab.

114 **Fig. 4.2.39** Spider graph showing the Small Groups Collab's performance across key criteria.

115 **Fig. 4.2.40** Axonometric of Small Groups Collab.

115 **Fig. 4.2.41** Placement plan for Small Groups Collab.

116 **Fig. 4.2.42** Spider graph showing the Lounge's performance across key criteria.

117 **Fig. 4.2.43** Axonometric of Lounge.

117 **Fig. 4.2.44** Placement plan for Lounge.

118 **Fig. 4.2.45** Spider graph showing the Collab + Storage's performance across key criteria.

119 **Fig. 4.2.46** Axonometric of Collab + Storage.

119 **Fig. 4.2.47** Placement plan for Collab + Storage

120 **Fig. 4.2.48** Spider graph showing the Reconfigurable Meeting Space's performance across key criteria.

121 **Fig. 4.2.49** Diagram showing potential results when users can select the pod they want to use.

122 **Fig. 4.2.50** Diagram showing results when the pods users use are computed.

122 **Fig. 4.1.51** Axonometric of two Reconfigurable Meeting Space blocks combined.

123 **Fig. 4.2.52** Axonometric of Reconfigurable Meeting Space.

123 **Fig. 4.2.53** Placement plan for Reconfigurable Meeting Space.

Fig. 4.2.54 Spider graph showing the Phone Booths's performance across key criteria.

125 **Fig. 4.2.55** Axonometric of Phone Booth.

125 **Fig. 4.2.56** Placement plan for Phone Booth.

126 **Fig. 4.2.57** Spider graph showing the Acoustic Divider's performance across key criteria.

127 **Fig. 4.2.58** Axonometric series of Acoustic Dividers.

127 **Fig. 4.2.59** Placement plan for Acoustic Dividers.

128 **Fig. 4.2.60** Spider graph showing the Planters's performance across key criteria.

129 **Fig. 4.2.61** Axonometric series of Planters.

129 **Fig. 4.2.62** Placement plan for Planters.

130 **Fig. 4.2.63** Spider graph showing the Edge Seating's performance across key criteria.

131 **Fig. 4.2.64** Axonometric series of Edge Seating.

131 **Fig. 4.2.65** Placement plan for Edge Seating

132 **Fig. 4.2.66** Spider graph showing the Personal Caddy Storage's performance across key criteria.

133 **Fig. 4.2.67** Axonometric of Personal Caddy Storage.

133 **Fig. 4.2.68** Placement plan for Personal Caddy Storage.

135 **Fig. 4.2.69** Typical floor plan of level 3, 4, 6, and 7 with a possible arrangement.

136 **Fig. 4.2.70** Typical floor plan of level 3, 4, 6, and 7 with modular grid overlaid.

137 **Fig. 4.2.71** Typical floor plan of level 3, 4, 6, and 7 with unique neighbourhoods highlighted.

138 **Fig. 4.2.72** Typical floor plan of level 3, 4, 6, and 7 with block types used colour coded.

139 **Fig. 4.2.73** Typical floor plan of level 3, 4, 6, and 7 with carpet colour coded.

140 **Fig. 4.2.74** Typical rendering of level 3, 4, 6, and 7.

141 **Fig. 4.2.75** Typical rendering of level 3, 4, 6, and 7.

143 **Fig. 4.2.76** Floor plan of level 5.

144 **Fig. 4.2.77** Floor plan of level 5 with block types used colour coded.

145 **Fig. 4.2.78** Rendering of level 5 at the private offices.

147 **Fig. 4.2.79** Floor plan of level 8.

148 **Fig. 4.2.80** Rendering of the large multipurpose room setup for a company event.

150 **Fig. 4.3.1** Layout 1, axonometric of level 3 with original layout.

150 **Fig. 4.3.2** Diagram of block types used in layout 1.

150 **Fig. 4.3.3** Diagram of changes made in layout 1 from previous.

152 **Fig. 4.3.4** Layout 2, axonometric of level 3 with second layout.

152 **Fig. 4.3.5** Diagram of block types used in layout 2.

152 **Fig. 4.3.6** Diagram of changes made in layout 2 from previous.

154 **Fig. 4.3.7** Layout 3, axonometric of level 3 with third layout.

154 **Fig. 4.3.8** Diagram of block types used in layout 3.

154 **Fig. 4.3.9** Diagram of changes made in layout 3 from previous.

156 **Fig. 4.3.10** Layout 4, axonometric of level 3 with fourth layout.

156 **Fig. 4.3.11** Diagram of block types used in layout 4.

156 **Fig. 4.3.12** Diagram of changes made in layout 4 from previous.

159 **Fig. 4.4.1** Series of elevations of the personal caddy. Top Left: Scale figure, Top Middle: Front elevation, Top Right: Plan, Middle: Left elevation with slide-out panel and handle retracted, Bottom: Left elevation with slide-out panel and handle extended.

161 **Fig. 4.4.2** Series of renderings illustrating the different possible variations of slide-out panels for the personal caddy.

162 **Fig. 4.4.3** Floor plan with location of personal caddy storage highlighted in orange.

163 **Fig. 4.4.4** Series of illustrations showing the retrieval and docking of the personal caddy onto the workstaiton.

165 **Fig. 4.4.5** Series of elevations of a workstation. Top: Plan, Middle: Front elevation, Bottom Left: Left elevation, Bottom Right: Right elevation.

166 **Fig. 4.4.6** Rendering of a typical workstation at its lowest setting with personal caddy placed on docking area.

167 **Fig. 4.4.8** Rendering of a raised workstation with unique configurations and wayfidning light indicator turned on.

169 **Fig. 4.5.1** Represenation of mapping the position of a person using UWB in two dimensions using trilateration.

171 **Fig. 4.5.2** Illustration of a heat map of the office floor plan showing utilization of different spaces from data collected through UWB positioning.

172 **Fig. 4.5.3** User interface of wayfinding kiosks.

173 **Fig. 4.5.4** Rendering of a typical wayfinding kiosk located near the elevators.

176 **Fig. 4.5.5** User interfaces for a workspace configuration app. Left: Homepage of workstation settings. Right: Configuration settings for ambient light colour.

177 **Fig. 4.5.6** User interfaces for a workspace configuration app. Left: Configuration of desk lamp. Right: Configuration of picture shown on display.

180 **Fig. 4.6.1** Photograph of the workstation prototype in a unique configuration.

181 **Fig. 4.6.2** Photograph of the workstation prototype in a unique configuration.

182 **Fig. 4.6.3** Exploded axonometric diagram of the different parts used in the workstation prototype.

183 **Fig. 4.6.4** Screenshot taken within the mobile app showing the proximity of the user from the targeted workstation prototype.

185 **Fig. 4.6.5** Diagram of the flow of data between the mobile app, server, and main control board.

INTRODUCTION

The rise of hybridity in the workplace has necessitated a shift away from traditional workplace design. In this context, hybridity refers to a flexible work model where employees divide their time working in the office and remotely. While initially required during the COVID-19 pandemic, hybridity has solidified itself in the workplace as a method to offer staff members with increased flexibility in their location of work. However, it has also led to challenges with both new and existing offices to experience a substantial increase in underutilized spaces. With fewer employees attending the office in person each day, buildings are left with underutilized spaces that were initially designed and intended for a larger in-person workforce.

A common strategy to help alleviate this issue is with hot desking, where employees share desks and other spaces, allowing the organization to relocate to a smaller office. While this strategy alleviates the underutilization caused by the transition to a permanent hybrid work model, it does not improve the existing issues in the popular open floorplan office design such as large, underutilized meeting spaces, lack of task specific spaces, and the inability for the office to adapt easily to the evolving needs of teams and the organization. Furthermore, the implementation of hot desking creates new issues related to the lack of familiarity with a space that were not present before.

This thesis examines the challenges that exist with the current implementation of hybridity in the workplace and ultimately a new design is created that tackles the most prominent issues found in current implementations. It offers insight into what the workplace could become when hybridity is implemented permanently while prioritizing the experience of the user first.

The scope of the thesis involves researching what hybridity is and how it exists within the context of the workplace. The research will look at the problems hybrid work models aim to solve, and the current strategies taken to implement them into the workplace. Then the research will continue with an analysis on the evolution of workplace layout designs with a focus on key design trends. A selection of architectural case studies from different time periods will be examined in greater detail in order to understand the varied approaches in office design and their unique limitations. The research on layouts will end by examining a contemporary approach to dividing the office into smaller working groups to promote privacy and aid in more meaningful collaboration. The final section of the research will look into the workplace and how it relates to the user experience of working in the office.

The scope of this thesis will conclude with a multi-storey office building design that incorporates various strategies specifically aimed at addressing issues identified within the research of hybrid office design. The design will be carefully

documented through a series of drawings and accompanying text, providing a detailed breakdown of the strategies employed. Furthermore, a single furniture element will be selected for deeper exploration at a larger scale as it plays a crucial role in completing the user experience of working in the space.

Through the research and design exploration, the thesis will offer an alternative approach to hybrid workplace design that prioritizes user experience and adaptability. The design exploration of a multi-storey office building and an accompanying furniture design will demonstrate how architectural interventions can address challenges associated with hybrid work models and contribute to insights into the ongoing evolution of workplace design.

HYBRIDITY

1 - HYBRIDITY

This first chapter examines hybridity in the context of the workplace. Hybridity in the office can appear in various through various ways whether it be through building design or work methods, each offering its own set of benefits. However, many offices were not originally designed with hybrid work models in mind, leading to challenges when transitioning to permanent hybrid arrangements. Solutions currently exist to mitigate some of these issues but fall short in prioritizing and enhancing user experience. This chapter will investigate these topics and identify areas where improvement is needed.

1.0 HYBRID WORKING MODEL

In the first quarter of 2020, the global workforce experienced widespread disruption as 81%[1] of employees were affected by the closure of businesses as required by the COVID-19 outbreak. In Canada, depending on the jurisdiction of an organization's operation, governmental recommendations varied from urging businesses to implement work from home policies to non-essential businesses facing mandatory closures to all their in-person operations. During this period, there was a rapid transition to remote work as organizations adapted to the new circumstances. Employees shifted from working physically in offices to either taking time off or collaborating remotely from home. Digital infrastructure was relied on to continue operations while in isolation. This immediate transition was done with the aim to enforce physical isolation measures in hopes to contain and slow the spread of a contagious virus.[2] Many of these implementations were thought to be temporary, responding promptly to rapidly evolving directives and policies. As stringent isolation measures began to ease, businesses reacted to those changes by requiring more employees to go back into their offices.

Hybridity in the workplace existed in many forms prior to the sudden adoption of a hybrid working model during the global pandemic. *Hybrid*, as defined by the Oxford English Dictionary, is: "Derived from heterogeneous or incongruous

1 Krajčík, Alshatti Schmidt, and Barath, "Hybrid Work Model."
2 Canada, "COVID-19 for Health Professionals."

sources; having a mixed character; composed of two diverse elements; mongrel."[3] From this definition, one version of hybridity in the workplace can be described as something that is structured as a mixture of two or more unrelated elements. This can be seen and recognized through the inclusion of retail spaces, residential units, transportation infrastructure, art exhibits, and public oriented space integrated within commercial office structures, as a method to create a seamless integration for the place of work into the urban fabric. Another variation is the inclusion of complimentary cafes, meditation rooms, maker spaces, and rest rooms within the boundaries of the office limited to only the staff members that work in that particular building. While the examples of those offices illustrate a complete privatized approach, co-working spaces, as popularized by WeWork and Regus, use a method that is less strict, allowing the public to book and rent access as they become available.

In another use of the term, hybridity in the workplace refers to an approach that combines traditional in-office work with remote or flexible work setups. This structure creates a new method of operation by homogenizing various elements from past practices into a cohesive, modern system. It leverages technology to bridge the gap between remote and on-site staff. "Historically, the modern office was pure in concept and singular in development. It stood apart from the rest of the city, aloof even from the local neighbourhood or district. Its forbidding facades revealed little of what went on inside and its connections with the world outside were weak. Its doors were closed, and access was guarded."[4] Hybridity breaks free from the rigid boundaries used in conventional approaches and extends the processes of the office beyond its physical

3 Oxford, "Oxford English Dictionary."
4 Myerson and Ross, *Unworking*.

confinement. It recognizes the need for providing employees with greater autonomy over their location of work, aligning more accurately with individual preferences and needs. By mixing remote work with the activities of those who are physically present in the office, this form of hybridization in its simplest arrangement is a hybrid between the people and the office, being the physical layer, and the bits and bytes, being the invisible layer, flowing into and out of the office. This connection between these layers, digital infrastructure and the internet, facilitate this flow of information connecting the physical and virtual aspects of the workplace.

As hybridity in the workplace continues to evolve, some would argue that the next iteration would be a mix between the workplace, people, and computers. Depending on the way these components are implemented, the space could continue to evolve beyond its initial formation, following the changing needs of its occupants. Certain aspects of the office can be simplified, streamlined, and decided by a computer lifting the burden off of the occupants. Given this direction, the office will transition to "the most radical combo of all— a world of augmented work in which people share the same workplace with robots and other forms of machine intelligence."[5] Less decision making and control from the occupants frees up the mind allowing them to focus their attention solely onto the day-to-day tasks.

Taking on many roles, hybridity as the role of blending workplace environments illustrates a shift in how the workplace is perceived and what it is to an individual. Regardless of an individual's location, technology is used as the intermediary to connect the physical and virtual spaces of the workplace together.

5 Myerson and Ross, *Unworking*.

1.1 HYBRID IMPLEMENTATIONS

In the context of a hybrid work arrangement, there are numerous approaches to implementation. Each approach varies with the amount of flexibility given to a worker. If requiring employees to be present in the office on a daily basis, the conventional working arrangement, is the least flexible offering little to no adjustment in an employee's personal schedule and location of work. Each method of implementation of hybrid work arrangement can be measured in relation to the baseline of the conventional. Hybrid work arrangement can then be identified as four unique types as illustrated in Figure 1.1.1 and listed below:

1. **Conventional:** If the traditional working arrangement is characterized by fixed schedules and a fixed location of work, it can be considered the least flexible, allowing little to no control to each person.
2. **Interval:** The employer has a fixed requirement on the days an individual must be present in the office, in this case Mondays, Wednesdays, and Fridays. On all other days, an individual has the option of working remotely. Already, this method represents an improvement in autonomy compared to the standard approach.
3. **Flex:** This approach provides more freedom by allowing an individual to choose which days they want to be in the office on a day-to-day basis with the only requirement of being in person for at least three days per week.

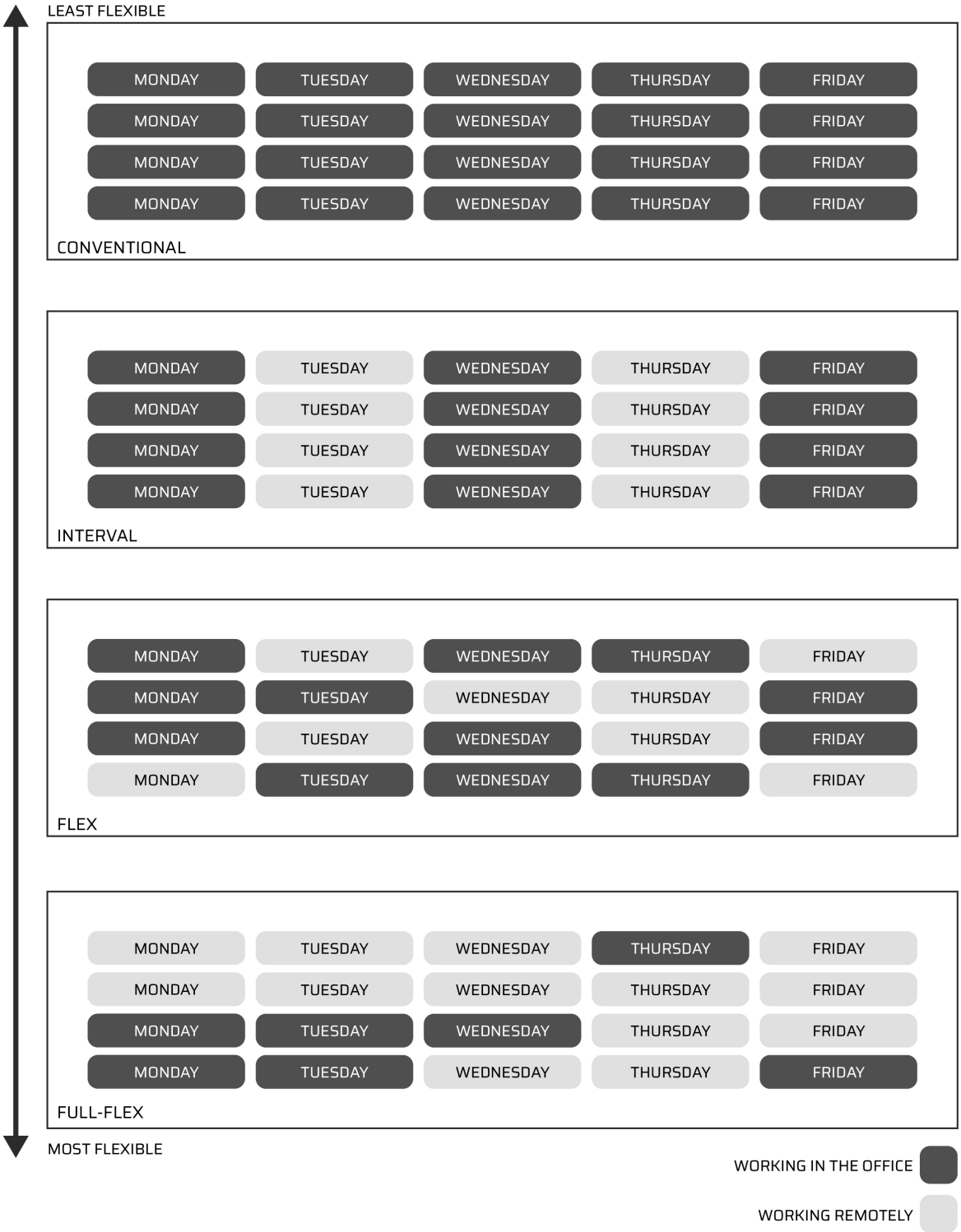


Fig. 1.1.1 Diagram of different methods of implementing hybrid work with varying levels of flexibility given to the staff member.

4. **Full-Flex:** Offers the most flexibility, by removing the requirement of a minimum number of days to be present in the office, offering the most freedom and flexibility.

Historically the majority of work in an organization of people within the same time zone occurs synchronously with the bulk of action taking place during normal working hours. In a physically co-habited environment, synchronous collaboration, people work together and engage with each other simultaneously. Synchronous collaboration is not dependent on location but entirely by time of occurrence. Collaboration that is done through a call is synchronous. Hybridity at its extreme can allow for asynchronous collaboration. With a distributed workforce, an organization can transition towards an asynchronous approach if work is structured appropriately. In practice it is similar to collaborating with people in different time zones. Basecamp, a Chicago based software company formerly known as 37signals, requires a forty-hour workweek but embraces an asynchronous approach.[6] For them, it does not matter how their employees distribute those hours throughout the week as long as they are completed. However, they do recognize that not all work can be done asynchronously.[7] Hence, there is a clear need for a well-defined structure to manage the coexistence of asynchronous and synchronous work.

The concept of work from anywhere (WFA) more accurately describes what occurs when an organization implements hybrid working over work from home (WFH). WFA provides a more accurate depiction of the flexibility and freedom an

6 Basecamp, "The 37signals Guide to Internal Communication."
7 Hansson and Fried, *Remote*.

employee has where and when they want to work. They aren't limited to simply the office or home. It is the office, home, and everything that exists in between. Certain tasks may simply be more productive or well suited to be done outside of the office. Historically, the act of keeping sensitive records of something on paper, was done externally from the office as it dealt with confidential information and required intense concentration.[8]

What many organizations initially implemented as a temporary adjustment has undoubtedly become something that will remain integral to the workplace. Prominent companies including but not limited to Shopify[9], Uber[10], Allstate[11], and Instacart[12] have embraced either full WFA or are committed to continue offering hybrid work arrangements into the future. Certain industries can transition more naturally into a hybrid environment whereas industries such as "manufacturing, bricks and mortar retail, healthcare and hospitality"[13] are not feasible to implement due to the hands-on nature of the work.

The transition from conventional office work to more flexible arrangements represent a shift in the operation of the office. The office is no longer the only physical container for work. Individuals seek for varying degrees of freedom in their schedule and location of work through flexible arrangements. As a result, it is apparent that hybridity plays a vital role in the workplace and is here to stay.

---

8 Architects Handbook
9 Kauk, "What Does Working Remotely Mean for the Planet?"
10 Krishnamurthy, "Our Return to the Office."
11 Allstate, "For Allstate, the Future of Work Is Virtual."
12 Instacart, "Introducing Flex First, Instacart's Future of Work."
13 Hill and Hill, *Work From Anywhere*.

1.2 WHAT IT AIMS TO SOLVE

The approach of providing employees with the option of working from anywhere while the organization simultaneously maintains a dedicated office for staff to gather for work provides benefits to both the individual and to the organization.

The benefits for the individual can be divided into the categories of well-being and efficiency. As the requirement for regular office attendance is reduced, employees gain greater flexibility in choosing their home location and its proximity to the office. If the office's immediate surrounding neighbourhoods are gentrified, a person may consider living further away in more affordable areas as the amount of time spent for a commute may be more reasonable when not done every day of the week.[14] Given the ongoing concern over housing affordability[15] for many individuals, the flexibility in choosing a home location alleviates unnecessary financial strain. Additionally, people can spend more time with their family or partners on a regular basis which contributes to improved overall happiness and work-life balance.[16] In many ways, hybrid work is designed for the convenience of the employee on a day-to-day basis. An employee no longer needs to rush to work, jostling for space on overcrowded

14 Hill and Hill, *Work From Anywhere*.
15 Choudhury, "Our Work-from-Anywhere Future."
16 Tran, "The Impact of Hybrid Work on Productivity: Understanding the Future of Work."

trains or navigating through traffic gridlock. They also no longer need to allocate time in the morning preparing to get to the office nor do they need to do the same just to get home. Furthermore, employees no longer need to deal with the constraints of a fixed workspace. They can vary their options from home to elsewhere throughout the week. In cases where relaxed schedules are taken to the extreme, an employee has even greater flexibility and control over their time.

For the organization, as employees feel more comfortable in their role within the organization, employee retention improves.[17] The improvement in happiness is directly correlated to level of productivity. Happier workers tend to equate to higher levels of productivity. This relationship will be discussed further in the following sections. Overhead expenses can also be reduced. As the number of employees commuting to the office decreases, organizations can streamline their expenses by adjusting costs associated with utilities, complimentary transportation, catering, and other in-office related expenses to align with a reduced usage reflecting the lower occupancy rates. The organization would become more resilient with better business continuity in case of emergency situations where work in the office is interrupted. The environmental impact of the organization

17 Hansson and Fried, *Remote*.

is reduced, as a result of fewer people commuting to the office and a smaller office to operate. Inclusivity can also be improved by making work more accessible for people with disabilities or other needs who may find commuting or working in a traditional office environment challenging.

By embracing the hybrid work model, both the employee and the organization experience benefits. An individual can allocate their time and attention more effectively, choosing where and when they want to work on each day while the organization can reduce costs and improve employee satisfaction.

1.3 MOVING TOWARDS SHARED OFFICES

For existing offices, with a reduction of the number of employees working in the office, the space becomes oversized as it was designed with the requirements for a larger occupancy. This results in the underutilization of floor area as the allocation of space per person far exceeds the average recommendation of one hundred square feet per person. These issues typically arise when organizations adopt hybrid work arrangements. This is different than in the extreme case of a complete WFA approach where the office remains completely empty.

To mitigate the inefficiencies associated with the underutilization of floor area, an organization has two options as illustrated in Figure 1.3.1. One strategy is to relocate to a different location with a smaller footprint. The new location would be designed proportionate to the maximum reduced occupancy expected on any given day. In essence, the operation would resume in the new space much like before but with a reduced number of people and with the same selection of programmed spaces, but at a reduced quantity. The other option would be to remain in the current office, but reconfigure it to accommodate two tenants rather than one. The space would be designed in a way where areas that require isolation between the organization to be private and separated, while areas such as meeting rooms and common areas to be shared between the tenants. This strategy is not limited to merely two tenants but can be increased to

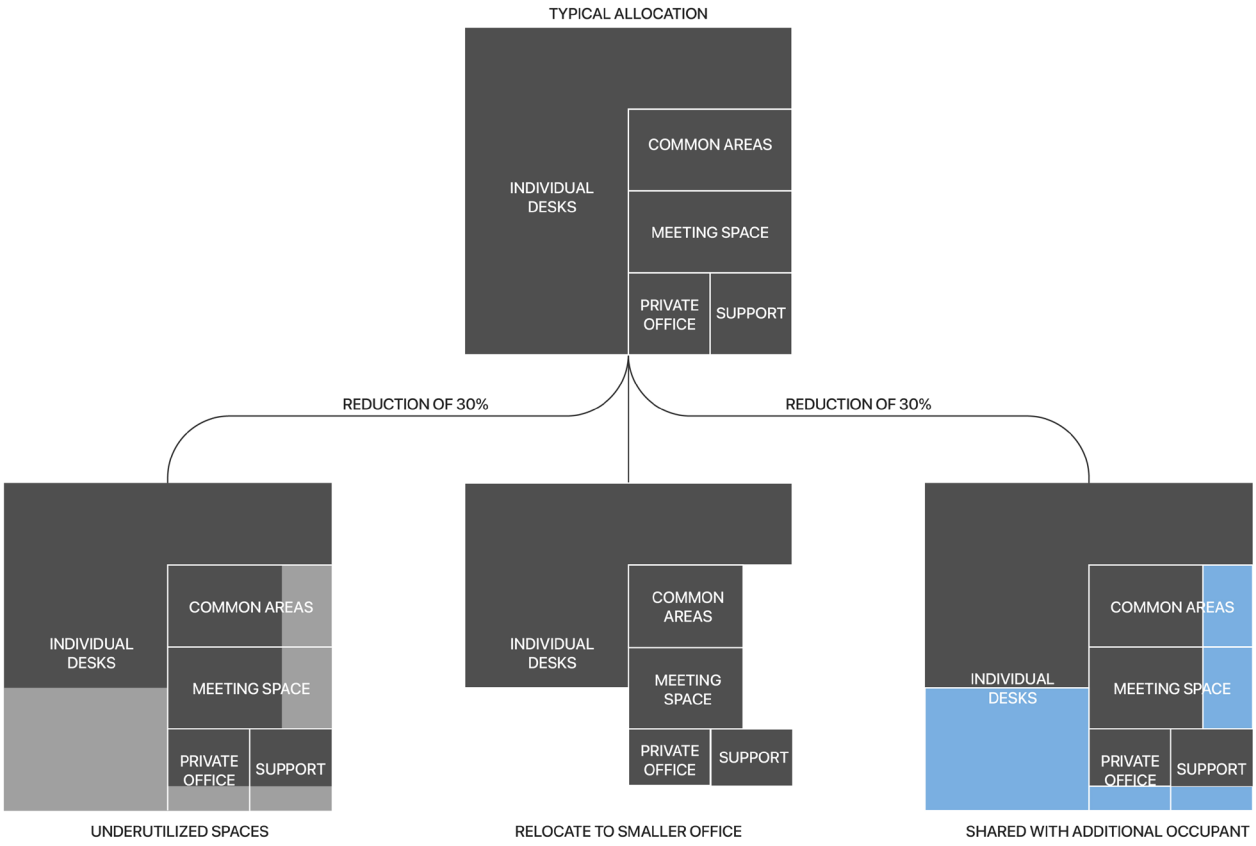


Fig. 1.3.1 Illustration of the result to reducing the in-person workforce of an office space by 30%.

accommodate greater numbers depending on the reduction or area needs of each organization. These strategies target organizations specifically looking to downsize their existing space.

Both of these strategies necessitate rethinking the traditional allocation of individual spaces, which were previously designated for single occupants. As that approach would no longer be viable due to it being the primary cause of inefficiency, individual private offices and workstations that were previously assigned would instead be shared and booked as they become available throughout the week. As a result, implementing hot desks, a strategy for sharing desks, has become imperative. Meeting rooms with a typical utilization rate of 40%[18] are amongst the least performant spaces in an office. However, this rate can be improved when multiple tenants share the rooms, filling in the slots that would otherwise be unoccupied.

18 Robin, "How to Calculate Office Space and Meeting Room Utilization."

1.4 HOT DESKS

When hot desks are implemented, the employee is given the choice of where they want to be seated inside the office. A person may be limited to options within a particular zone or be allowed to choose any seat available. The primary objective is to allow an organization to operate within a smaller space but employ the same or larger number of employees.[19] Scenario number one in Figure 1.4.1 illustrates what a person may be presented with as a representation of available seating on a specific Monday. They would then choose the seat that would be their most preferred (Figure 1.4.2). When the employee decides to come into the office again on a Thursday, scenario number 2, the seat they had previously chose is unavailable (Figure 1.4.3). From the remaining available options, they would then choose their most preferred seat (Figure 1.4.4). At a glance, the issue of constant change in immediate surroundings may not be prominent. However, when this is multiplied over an extended period of time (Figure 1.4.1), it can lead to a sense of chaos, disruption, and the challenge to adapt to new surroundings every time.

The emergence of hot desk booking applications began in the early 2010s, from companies such as OfficeSpace Software and Robin Powered. However, the demand for these applications grew significantly during the COVID-19

19 Bishop, "What Is Hot-Desking and What Are the Benefits?"

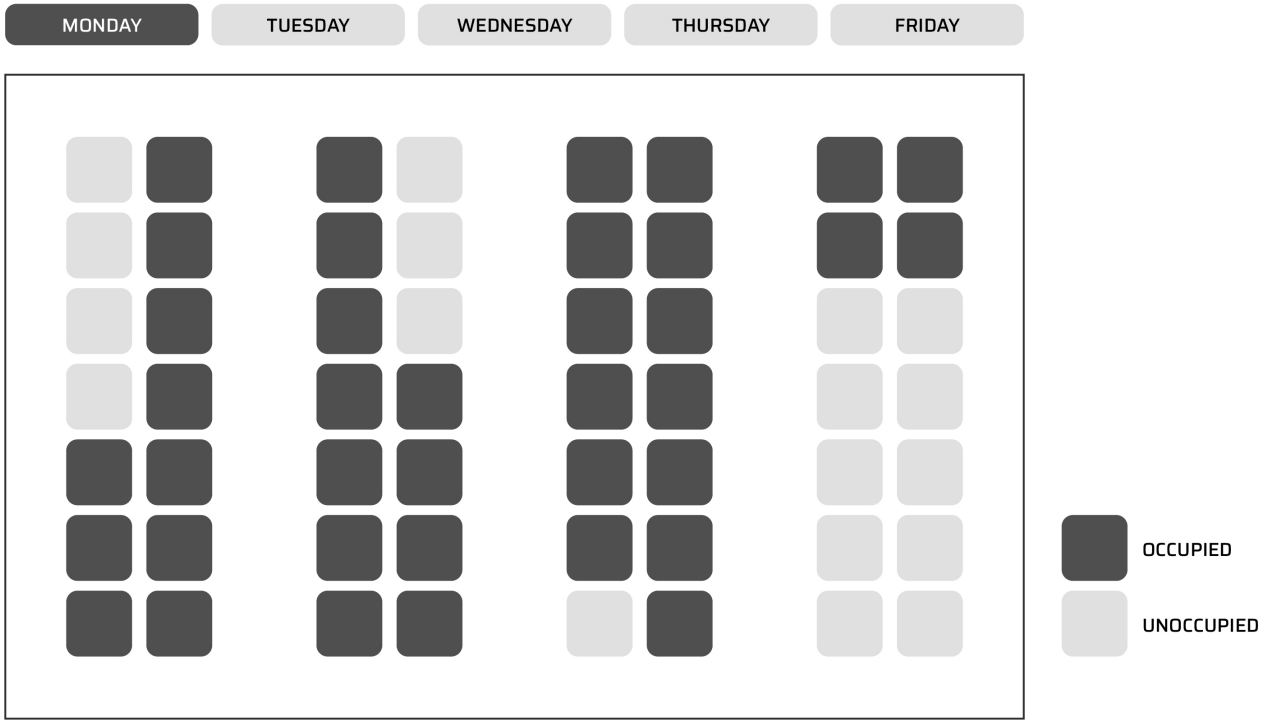


Fig. 1.4.1 Scenario 1 diagram of seat availability on a Monday of an example seat layout.

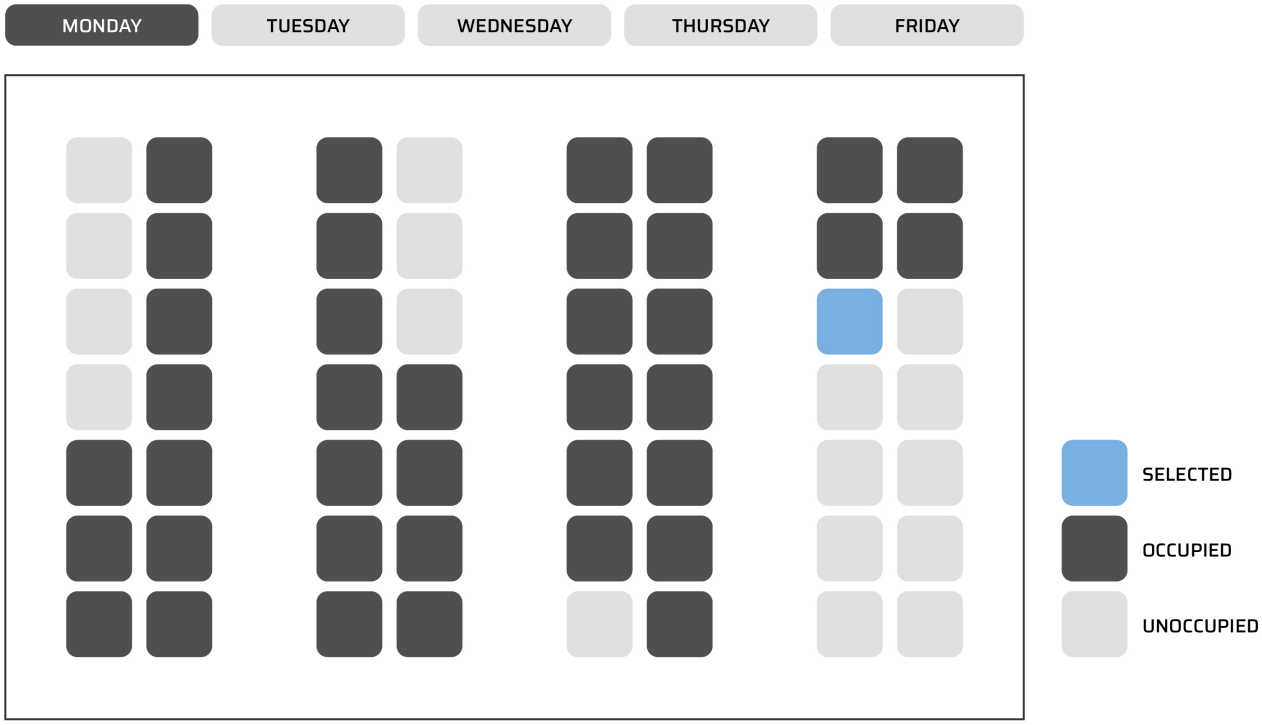


Fig. 1.4.2 Scenario 1 diagram of seat selected on a Monday given what is available.

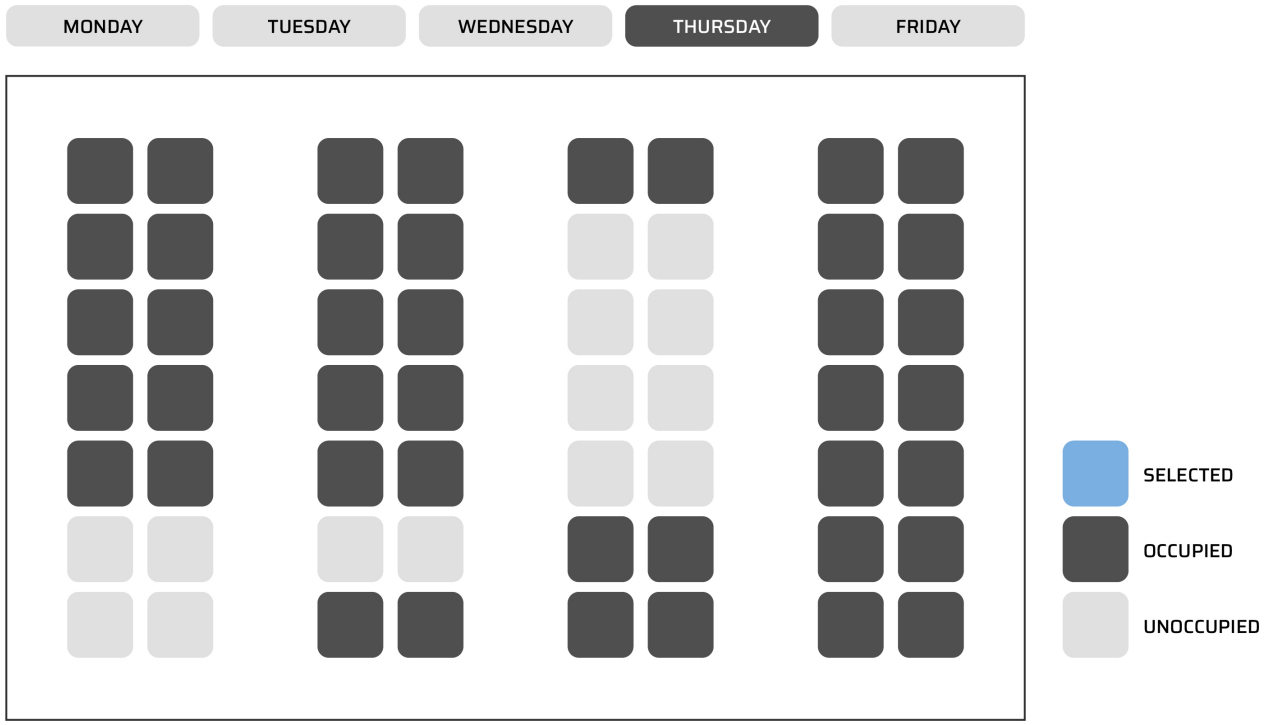


Fig. 1.4.3 Scenario 2 diagram of seat availability on a Thursday of an example seat layout.

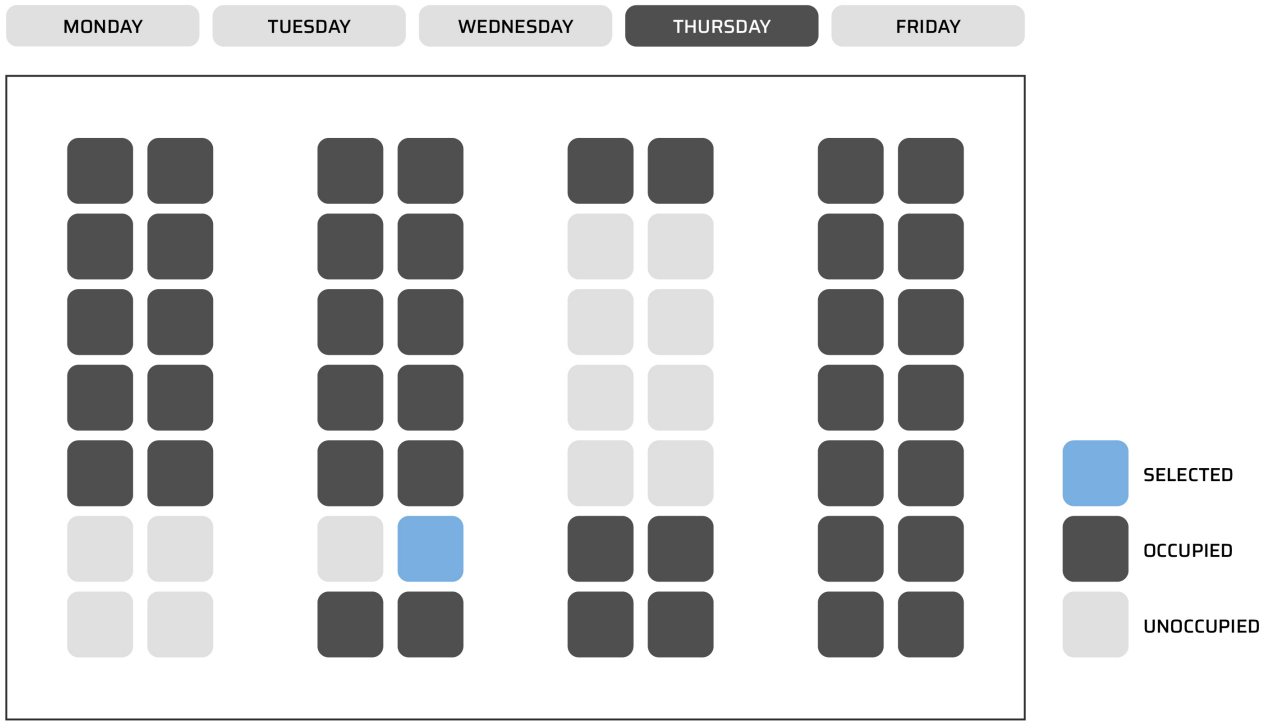


Fig. 1.4.4 Scenario 2 diagram of seat selected on a Thursday given what is available.



Fig. 1.4.5 Illustration of the chaos if a person sits at a different location in the office everyday for an extended period.

pandemic.[20] These applications streamline the desk sharing process, ensuring that employees can easily reserve and manage their workspace in a flexible and organized manner. Furthermore, many of these tools update a map of floor plans, in real-time, allowing users to book spaces as they become available.

In many ways, the approach of sharing spaces draws similarities with public seating norms in cafés, libraries, and hotels. A person would either come into a space and choose what is available or depending on the location, they may be able to book a space before their arrival, guaranteeing an available seat or amenity that would be most aligned with their personal preferences given what is available to choose from. This method of removing the permanent designation of space, furniture, or zones to individual people demands a departure from traditional, permanent office infrastructure. Spaces need to be well suited for the variety of people that may be using them. Consequently, many of these spaces then become designed in a way that is generalized, catering to the varied preferences of the workforce. This approach to a generalization in design draws similarities with exhibition, theater, and hospitality design where permanent infrastructure is complemented with that of temporary or transient infrastructures.[21] Spaces used in those sectors are designed with the objective to start at a basic or universal state and be allowed to become easily reconfigured into something else to make it more useful and productive to the people using it. For theater, depending on the performance, they typically require unique lighting conditions and sets. Likewise, exhibitions spaces typically have no permanent partitions, allowing temporary partitions and walls to divide the space uniquely.

20 Robin, "Human-First Hybrid Work Software | Robin."
21 Ching, *Interior Design Illustrated*.

In the case of hotels, most elements are permanent, however the temporary aspects include the person themselves and the objects that they bring in.

This chapter explored the concept of hybridity in the workplace through an examination of its various approaches and implementations. While hybrid work models offer benefits for both the employee and the organization, many offices were not originally designed to accommodate such arrangements. As a result, this along with new challenges associated with this method of operation has led to challenges in transitioning to permanent hybrid structures. Areas such as the design of the workplace and strategies for implementing hot desks and shared spaces should be improved on to better support hybrid operations.

OFFICE LAYOUTS

2 - OFFICE LAYOUTS

This chapter covers the evolution of office layouts and analyzes the strengths and weaknesses of each design approach. Architectural case studies have been included for each key transition in office design trends. It concludes with an exploration of the recent “neighbourhood” strategy in office design with multiple architectural examples that demonstration unique methods of implementation of this approach.

2.0 OPEN OFFICE

The start of dedicated office spaces for banks and many other major businesses first appeared in the 18th century.[1] The start was initiated by the possibility for many people in different areas to come together in a central location by the means of newly constructed railways, connecting people from all around. These early offices started out as large open-plan layouts with many rows of desks placed tightly inside. This partition free space was created to allow for the ease of surveillance of what the employees were doing within the space.[2] However, managers and other executives, had their own dedicated rooms, which were designed similar to that of a home office. This created separation amongst the workforce, as the status of employees can be visually seen based on the amount of privacy and space they had given to them.

The open-plan office layouts were designed to make the office better by breaking down the social walls that divided people. The best approach to do this was to remove the physical walls and partitions that isolated people from one another. Frank Lloyd Wright had strong opinions against the rigidity and confinement of walls that they imposed into a space.[3] An open space would in theory provide more flexibility

1 Pickard, *The Architects' Handbook*.
2 Pickard, *The Architects' Handbook*.
3 Wright, *The Future of Architecture*.



Fig. 2.0.1 Photo of atrium at the Larkin Administrative Building, Buffalo, New York, 1906. Photo from Larkin Company Photograph Collection.



Fig. 2.0.2 Photo of typing department at the Larkin Administrative Building, Buffalo, New York, 1906. Photo from Larkin Company Photograph Collection.

and the push towards a complete open-plan layout was also driven by the practical benefit of its density, allowing the maximum number of people to be accommodated within a given space. The Larkin Administration Building in 1906 by Frank Lloyd Wright featured large open floorplans with the desks of employees placed tightly together (Figure 2.0.1 & Figure 2.0.2). Employees were grouped together in large open areas which allowed for improved supervision by their managers. The arrangement was seen commonly in offices, particularly for typing pools. This layout allowed for efficient allocation of space with compromises made to personal space and privacy.

The first expression of an office layout where the individual experience was the focus rather than the optimization of space was in the Quickborner's office plan as show in Figure 2.0.3. Wolfgang Schnelle and Eberhard Schnelle from Quickborner pioneered the Bürolandschaft or office landscape movement which took the rigid and strict office layout norms and transformed it into something that was smooth and organic to increase the sense of community and ownership over personal space. Smooth spaces with rounded design elements are correlated to improving creativity.[4] Instead of the placement of workstations adhering to a rigid pattern of rows and columns, they were positioned throughout the space at different orientations without following a specific organizational pattern or grid. Although the plan may have looked unorganized, people found a way to create order within it by sitting in clusters. A circulation path can also be seen which flows freely through the space connecting the smaller groups together. While this approach aimed to provide each individual with a more accurate personal space

4 Wu et al., "Rounded or Angular?"

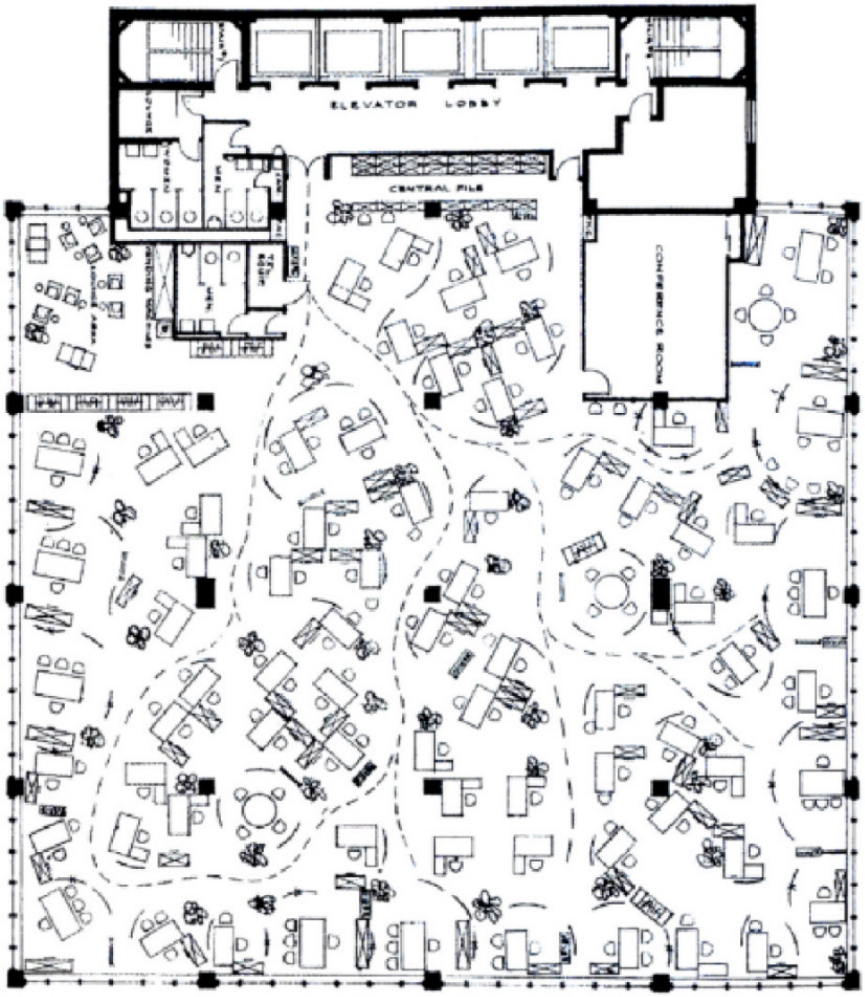


Fig. 2.0.3 Quickborner's office landscape plan. Drawing by Quickborner's team.

aligned to their role's needs, Kaufmann-Buhler would argue that, "even as the open plan projected an image of greater inclusivity, hierarchy was always an integral part... that codified and reinforced positions, priorities and preferences of those in power."[5]

The Bürolandschaft movement, sought to provide occupants with greater autonomy and control over their own space while offering a variety of options to cater to unique individual preferences. People naturally tend to want control over their working area as it will increase comfort, allowing for improved productivity. This natural inclination can be observed to occur commonly in spaces that are designed to be public such as the seating areas of cafes (Figure 2.0.4) and libraries (Figure 2.0.5). The designer simply designates zones for people to sit in and it is up to the occupants to then subdivide and transform the zone based on the amount of space they need and the number of people they need to share it with. These subdivisions which change throughout the day occur without effort but are integral into allowing a person to feel settled into a foreign space.

The case studies covered in this section each demonstrate a balance between organizational efficiency with human tendencies such as control over one's own workspace. These two factors appear correlated with each other. When organizational efficiency increases, the human qualities of the space decreases.

5 Drucker, "Knowledge-Worker Productivity."

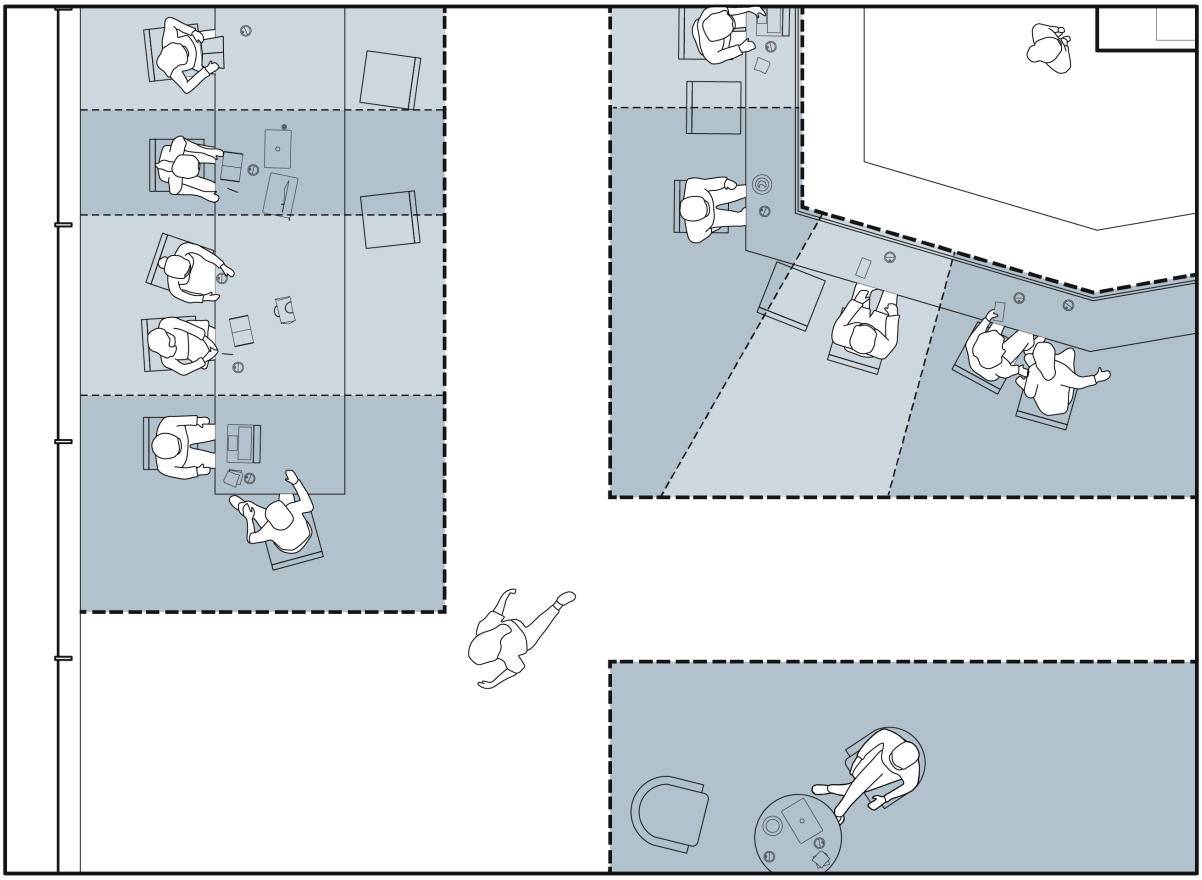


Fig. 2.0.4 Partial floor plan of a Starbucks in Don Mills revealing subdivisions of the space created by users.

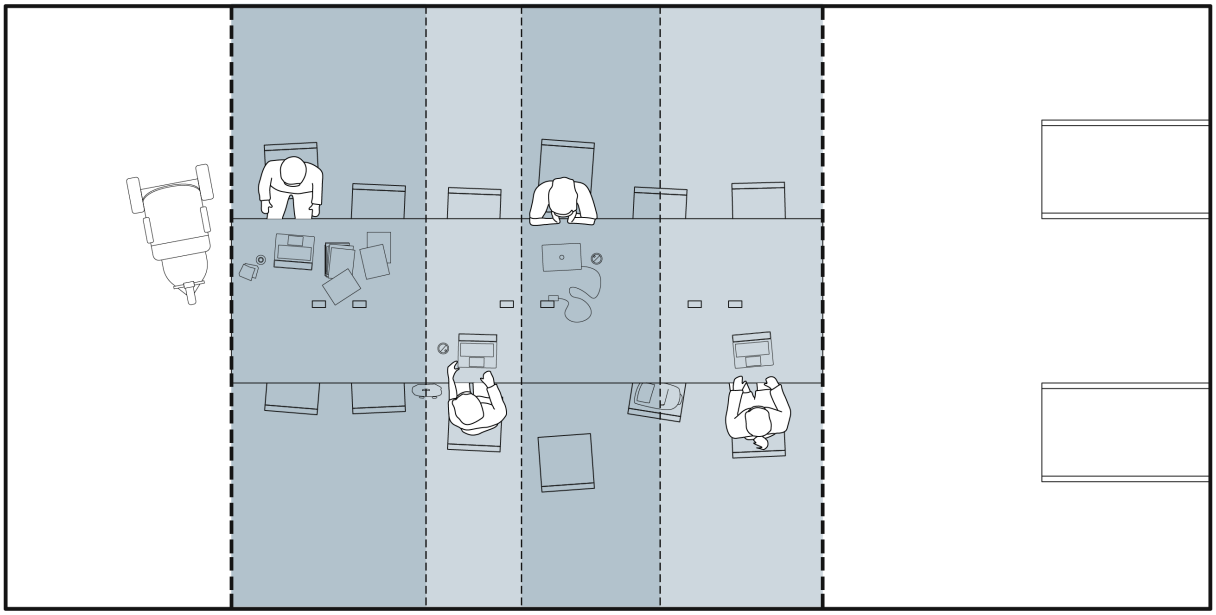


Fig. 2.0.5 Partial plan of Toronto Public Library revealing subdivisions of the space created by users.

2.1 CLOSED OFFICE

One of the primary issues with the open-office layout, similar to those of Quickborner's, was the lack of privacy and personal space each employee had. The office cubicle was created as part of the Action Office system (Figure 2.1.1) subsequently followed by Action Office II (Figure 2.1.2) and Figure 2.1.3), designed by Robert Propst for the furniture company Herman Miller in the 1960s[6]. It sought to offer privacy by converting existing open office spaces. Distractions are cut off and concentration levels are maximized, which would in turn boost efficiency and decision-making due to having a clearer and relaxed mind.[7]

There are however some drawbacks with near total privacy in the office. It is evident that people who are isolated and restricted to their own cubicle for long periods of time during the day may encounter feelings of discomfort, constraint, and a sense of burden.[8] For those in management positions, overseeing each team member becomes more challenging as they are now dispersed into their own cubicles and concealed from direct view. Moreover, closed offices tend to be associated with a higher setup cost due to the additional pieces of furniture required and the amount of floor area

6 Pickard, *The Architects' Handbook*.
7 Muzaffar, Noor, and Mahmud, "A Comparative Study on the Impacts of Open and Closed Office Layouts Towards Employees' Perceived Productivity."
8 Naish, "Open Office vs Closed Office."



Fig. 2.1.1 Action Office I Robert Propst, George Nelson, 1965.



Fig. 2.1.2 Action Office II Robert Propst. Image from WSJ.



Fig. 2.1.3 Action Office II, Robert Propst. Image from Herman Miller Archives.

needed to be allocated per person. Poor utilization of space results in higher operating costs.

The introduction of the office cubicle system represented an attempt to provide privacy to each individual not possible before. While successful in creating privacy, they resulted in challenges related to isolation and the loss of communication between team members. It is apparent that neither extreme, completely open or enclosed spaces, are the ideal solution, necessitating a more nuanced approach.

2.2 RETURN TO OPEN OFFICE

Many of the drawbacks of the closed office led to a shift in the late twentieth century back to open-plan office layouts but with slightly less density to give employees more personal space. The office cubicle, while rare in new office buildings, does still exist in a new form in smaller numbers called “pods” offering many of the same privacy focussed features. The open floor plan gained popularity because it significantly reduces the setup costs for companies while also maximizing the use of space available.[9]

The Foster & Partners Headquarters in London, designed by Foster + Partners and completed in 1990 utilizes a reimagined open office layout. The space contains long, uniform rows of desks, with more space allocated to each person than was typical in open offices of the past as photographed in Figure 2.2.1.

The revamped open office drew insights from the privacy and space allocation of traditional cubicles. In this approach, uniforms rows of desks returned but with the addition of low height dividing panels in between workstations, effectively breaking the work surfaces between employees seated across from each other. Employees were spaced further apart, increasing the amount of personal space each employee had.

9 Herman Miller, “How to Bring Focus Back to the Open Office.”

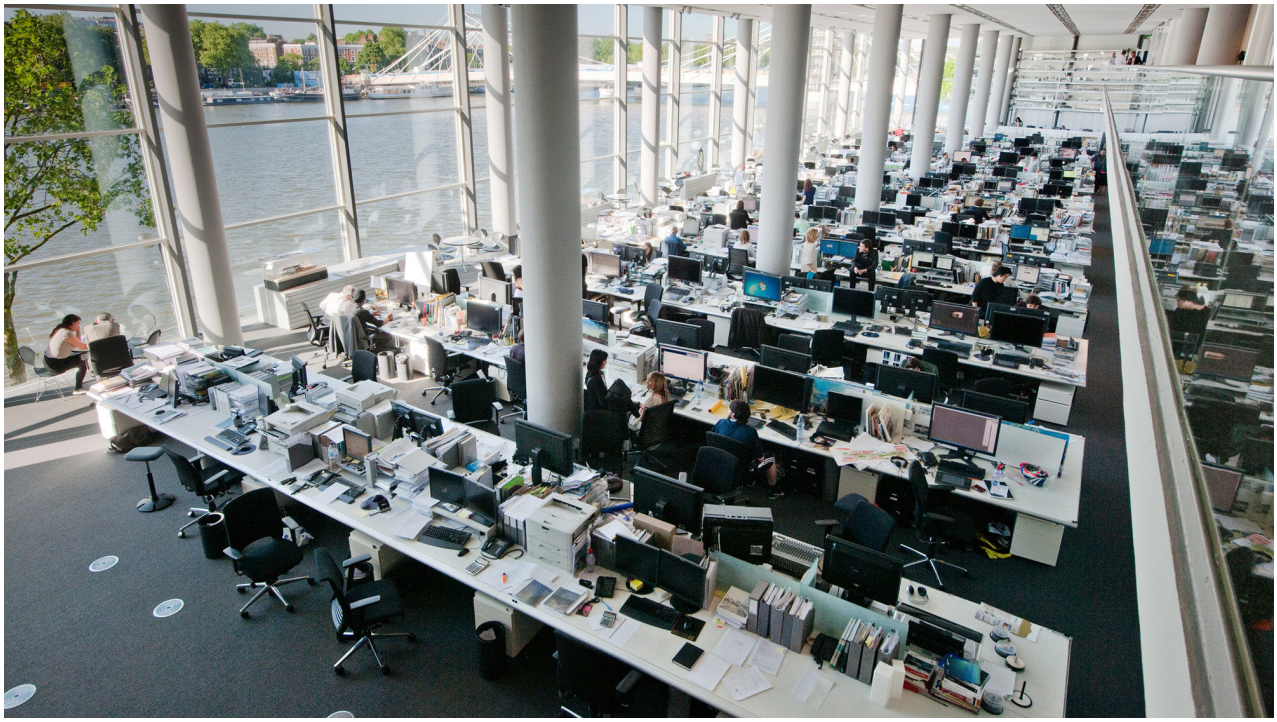


Fig. 2.2.1 Photograph of the Foster & Partners Headquarters in London. Photograph from Foster + Partners.

2.3 OFFICE NEIGHBOURHOODS

The neighbourhood concept can be seen as a hybrid between an open office layout and one that is closed. It addresses the main issues presented in each form while maintaining their primary benefits. Drawing from the closed office model, it addresses personal privacy concerns of the open model, by recognizing the importance of individual space for improved concentration. It caters to this through the use of smaller groups of spaces, called neighbourhoods, over a single large space with many rows of desks. It combines both the enclosed and open spaces to maximize the benefits from both. Each neighbourhood is designed to accommodate a single team allowing for streamlined communication between key members, without the distraction from other groups. The probability of meaningful spontaneous interaction between employees in an office is dependent on the distance between them and their colleagues. A team that works entirely remotely has little to no chance of spontaneous interaction. However, even within the open office plan, it does not promote this type of interaction either. Utilizing a hybrid model with office neighbourhoods can increase the probability of spontaneous interaction. It is found that placing people into smaller and more confined groups promote more interaction. By simply adding dividers into a space, it can increase the number of interactions by fifty percent due to the balance

between visibility and proximity.[10] The absence of defined boundaries can potentially result in the space feeling too expansive. This may lead to individuals feeling disconnected from one another rather than part of a cohesive group.

Much like neighbourhoods that can be seen in the city which have personal spaces such as homes and shared spaces like parks and squares, neighbourhoods in the office offer the same to support different types of work. These spaces can be build community within the office as "a place where people bond around shared values, feel valued as human beings, and have a voice in decisions that affect them"[11]. While in some office environments each neighbourhood is designed identically to one another, offering the same number of desks, meeting areas, and storage, neighbourhoods can also be tailored to the needs of certain teams. In scenarios where employees have specialized equipment requirements, having identical neighbourhoods throughout would not be appropriate. Employees can decide when, where, and how they would like to work within the neighbourhood. Each employee can choose the space that works best for them based on what they need to complete. Variation of work environments give each person flexibility on how they would like to work, recognizing the differences in work preferences and tasks. Having the choice to choose the type of space to work in helps stimulate the brain, enhancing focus and supporting longer attention spans for improved productivity. When collaboration with other teams is needed, collaboration spaces would be available to choose from, or neighbourhoods can merge to encourage the flow of information between teams.

---

10 Ethan Bernstein, Ben Waber. "The Truth About Open Offices".

11 "The New Hybrid Neighborhood."



Fig. 2.3.1 Interior photograph of Centraal Beheer Insurance Building. Photograph by Willem Diepraam, Aero Carto Aviodrome and Herman van Doorn from AHH.

The emergence and experimentation of something similar to modern neighbourhoods in office design can be seen early in the Centraal Beheer Insurance Building (Figure 2.3.1) that was designed by the architect Herman Hertzberger and completed in 1972. His design focused on the occupant, approaching it at a detailed human scale. It utilized a dedicated primary circulation space, defined as the 'street concept'[12], which aided with creating a greater sense of community. The street included both narrow circulation spaces to as large as the central atrium. These streets were not considered to be office space, rather it would be used for the purpose of supporting communal activities and spontaneous interaction.

Herzberger's solution offered more privacy by dividing the space up into smaller chunks of 56 modules, similar to the neighbourhoods being used today. Each person within these larger modules would receive their own personal unit as illustrated in Figure 2.3.2, but with slightly less privacy than cubicles. However, the compromise would allow for more

12 Pickard, *The Architects' Handbook*.

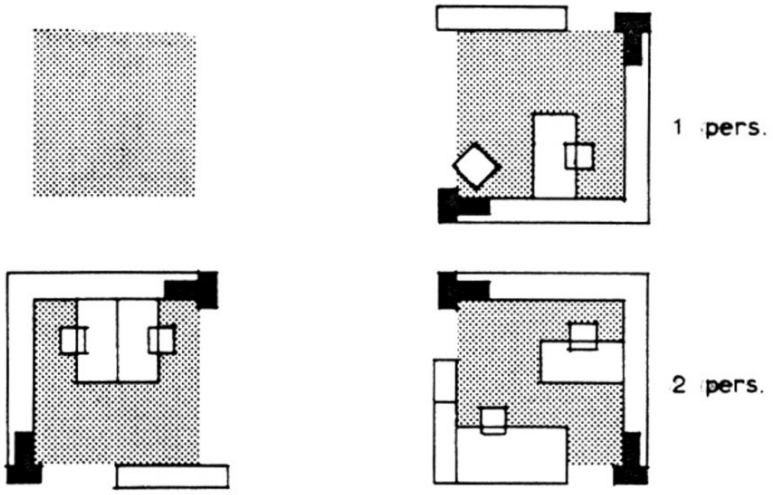


Fig. 2.3.2 Illustration of working zones used in the Centraal Beheer Insurance Building by Herman Hertzberger. Drawings from AHH.

meaningful interaction with people around within the smaller groups. By design, it enabled each employee to have more control of their own area, offering the additional benefit of being able to decorate the space as desired and relocate furniture as needed. Furthermore, changes made to one block are independent from others, allowing for frequent adjustments to occur.[13]

The AirBnB's Dublin office as show in Figure 2.3.3, designed by Heneghan Peng Architects and completed in 2016, uses a neighbourhood system throughout the building. People are free to move around the space and work where it best suits them.[14] Each neighbourhood contains the same ratio of furniture to storage. A landing space is designed into each neighbourhood to promote spontaneous interaction with people passing by.[15] Dedicated locations are available for

13 Hertzeberger, *The Future of the Building "Centraal Beheer."*
14 Heneghan Peng Architects, "AirBnB EMEA Headquarters, The Warehouse | Dublin."
15 Searer, "Airbnb Offices - Dublin."

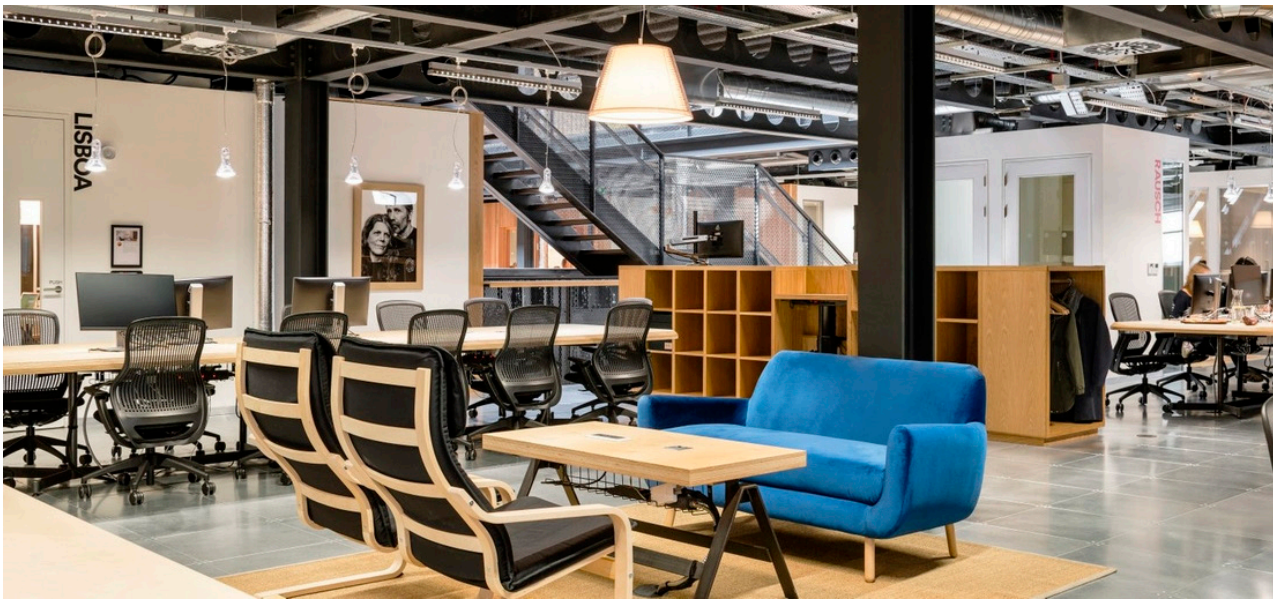


Fig. 2.3.3 Airbnb Dublin Headquarters. Photography by Donal Murphy.

people to place personal items on display, turning the foreign space into something more personal and home like.[16] The placement of each neighbourhood allows for a variety of options for users to choose from. While efforts of creating a dedicated location for personal items to be displayed are present, this still ties down the employee to a single area and restricts them from the goal of allowing employees to move around freely in the office and work at different locations. This space necessitates a consistent configuration, leaving it devoid of personalization. As such, it cannot create an equal experience to a space where dedicated workstations are assigned.

The Green Room, Figure 2.3.4, designed by Space Encounters completed in 2020 utilizes planted dividers to create a visual and physical separation in the office floor plan.[17] The dividers are placed within the space to separate

16 Heneghan Peng Architects, "AirBnB EMEA Headquarters, The Warehouse | Dublin."

17 Levy, "Space Encounters Uses Planted Partitions to Divide



Fig. 2.3.4 Green Room by Space Encounters. Photography by Peter Tijhuis.

circulation from areas of work in addition to neighbouring clusters of desks. The permeable quality of the divider allows light to penetrate into deeper areas of the space while adding a sense of privacy and colour into the place. This design element enhances the overall atmosphere by bringing in natural elements to create a calming environment, while maintaining a crucial balance between openness and seclusion in the workplace.

Macquarie Bank by Clive Wilkinson Architects (Figure 2.3.5) utilizes the organizational principles of a neighbourhood layout. It adopts an activity-based-work environment where throughout the entire space, on each floor, there are an abundant of places to work. Many of these spaces offer unique characteristics to suit different work styles. Within months of the building opening, it was recorded that 55% of their staff change the location of where they work each day.[18] This variety exists within each individual neighbourhood.

Synchroon's Utrecht Office."

18 Archdaily, "Macquarie Bank / Clive Wilkinson Architects."

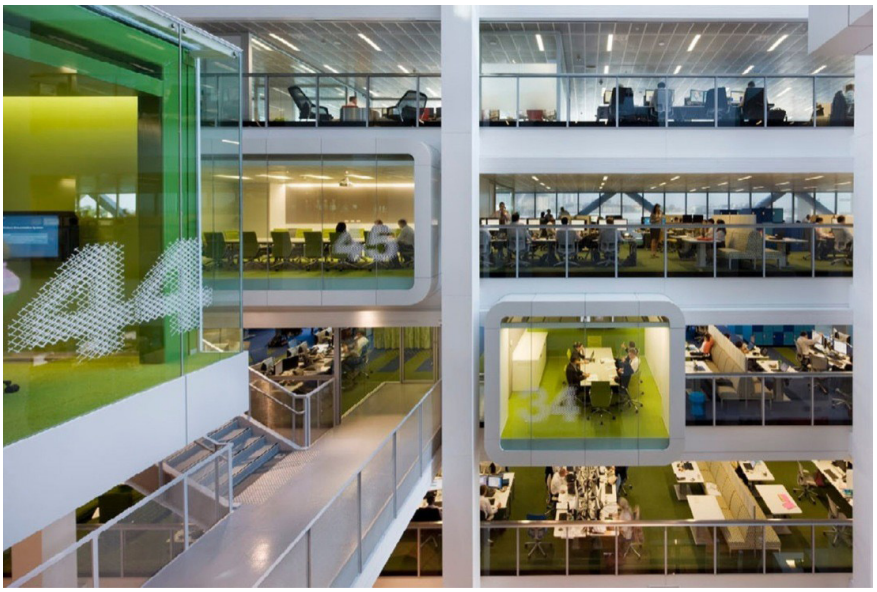


Fig. 2.3.5 Macquarie Bank by Clive Wilkinson Architects. Photography by Shannon McGrath.

The separation of neighbourhoods is achieved through the modulation of both physical and visual elements. Neighbourhoods sharing the same floor can be distinguished by the use of varying colours for the carpet, walls, and furniture as illustrated in Figure 2.3.6. Furthermore, areas that are designated for circulation, which bridge separate neighbourhoods together, use patterned carpet to create a clearer visual distinction between areas for movement and zones for working. Within neighbourhoods, privacy between coworkers of the same team is achieved through the placement and orientation of groupings of desks. Unlike what is typically found in offices, rows of desks repeating linearly through the length of a space, desks are placed in smaller clusters varying from groups of two to eight with ample space in between. Additionally the orientation of these groupings are rotated by ninety degrees throughout the neighbourhood. The combination of smaller groupings and varied orientations help break up the space and offer more privacy to each individual. This departure from the rigid linear layouts traditionally found in office design encourages more meaningful collaboration

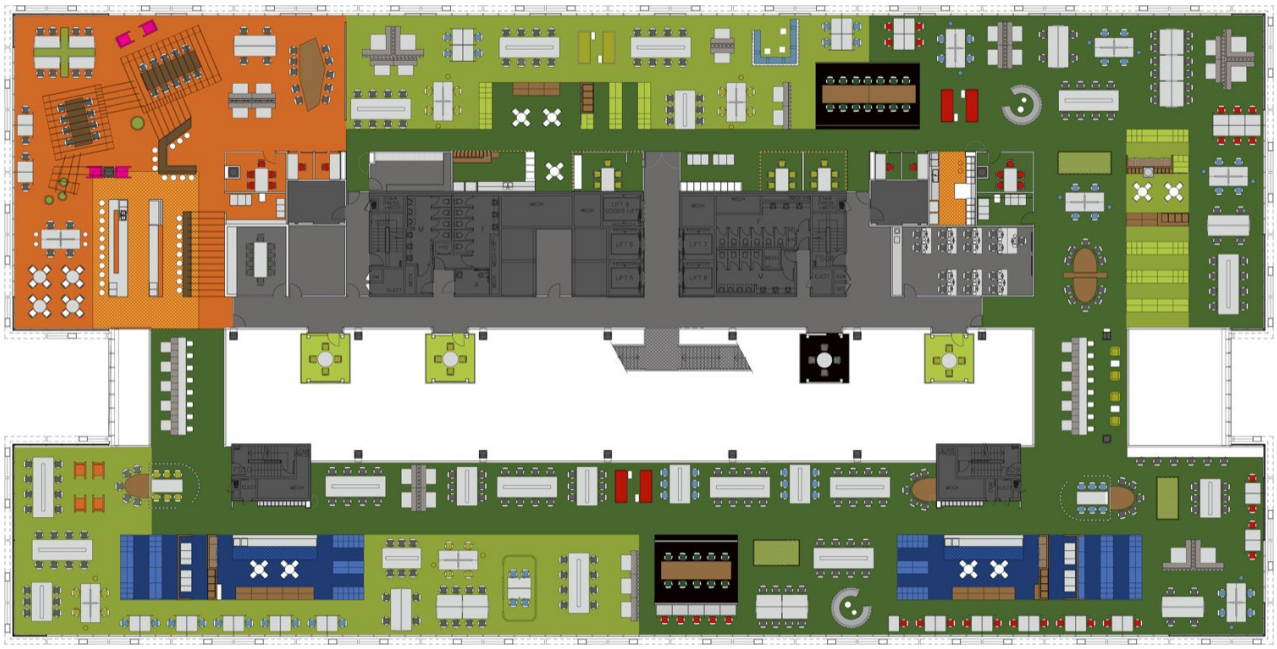


Fig. 2.3.6 Level 6 floor plan of Macquarie Bank by Clive Wilkinson Architects. Drawing by Clive Wilkinson Architects.

within the smaller groupings when necessary. The separation between groupings help ease distractions from the activity of one group affecting another. These groupings are crucial to subtly delineate secondary boundaries while maintaining the formation of a larger neighbourhood.

Communal areas located in designated areas on each floor in addition to the complete assignment of the ground floor help promote spontaneous encounters between employees from different neighbourhoods. Certain programs that have been included to promote this interaction include playrooms, coffee houses, dining areas, and meeting spaces cantilevered into the central atrium which they call tree houses.[19] These communal areas are included in addition to dedicated collaboration spaces within each neighbourhood.

The evolution of office layouts shows an effort to balance privacy, collaboration, and employee well-being. Each major iteration of the office layout has positioned itself to address the shortcomings of previous versions. The current shift towards an office that prioritizes meaningful interaction amongst smaller groups with use of neighbourhoods combines the benefits of both open and closed layouts. This approach also recognizes the diverse needs of employees to improve productivity and employee satisfaction. Effective office design should be adaptable and flexible, provide a balance between space efficiency, privacy, and employee comfort.

19 Clive Wilkison Architects, “Clive Wilkinson Architects | Macquarie Group, One Shelley Street.”

USER

3 - USER

This chapter covers the importance of providing users in the office with the ability to personalize space and how it relates to familiarity. Then it will explore the role of reconfigurability in the workplace with architectural case studies implementing this in unique ways. The psychological importance of habits and routine will be discussed and how they are essential to ensure productivity in the workplace. The chapter concludes by discussing how modifications to the space can occur automatically, without requiring manual input, emphasizing the importance of seamless, intuitive adaptations.

3.0 FAMILIARITY & PERSONALIZATION

The concepts of familiarity and personalization, particularly within the area of the personal workstation, are crucial at creating an environment that is both comfortable and productive.[1] Depending on the role of the employee, the personal workstation is where individuals spend the most significant portion of their day. For that reason, these spaces should be designed with greater care to reflect the personal preferences and functional needs of the user. However, in a hot desk model, assigned workstations are replaced by ones that are shared and booked by staff members. As such, these desks are designed to be generalized to be able to accommodate any user. Personalization in this case is limited as these workstations would need to be returned to their original setup manually at the end of the day, ensuring they are ready for the next user.

In the scenario where personal workstations are used, users would naturally have it set up and personalized in a way that works best for them, making it familiar and recognizable as their own when they come back to work every time. Familiar elements, whether through colour schemes, arrangement of personal items, or even the adjustment of the furniture itself, create a sense of ownership and ease. Personalization does not need to be extensive to make improvements in

1 Lindberg, Tran, and Banasiak, "Individual Differences in the Office: Personality Factors and Work-Space Enclosure."

both comfort and productivity. Employees who place even a single plant or photo in their own space has been correlated to 15% improvement in productivity. [2] Those who have full control over the personalization of their space can see a 25% improvement in productivity.[3] If personalization through adding personal items can increase productivity, then empty bare desks, commonly a result of implementing hot desks with single-user workstations, limit efficiency and the quality of work an employee is capable of. Working in a space that is familiar, creates a sense of identity to the place and naturally makes people happier and work more efficiently. Providing control over a shared space to staff will boost happiness. Happier people tend to be more optimistic, which has the probability of resulting in greater success as being positive allows a person to see more possibilities and ways of doing something.[4]

Gustav is a product that was designed to address the personalization issues associated with shared desks as a result of implementing hot desks (Figure. 3.0.1).[5] The desk's adjustable features, including a built-in laptop stand, are designed to meet each user's ergonomic needs, enhancing comfort and well-being. Customizable lighting and accessory integration allow users to curate a workspace that reflects their personality and work style. This personalization aims to create a sense of ownership, boosting productivity.

Mediated Atmospheres (Figure 3.0.2), focuses on enhancing the experience of working while seated at a desk, by the

2 Borzykowksi, "What's so Wrong with Dressing up Your Desk?"
3 Borzykowksi, "What's so Wrong with Dressing up Your Desk?"
4 Groves and Marlow, *Spaces for Innovation*.
5 Gustav, "The Power of Personalized Workspaces."



Fig. 3.0.1 Mobile desk organizer designed by Gustav. Photo from Gustav Concept.



Fig. 3.0.2 Mediated atmospheres with different atmoshperic scenes. Photo by Nan Zhao.

Responsive Environments group at the MIT Media Lab utilizes biosignal sensors, devices that detect and measure physiological signals, like heart rate, brain activity, or muscle movements, from the body to automatically initiate changes within the space with the intent to help users remain focussed while they work. The system triggers changes through the use of lighting effects, sound, climate control, smell, and images displayed in the room. Much like how Spotify recommends music based on a user's listening history, this project aims to optimize a person's space by offering the most effective configuration at the right time.[6]

The Edge is a forty thousand square metre office building located in Amsterdam's Zuidas designed by PLP Architecture and completed in 2015 (Figure 3.0.3). This building leverages smart building infrastructure technologies to enhance the usability, efficiency, and comfort for occupants in the building. The design for the building was done in hopes of accelerating a transition to smart building design.[7]

At its core, the building's user experience is interconnected through a mobile app specifically developed alongside the building. The experience of working there starts before an employee leaves their home. It provides a schedule for the user to know where they should be throughout the day. At the Edge, there are twenty-five hundred workers but only a thousand desks and not a single one is permanently assigned. However, unlike other offices where a hot desk approach is implemented, users at the Edge do not choose where in the office they would work that day. As the application is aware of a person's daily tasks and schedule, it will automatically

6 Lab, "Mediated Atmosphere."
7 Carl, "The Edge, Amsterdam, The Netherlands."



Fig. 3.0.3 Photograph of the atrium at the Edge designed by PLP Architecture. Photograph by Ronald Tilleman and Horizon Photoworks.

assign a location to the employee for each day of work.[8] These spaces may be a normal single person workstation, concentration room, meeting room, a private work booth, or a balcony seat. The space is entirely dependant on what the app computed to be the best match for the type of work a person has when optimizing allocation of seats.

Within the app, each employee can create a personal profile that includes data reflecting their specific preferences, such as lighting and temperature settings. With these parameters set, as users move from space to space, the building will automatically change the environments to reflect the settings in the profile if available.[9] For this to work effectively, recognition of where a person is in the building would be needed. The Edge does this in several ways, depending on the purpose of the identification. To know which space a person is in, the app utilizes the planned schedule of the user. As another scenario, for identifying users who drive to the office, the building has sensors that can identify vehicles to let the employee know where to park as they arrive. The integration of the user experience in the office extends down to minute details such as coffee machines knowing the exact type of drink is preferred by the user. Without a permanent seat in the office, personal items become a challenge as employees move around during the day. Lockers placed in the office aim to solve this issue. These lockers are connected into the system as well. Each locker has a green LED to convey its availability. To use the lockers, employees would present a badge to the locker. The app then knows which locker is being used by that specific employee. If an employee leaves

8 Tom Randall, "The World's Smartest Office Building in the World."

9 Tom Randall, "The World's Smartest Office Building in the World."

the office without emptying their locker, they will receive a notification to remind them to clear their items to free it up for others.

Throughout the building there are a total of about twenty-eight thousand sensors of varying types. These sensors are integral in providing live feedback to the system, allowing the building to react accordingly. For example, if it is identified that there are fewer employees than expected on a day, parts of the building may be shut off to reduce costs associated with energy usage and maintenance. With the implementation of these sensors, the data from them is tracked to provide insight into how the building is functioning over a period of time. This allows building managers to act when needed to further improve the efficiency and experience for all employees. Together, these features create a cohesive and tailored experience for the entire day of work.

Personalization plays a vital role in improving a user's connection to the space even in shared environments. Incorporating customizable elements into a shared space can help these spaces feel personal and recognizable.

3.1 AGENCY IN PLACE & SPACE MAKING

Allowing individuals to shape their environments according to their needs and preferences creates a sense of ownership over their space.[10] When the space is shared, giving users the ability to personalize and reconfigure it reinforces a sense of agency and belonging. It recoups a level of ownership that is lost from switching away from a permanently assigned workstation. By granting individuals the autonomy to adapt their surroundings and environment, the shared space can better accommodate the preferences and working styles of the temporary user, leading to greater satisfaction.

> "When people feel uncomfortable in their surroundings, they are less engaged — not only with the space but also with what they can do in it. If they can have some control, that all changes and people report being happier at work, identifying more with their employer, and are more efficient when doing their jobs."[11]

Providing control to employees typically results in greater happiness which is a result from being physically and mentally

10 Mohezar, Jaafar, and Akbar, "Open-Space Workplace Design."
11 Knight and Haslam, "Your Place or Mine?"

more comfortable. The level of control provided to employees can be classified into three types:[12]

1. **Lean Spaces:** Employees have minimal control over their workspace, resulting in a space that is often bare and purely functional.
2. **Enriched Spaces:** Employees are allowed to add personal items such as pictures to their workstation.
3. **Empowered Spaces:** These spaces have design elements that can be tweaked and modified by the employee.

An example study has found that enriched spaces are 17% more productive than lean spaces while empowered spaces are 32% more productive than lean spaces.[13] These results emphasize that the more control a person has over their working spaces, the more motivated and happier they become.

Nikken Space Design's office, completed in 2014, gives user control to change the positioning of furniture within the

12 Knight and Haslam, "The Relative Merits of Lean, Enriched, and Empowered Offices."
13 Knight and Haslam, "Your Place or Mine?"

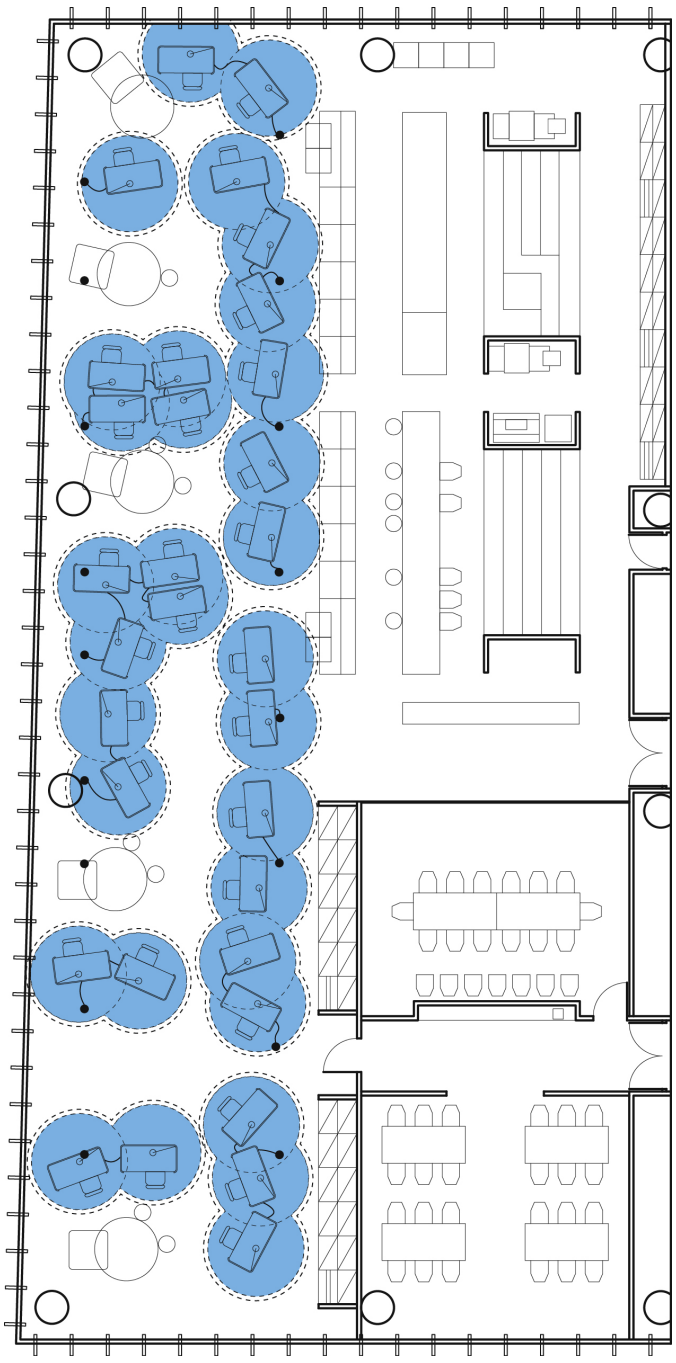


Fig. 3.1.1 Plan of Nikken Space Design showing the range of motion for the moveable desks.

space. Instead of having a set rigid layout for the personal workstations, the workstations have wheels allowing the employees to change the arrangement throughout the day (Figure 3.1.1). They can orient and move the desks into small groups to position themselves in close proximity with their team.[14] As the desks include outlets to power laptops and other electronics, the desks are chained together in groups with the last one connected to a power outlet on the floor. The length of the cables was designed to optimize the range of motion for the desks without being too long which could cause interference to the organic layouts.

Another demonstration of agency and space making is in the Substrate Factory Ayse by Aki Hamada Architects and completed in 2017 (Figure 3.1.2 & Figure 3.1.3).[15] It was designed without any static walls or partitions. The partitions in this space are on rails and follow a grid pattern. This allows for a large variety of configuration and customizability depending on how the space is divided following specific circumstances and their functional requirements. The space is no longer static, and changes to accommodate the dynamic needs of its occupants throughout the day.

In a similar approach but at a smaller scale, SOHO 3Q Chengdu Office by Superimpose Architecture, completed in 2019, looks at increasing the utilization of a space occupied by meeting pods.[16] Meeting pods are placed on rails, allowing them to be separated, moved, and combined as shown in Figure 1.3.4. This allows for flexibility of the space depending on the number of participants in the meeting. Additionally, the pods can be moved away, clearing a large open area for various temporary activities.

14 Nikken Space Design, “Nikken Workplace Design Lab.”
15 Aki Hamada Architects, “Substrate Factory Ayase.”
16 Superimpose Architecture, “SOHO 3Q.”



Fig. 3.1.2 Partions dividing space at Substracte Factory Ayase. Photo by Kenta Hasegawa.



Fig. 3.1.3 Partions pushed aside at Substrate Factory Ayase. Photo by Kenta Hasegawa.



Fig. 3.1.4 Photograph of reconfigurable meeting space in SOHO 3Q. Photo by CreatAR Images.

Providing individuals with the option to reconfigure their environments promotes user agency and a sense of ownership. Reconfigurations can allow the space to function in a way that is aligned with user's tasks. These reconfigurations can play a role from the scale of a single piece of furniture to an intervention that impacts the entire building.

3.2 HABITS & ROUTINE

Familiar environments provide a sense of stability and predictability, reducing cognitive load and stress.[17] This result is deeply rooted into the human need for habits and routine. Habits are always associated with a cue, something that acts as a trigger that leads to an action.[18] These cues exist throughout everyone's daily life and are the foundation of an individual's set of habits. The actions that are a result of habits require little conscious thought. An example of a habit and a cue in daily life would be using the washroom and washing hands. The cue would be using the washroom, which triggers the habit and action of washing hands. In the context of working in the office, when employees work consistently in the same space, one that is familiar, the human brain can transition into work mode more seamlessly as the space and environment becomes a cue for productivity. It establishes a mental association between the workspace and focused work. As such, for there to be a consistent and effective transition each time a person arrives, the cue must be consistent. The more consistent the cue is each time, the more seamless the transition would be. If the cue is a perfect match each time,

17 Choi, van Merriënboer, and Paas, "Effects of the Physical Environment on Cognitive Load and Learning."
18 Neal et al., "How Do Habits Guide Behavior?"

it can be determined that the transition would be at its most effective level. Over time as habits recur, they can turn into routines, further strengthening the seamless transition into a focussed head space.

When single-user workstations are used, it is more difficult to form a strong habit as the cue. The cue in this case would be the desk and its surroundings. In this scenario, they are not identical each time when an employee comes in for work. As the desks are shared, an employee may not be working at the same desk as the one they did the last time they came in. This creates a loss in the sense of familiarity which strays away from what is considered to be the perfect cue. However, if the employee is given the ability to personalize and configure their workstation, allowing it to be the same no matter which one they use inside the office, it has the potential to create the perception of a familiar space. This compensates for working at a different desk in a different location within the office, aligning the experience closer to results from an ideal cue.

Creating spaces that are familiar through user personalization help strengthen the natural behaviour of habits, contributing to greater efficiency and comfort. People tend to feel more comfortable in using something that they know well. When there is a discernible distinction between two or more items,

people would gravitate towards using the one they have used in the past. For example, in the office if there is a recognizable difference in the shared coffee mugs, there would likely be a preferred type that would be used all the time. Personal preference and habits also extend to people having a favourite stall in the washroom for the reason of it being more familiar and part of a built-up routine.[19]

In a shared workplace where the environment of an individual is constantly changing, there needs to be a level of consistency put in place to permit habits and routines to emerge. However, not all consistency is the same. Consistency by making every space the same for everyone lacks a strong personal connection. Spaces should be consistent to the user but unique from others due to their own personalization.

19 Brown, "Claiming a Corner at Work."

3.3 AUTOMATION

Personalization of a shared space can introduce potential distractions. By offering a higher level of customization of the space to employees, it may delay starting work, as more actions are required for setup. For example, employees might need to spend time adjusting the desk lamp, desk height, and placement of peripherals and personal items before they can begin working. Similarly, at the end of the day when leaving work, an employee would be required to reverse all the changes made to return the space to its initial configuration, ensuring that it would be ready for the next user. To mitigate these issues, many of these adjustments can be automated, requiring no additional action by the user on a day-to-day basis. Through the use of automated processes, the adjustments to the workstation can be made before the user arrives to the office. This creates the experience of walking into a familiar and personalized environment, ensuring a seamless transition into focused work.

The office itself functions as the machine in the workplace. A certain set of elements within space should be designed with the possibility to transform into predetermined ways from its initial configuration. It is crucial for there to be the possibility for adjustment as the preferences of each user is unique. These transitions can be seen to be the processes that should

be automated. Automations should be used to solve problems in meaningful and impactful ways. The way these processes are triggered should not interfere with the habits and routines of an employee. They should feel natural, and for it to be that way it needs to happen without any conscious thought so that the adjustments feel intuitive and unobtrusive. While creating a button for an employee to press to trigger an action of adjusting a space or workstation may seem intuitive, this approach is fundamentally flawed. Ignoring that in this system the computer does not know who pressed the button to make accurate adjustments, this interaction is not as seamless as the office recognizing the user upon approach, automatically adjusting to their preferences without any additional action required. The most seamless interaction is one that is invisible, integrating naturally into the user's routine and environment.[20]

To create this invisible interface, the positioning capabilities of ultra-wideband (UWB) technology, a low energy and short-range wireless communication technology that utilizes radio waves to provide accurate distance measurements, can be combined with user preferences collected through a web-based seat booking application. This combination allows the system to anticipate the timeframe and the people that will be utilizing each space throughout the day and adjust the environment accordingly to their predefined preferences without requiring additional action.

20 Krishna, *The Best Interface Is No Interface*.

Automation eliminates the need for time-consuming manual adjustments and ensures consistency between each day of work. When implemented effectively, it creates a seamless interaction between the user and the configurable elements of the space, making the process effortless and the adjustments invisible. Overall this chapter recognizes that the workplace should enable occupants to configure and reconfigure their spaces. Finding the right balance is essential. Shared spaces need to be effective for anyone to use yet also feel personal and familiar enough to build healthy and productive routines. Given this, frictionless adaptions should occur depending on the individual using the space.

DESIGN

4 - DESIGN

In this design exploration, the Wellabe headquarters—formerly known as American Enterprise Group—located in Iowa, United States, is used as the foundation for the design premises. The building was designed by SOM and was completed in 1965. It has undergone two extensive renovations, each implementing distinct strategies for the layout of the office. This design envisions the next transformation if the organization operating within it adopts a permanent hybrid working model, where only 50% of employees work in person each day. The building also has the characteristic of having windows only at both ends, making it ideal for an interior-focused design exploration. The goal is to transform the current spaces to support the evolving needs of a hybrid workforce.

Four key strategies are implemented, each building upon the research and learnings from the previous chapters. The first strategy implements a hybrid model with hot desking, allowing for a significant reduction in the primary tenant's space requirements. This freed-up area is then reconfigured to accommodate a total of three tenants who also operate on hybrid models. By sharing the space among multiple organizations, the building's overall utilization and efficiency can be maximized.

The second strategy focuses on making the space easily reconfigurable to adapt to changing needs and work patterns.

The design introduces a modular system of furniture and partitions that allows for frequent and simple reconfigurations, enabling even those without specialized knowledge to create effective layouts. Built-in constraints ensure that any changes made maintain the original design's principles, cohesion, and aesthetic appeal. This approach ensures the space is flexible, allowing the space to evolve continuously without compromising its overall integrity and functionality.

To address the loss of personal space typically associated with hot desking, the third strategy introduces automated integrations that transform key elements of the environment, specifically for a workstation design. These strategic transformations aim to provide a sense of familiarity and personalization within a shared space. By automatically adjusting certain aspects of the workspace, employees can experience a feeling of consistency and belonging despite the lack of assigned desks.

The final strategy carefully balances the integration of technology within the space. While leveraging automated systems and digital applications for space management, the design also incorporates physical interfaces like buttons, dials, and interactive displays. These tangible controls serve several purposes: they provide immediate access for quick adjustments, allow for spontaneous overrides of automated settings, and provide a direct line of control to the physical

environment. The goal is to create spaces that feel responsive and familiar without overtly displaying its technological capabilities.

This balanced approach to technology integration allows the space to transform smoothly to meet users' needs without requiring constant manual intervention. It aims to preserve a timeless quality in the design while still offering the benefits of modern office technology. By carefully managing the visibility and interaction with technological elements, the design creates an environment that adapts to its users, enhancing productivity and comfort without becoming a distraction in itself.

The chapter will first provide an overview of the current condition of the building, along with a brief history of its previous renovations. Following this, it will examine how the program of the new design will be distributed across each floor. Then, the design of each floor and the strategies implemented will be discussed in greater detail. A timeline of key moments will then be presented, highlighting the building's evolving spatial adaptions over time. The chapter will also explore the design of a personal caddy and workstation, integral components to the building's functionality and operation. Finally, it will conclude by discussing how technology is leveraged to enhance the overall experience of working in this office.

4.0 SITE AND CONTEXT

When the building was first completed in 1965, it used an open office layout strategy, in line with the trends of the time period. Standardized desks of small sizes were arranged in close proximity, maximizing the use of available area, but this arrangement sacrificed personal space and privacy. Executive's desks were placed in central locations in the plan to make it easy for monitoring staff. While most of the seats were in the open, there were focus group rooms. These were small rooms with clusters of individual workstations. Additionally, there were few meeting rooms but the ones that existed were of medium to large in size, accommodating six or more people at a time.

The first renovation of the building aimed to increase privacy for each employee with the addition of cubicles. Primarily, three sizes of cubicles were used, ranging from small to large. It can be assumed that the larger ones were used by executives as they were again placed in central locations in the floor plan. While being able to offer more space and privacy to each person, the total seat count in the office managed to increase. This is a result of a significant reduction of about 75% in the number of private single user offices in favour of smaller executive cubicles which occupy less area. Additionally, all of the focus group rooms were removed as the cubicle served the function of a semi-private meeting area.

The latest renovation, completed in 2015, made the transition



Fig. 4.0.1 Rear elevation of National Enterprise Group Headquarters. Photo by Morgan Sheff Photography.



Fig. 4.0.2 Courtyard of National Enterprise Group Headquarters. Photo by Nick Merrick.

back towards an improved open office plan. All cubicles were removed, and uniform rows of desks were used as the replacement. To address the primary concern of privacy in open offices, a significant increase in the number of meeting rooms and private spaces were introduced to meet the need for confidential work areas. Combining the increase in the amount of space allocated to each person, the increase in meeting room space, and the increase in private offices, the total occupancy of the building was reduced to about 55% of what the first renovation had, and about 60% of the original design. The significant spike in the capacity of meeting room spaces leads to the problem of large areas of under-utilized space.

The spike in the capacity of large meeting spaces resulted in large areas of potentially underutilizes space. Additionally, for each past iteration of the building, individuals were locked into a single or limited options of workspace types. This design exploration looks to improve space utilization by offering a wider variety of work environments including spaces with privacy and dedicated areas for collaborative work.

4.1 DISTRIBUTION OF SPACES

The building has eight levels, currently occupied by a single organization. The majority of the ground floor is occupied by the lobby area and a multipurpose room. The second floor is reserved as a cafeteria and lounge space. The third through seventh floor are the primary working floors, occupied primarily by individual workstations and several private offices. The top floor is reserved for meeting rooms of varying sizes and large executive private offices.

As this design exploration examines the scenario where the original tenant shifts to a hybrid model with 50% in-person work, a redistribution of spaces is necessary. With the original tenant reducing its space requirements, the space left over can be filled by the addition of two new tenants of a smaller workforce. These tenants would also adopt the hybrid work model. Each floor of the building is designated to be either private to a single tenant, shared by all tenants, or shared by tenants and the public. Levels 1, 2, and 5 are shared by all tenants. These floors are comprised of program that would function well when used communally or the program itself has characteristics of being private which allows employees from different organizations to work on the same floor while maintaining privacy between one another. Those programs include private offices and meetings rooms. Level 3, 4, 6, and 7 are private to each tenant where the largest tenant occupies two floors and the other two occupy the remaining. These floors house the main working areas and collaboration

spaces. Level 8 is shared by everyone including the public. This floor houses multipurpose rooms that can be booked by both the tenants and the public to maximize utilization.

The new distribution of levels and floor area converts a building designed for a single tenant into one that comfortably accommodate three tenants while maintaining adequate separation between each for programs that require it. This approach allows the original tenant to downsize their in-person workforce efficiently without creating underutilized spaces.

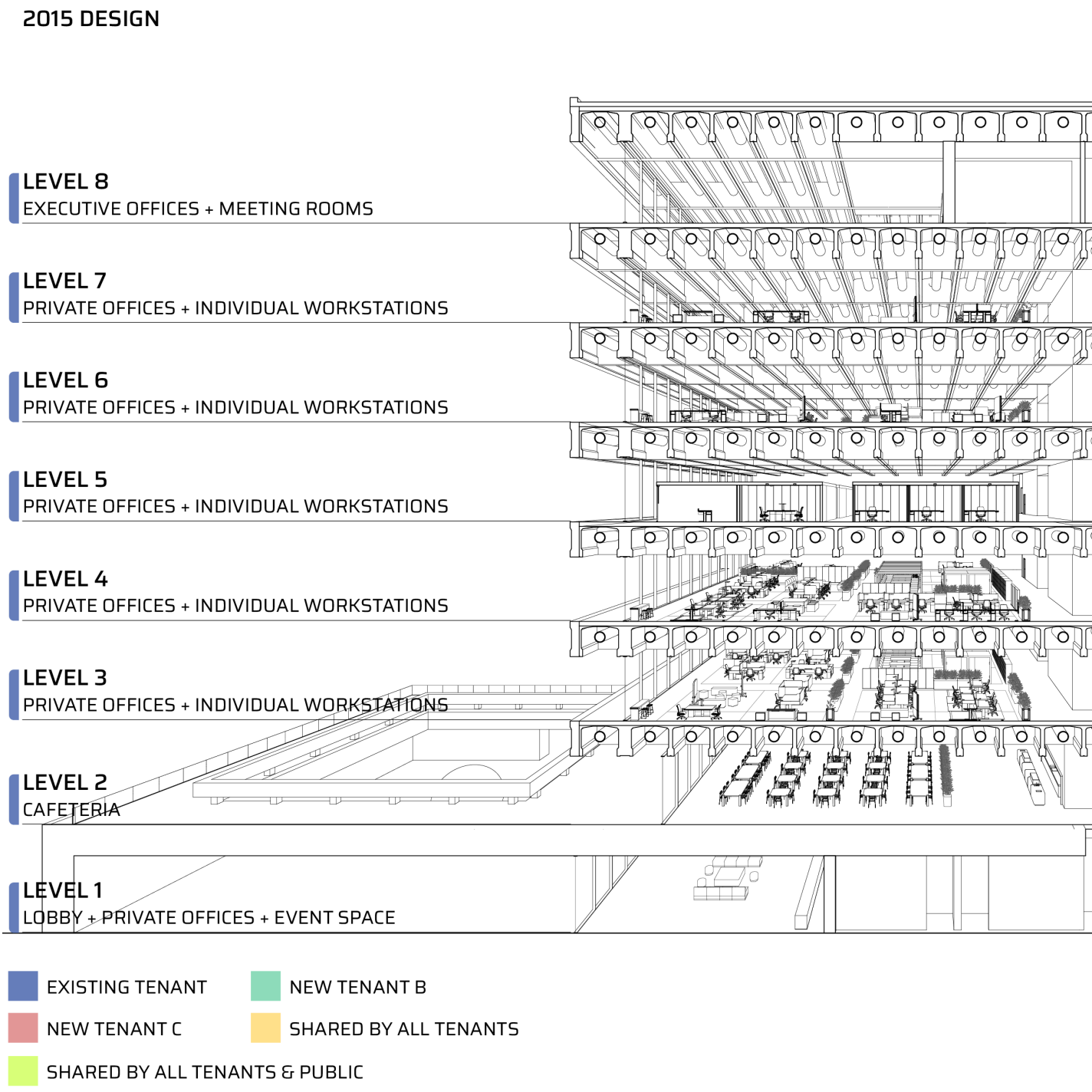
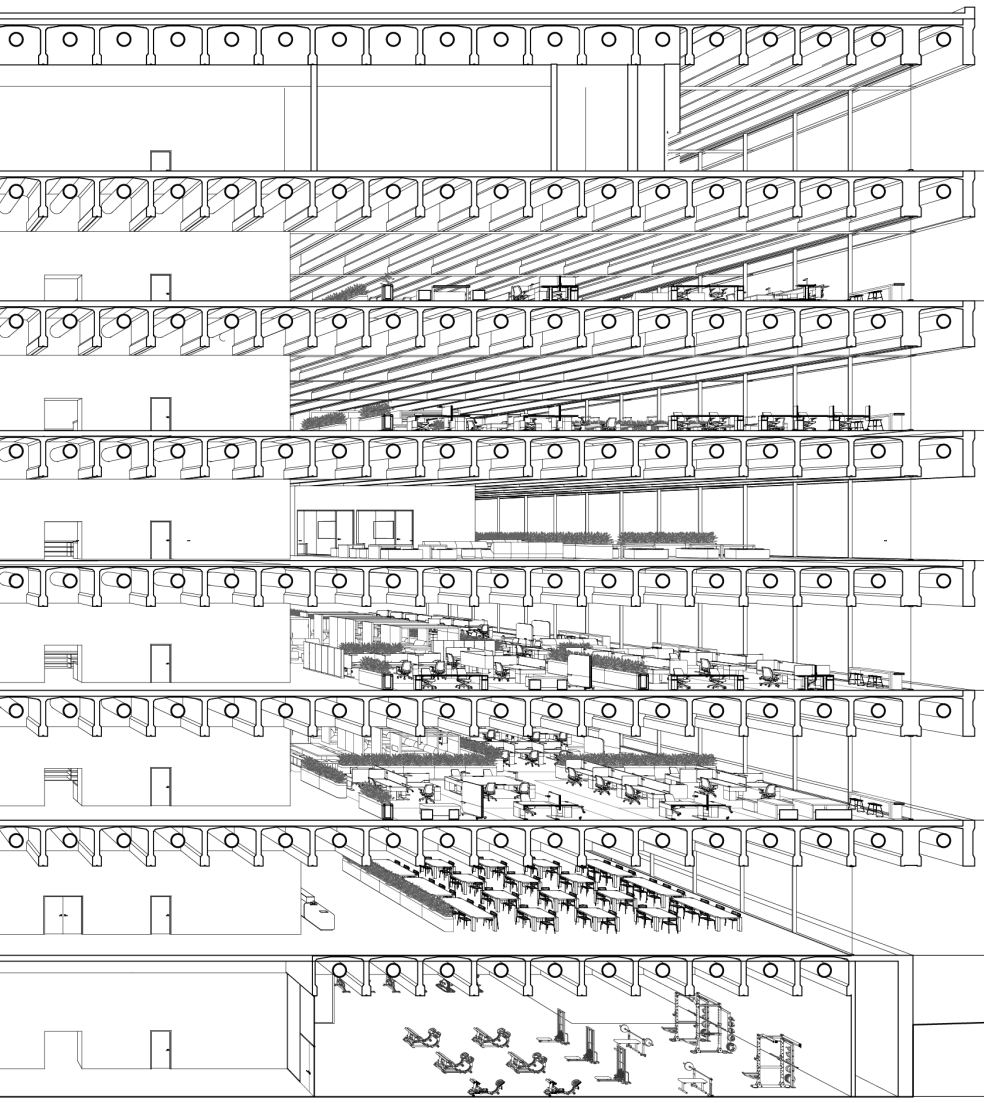


Fig. 4.1.1 Perspective section with designation for sharing spaces between multiple tenants and the public. The new design interior is illustrated here.

NEW DESIGN



LEVEL 8
SHARED MULTI-PURPOSE

LEVEL 7
TENANT C UNIT

LEVEL 6
TENANT B UNIT

LEVEL 5
SHARED MEETING ROOMS
+ PRIVATEOFFICES

LEVEL 4
TENANT A UNIT 2

LEVEL 3
TENANT A UNIT 1

LEVEL 2
SHARED CAFETERIA

LEVEL 1
SHARED LOBBY & FITNESS ROOM

4.2 LAYOUT AND MODULARITY

This section covers the design, and the strategies used for the layout on each floor of building. Each floor is covered as if navigating through the space, starting from the exterior courtyard at the front.

LEVEL 1

Upon entering the building from the exterior courtyard, visitors are greeted by a lobby that features a reception desk and seating for clients and guests (Figure 4.2.1). The space is anchored by a pair of gently curved walls extending from the central core, creating a welcoming path that naturally draws people towards the elevators with access to the main programs of the building. To the left of the central core, a locker room can be found, providing staff with secure storage for personal belongings. In a hybrid work environment that utilizes hot desking, these lockers are essential, offering one of the few permanents spaces for employees to store items that are impractical or unnecessary to carry back and forth between home and the office. To the right are washrooms equipped with showers to support the addition of a fitness room towards the rear of the building. This amenity promotes employee well-being and enhances workplace satisfaction by offering staff the opportunity to incorporate health and fitness into their daily routines. Towards the rear left of the building, a storage room is included to assist the strategies that would be taken from the main working floors above.

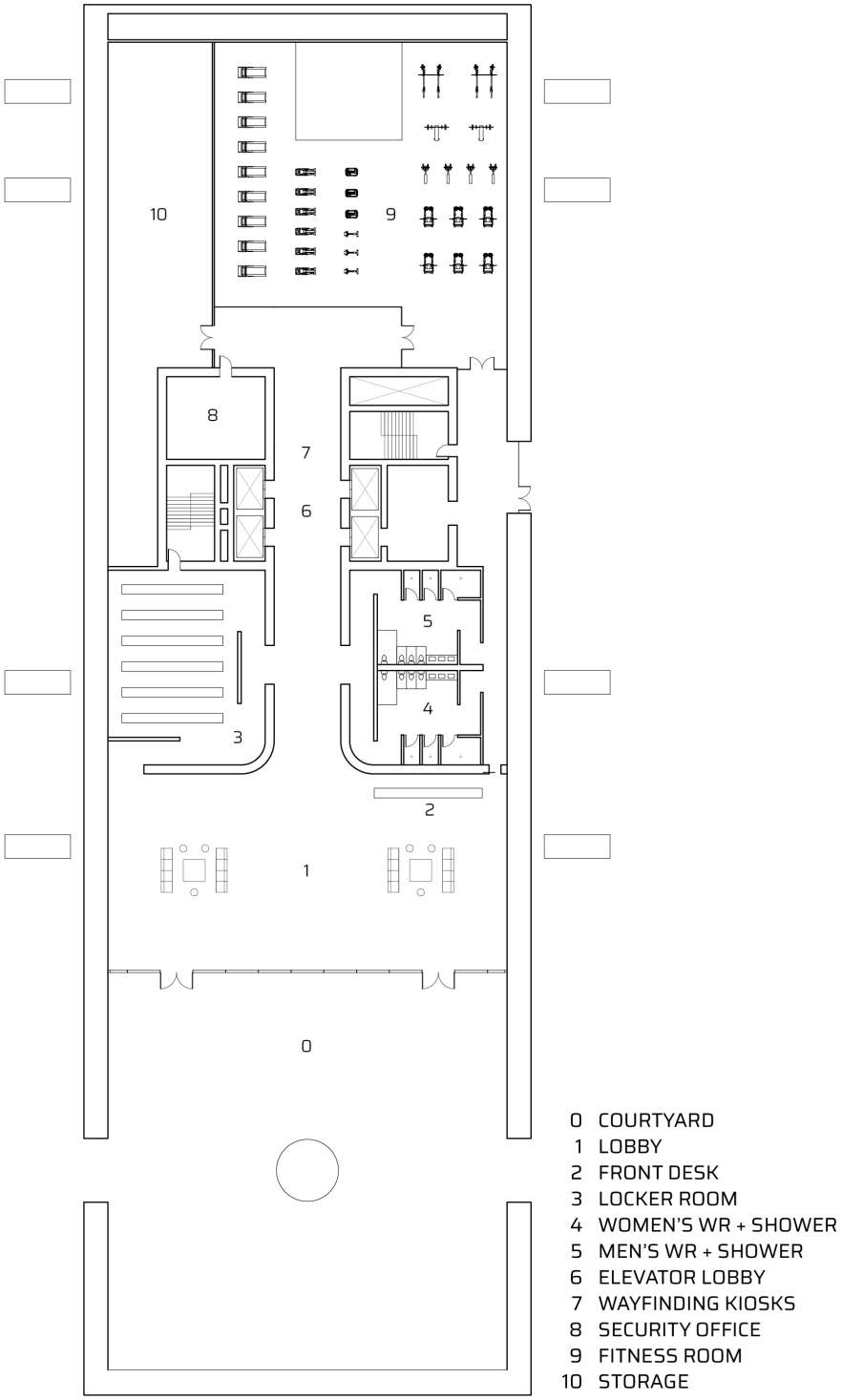


Fig. 4.2.1 Floor plan of level 1.



Fig. 4.2.2 Rendering of cafeteria located on level 2.

LEVEL 2

The second floor features a cafeteria (Figure 4.2.2) with food service that is shared by all employees. Upon exiting the elevators, seating is available on either side, flanking the central core (Figure 4.2.3). To the front-left of the building is a food service counter, supported by a large kitchen for efficient food preparation. The remaining three counters serve as kitchenettes, available to employee for reheating or preparing food that they brought in.

The layout is organized into four quadrants, with planted dividers separating queuing areas from dining spaces. Tables of varying sizes are distributed throughout the dining areas, accommodating parties of different sizes not only for having meals but also for staff looking to unwind and take a break. The seating areas provide an additional place for staff members to step away from work for a moment to relax on a different floor and potentially meet new people. Given the high foot traffic, especially during peak times such as lunch, generous circulation areas have been provided to allow for unrestricted movement and to be used as informal areas to gather and socialize. Access to the terrace can be found towards the front of the building.

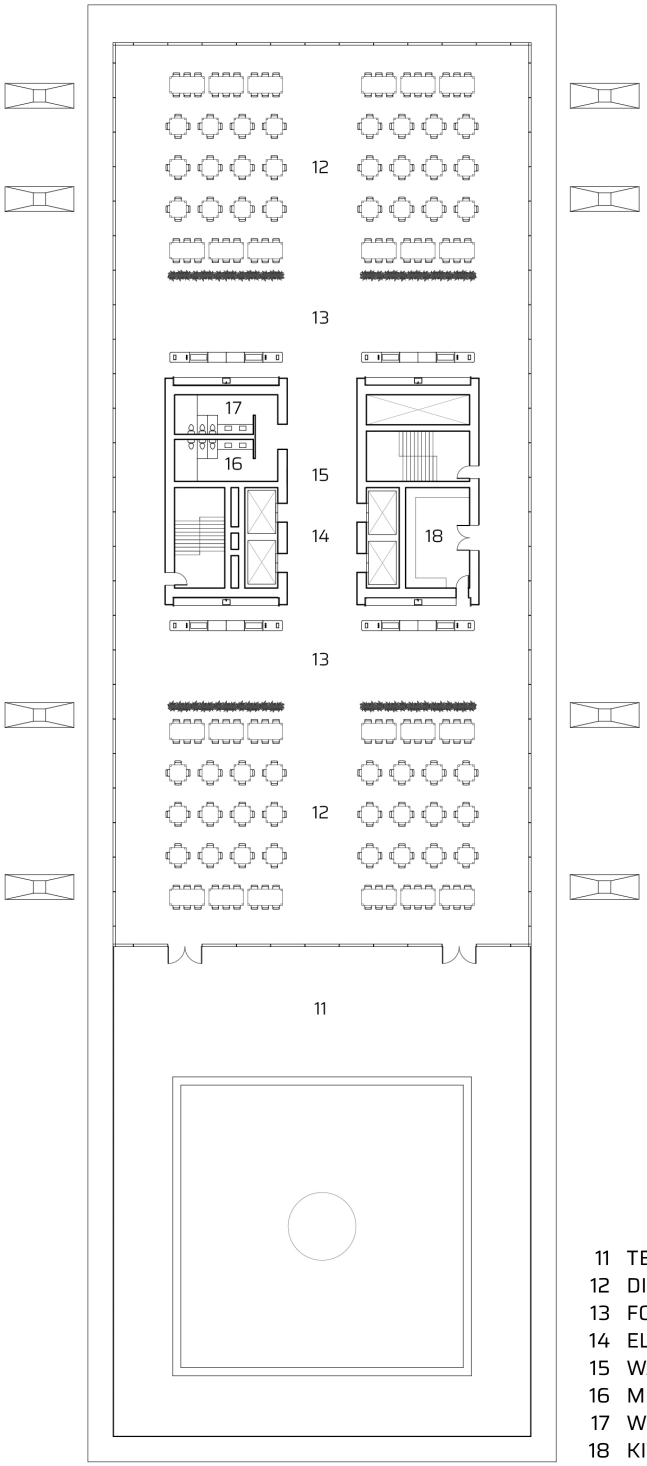


Fig. 4.2.3 Floor plan of level 2.

LEVEL 3, 4, 6, 7

The main working floors are organized using a modular layout system. This modular system was designed to ensure flexibility and adaptability as the needs of employees and teams evolve over time. This system allows the office environment to remain dynamic, accommodating growth and change without disrupting the overall spatial integrity. The modular approach enables seamless modifications, allowing occupants without architectural or space-planning experience to reconfigure the space easily as needed, all while maintaining cohesion and functional order in plan.

A grid, comprised of two rectilinear sizes: a larger 5.5-meter by 5.5-meter unit and a smaller 5.5-meter by 2-meter unit, was created, filling the boundaries of the level within each end of the floor as illustrated in Figure 4.2.4. The larger modules are arranged in clusters of four, with the narrower grids placed in between, surrounding the larger ones. This parent grid was created to define and anchor the placement of components precisely within the floor plan. The clusters of larger squares are designated as the main working areas, to be filled with layouts that allow for active programming. They also serve as the minimum size for a single neighbourhood. One of the six clusters on each end are excluded from being a neighbourhood. Instead, it is reserved as a shared zone for all the surrounding neighbourhoods.

The larger grid (Figure 4.2.5) has five categories of layouts, each with unique characteristics to support different work styles and functions. In contrast, the smaller grid (Figure 4.2.8) primarily serves as a transitional zone, delineating separate neighbourhoods and facilitating circulation. This grid is characterized throughout by a single category with multiple types. As users should be able to remove and replace

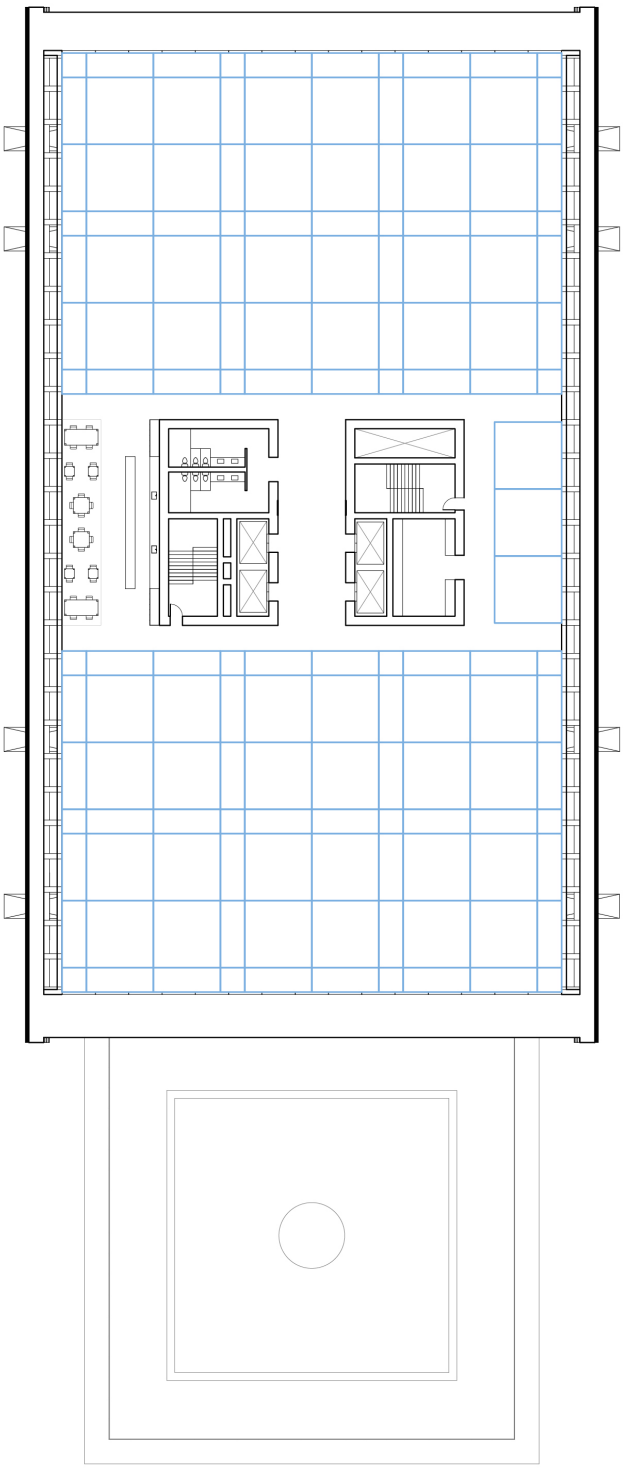


Fig. 4.2.4 Typical floor plan of level 3, 4, 6, and 7 with modular grid overlaid.

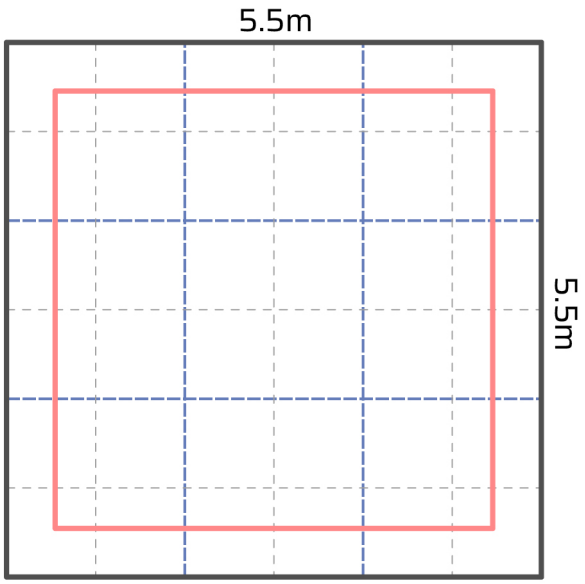


Fig. 4.2.5 Large grid layout.

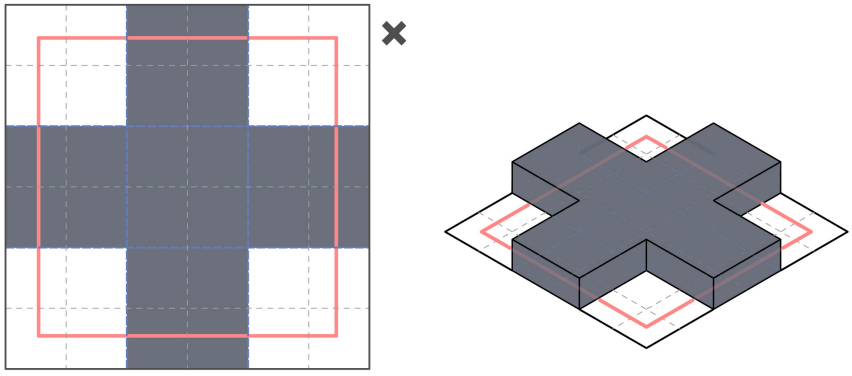


Fig. 4.2.6 Invalid configuration based on large grid rules.

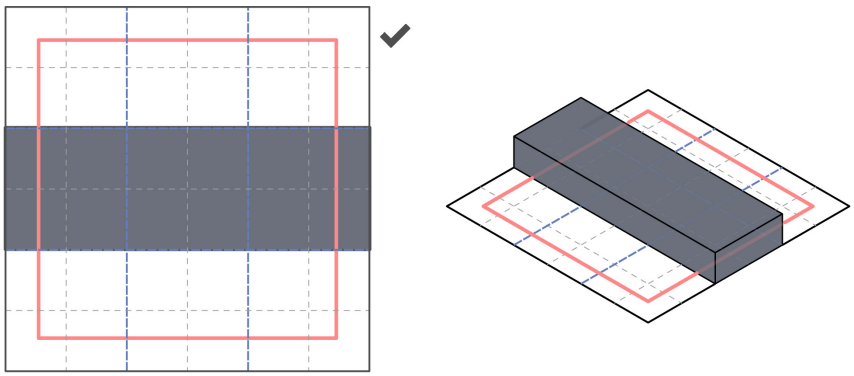


Fig. 4.2.7 Valid configuration based on large grid rules.

blocks frequently with ones more aligned with their work, every type of block must be compatible spatially with one another. To maintain cohesion with the design of each block, an additional placement grid was nested into the parent grid forming the rules for the design of each block.

In order for the design of a block to be valid, it must conform to a set of strict rules. The placement grid is comprised of three types of gridlines: primary (dashed blue), secondary (dashed grey), and secondary boundary (solid red). For the larger grid, solid objects, such as workstations and stationary seating, are to be placed in alignment along the primary gridlines. If objects are to stray away from the primary gridlines, they must be placed alongside the secondary gridlines. Solid objects are allowed to cross the secondary gridlines with some limitations. If solid objects cross, they must cross at a maximum of two of the four sides (Figure 4.2.6 & Figure 4.2.7). Additionally, the sides the object crosses must be parallel to one another.

For the smaller grid, the primary and secondary line rules remain the same. In this grid, objects must not cross the secondary boundary lines at all. Objects must be placed on either side of this line, leaving enough room for circulation. For this grid, there is the addition of a strict boundary line (solid purple). Objects must be placed within the strict boundary, again leaving enough room for circulation as illusrated in Figure 4.2.9 and Figure 4.2.10.

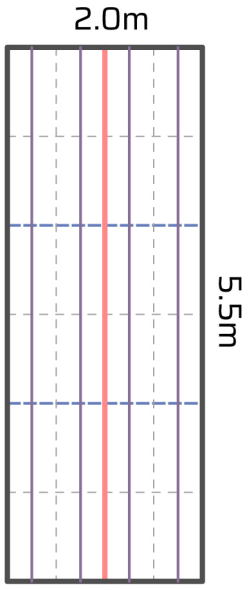


Fig. 4.2.8 Small grid layout.

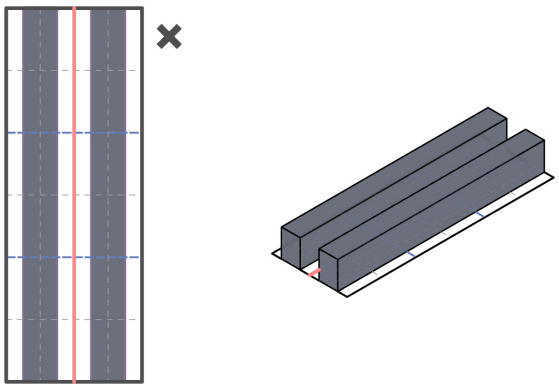


Fig. 4.2.9 Invalid configuration based on small grid rules.

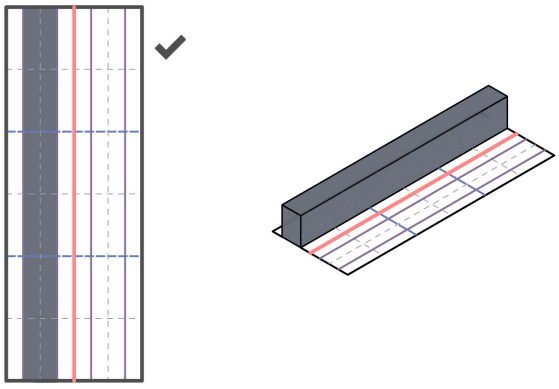


Fig. 4.2.10 Valid configuration based on small grid rules.

MODULAR BLOCKS

The following part of this section covers the design of each block that is created for each category. Each category of blocks is designated with a unique colour to allow for easy identification when placed on the drawings of floor plans. The characteristics of each block is illustrated in spider graphs. The key characteristics accounted for include privacy, interaction, personalization, and duration of use.

1. **Individual Day-use Spaces:** Designed for single person use, serving as a “home base” for the day.
2. **Group Day-use Spaces**: Designed to support collaboration throughout the entire day.
3. **Privacy Day-Use Spaces:** These are intended to be reserved to be used for the entire day with an emphasis on privacy and a distraction-free environment. This category includes features that can be personalized and automated.
4. **Collaboration Spaces**: Focus on promoting active collaboration between team members of varying sizes for sporadic periods throughout the day.
5. **Privacy Day-Use Spaces:** Spaces with a high degree of privacy to be used for short periods of time.
6. **Partitions.** The blocks in this category are used to create separation between distinct neighbourhoods and separation between circulation and neighbourhoods. Each type has qualities of being linear, appropriate height to provide the proper separation within a space, and varying levels of permeability. Certain partition types come in different lengths to provide clearance to allow people to cross and move between different zones.

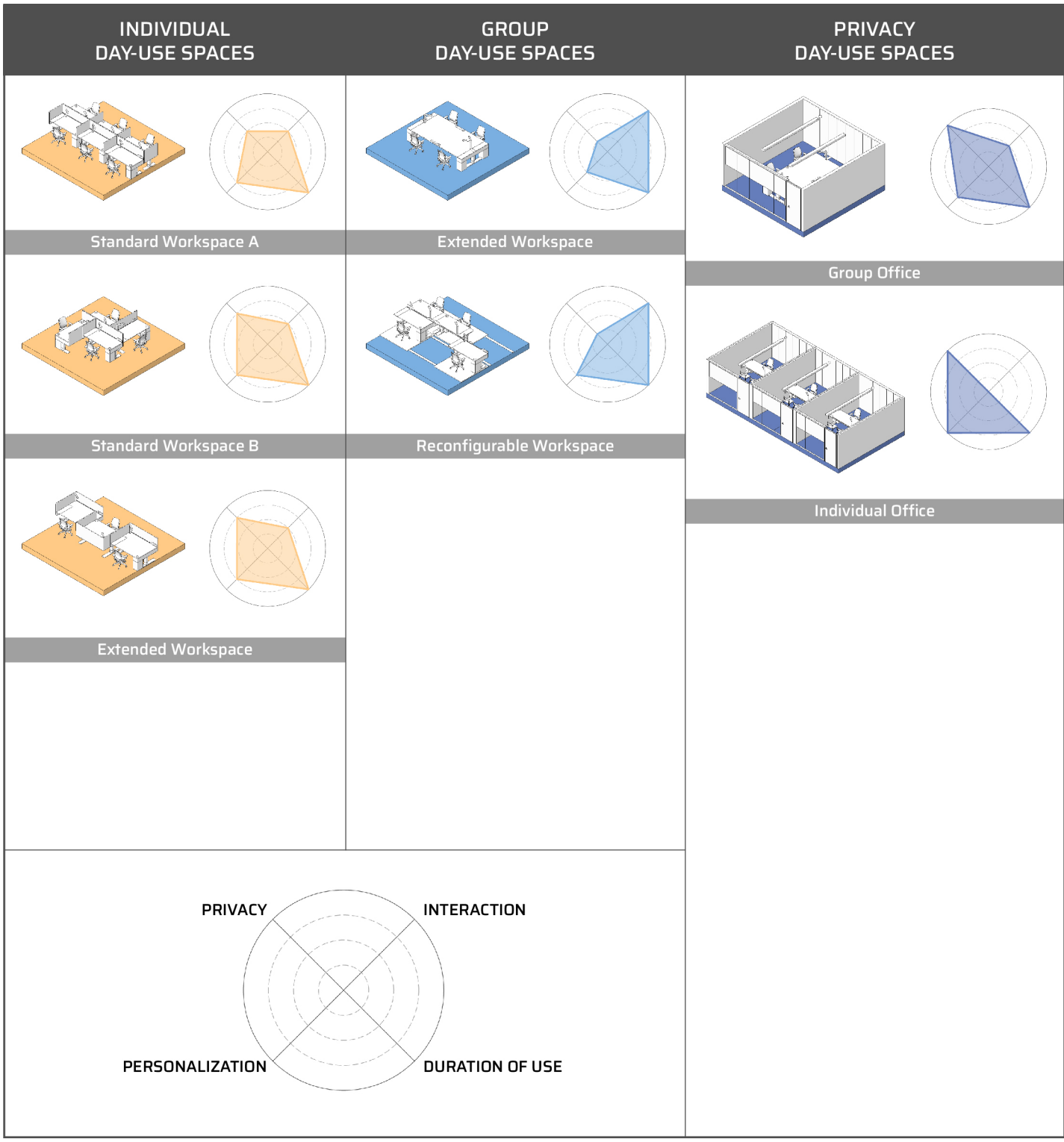
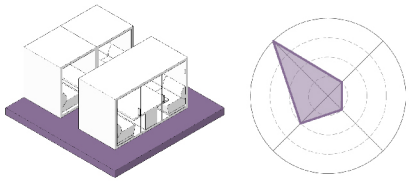


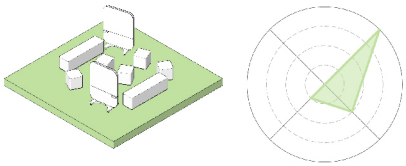
Fig. 4.2.11 Catalogue of modular blocks organized into their respective categories with their ratings of key criteria placed alongside as spider graphs.

PRIVACY SPACES

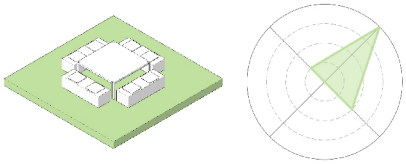


Phone Booth

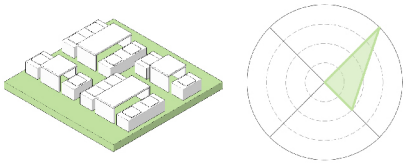
COLLABORATION SPACES



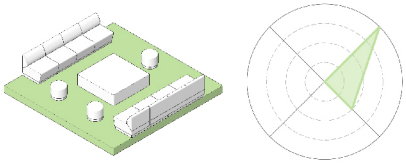
Innovation Space



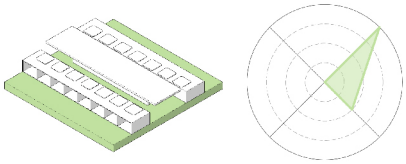
Large Group Collab



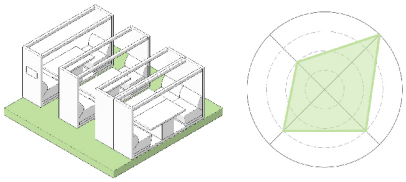
Small Groups Collab



Lounge

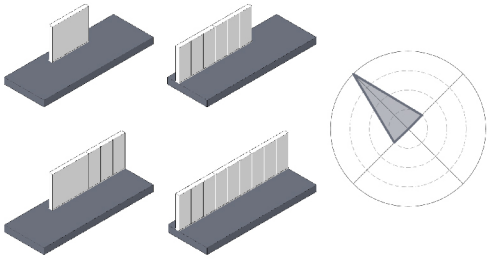


Collab + Storage

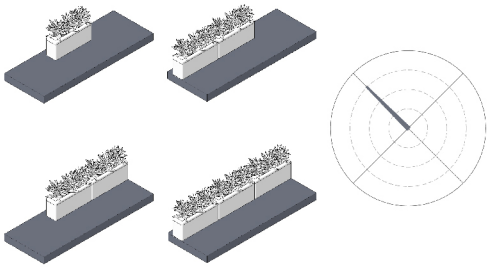


Reconfigurable Meeting Space

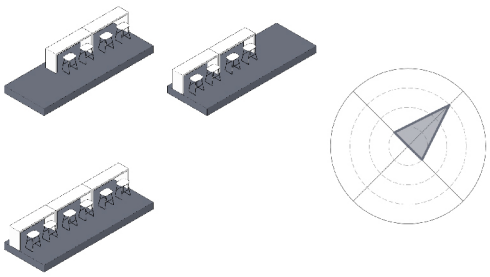
PARTITIONS



Acoustic Divider



Planter



Edge Seating



Personal Caddy Storage

5.5 X 5.5M

STANDARD WORKSPACE A

INDIVIDUAL DAY-USE SPACES

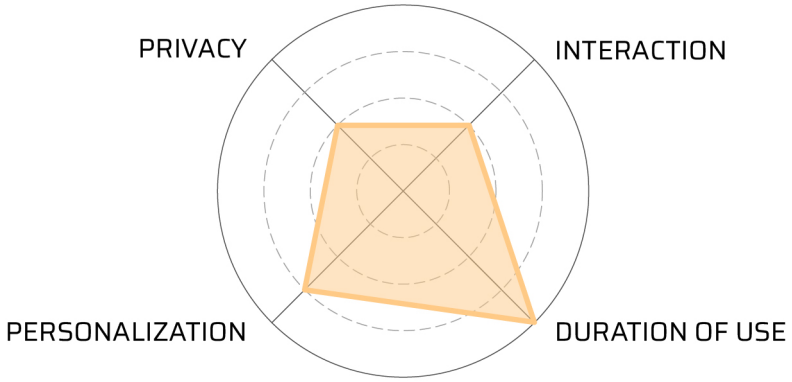


Fig. 4.2.12 Spider graph showing the Standard Workspace A's performance across key criteria.

This workspace has a maximum capacity of six people (Figure 4.2.13). It includes six workstations that can be personalized. Each workstation has a privacy divider to maintain personal space while being in close proximity to others. Each desk has the option to be equipped with monitors for staff to plug in their laptops to a larger display depending on the needs of each neighbourhood. These workstations include features such as height adjustment, ambient lighting, wayfinding indicators, a personal caddy dock, and a display. These features will be explored in greater at a later section, 4.4 Workstation Design. This space is best suited for individuals who do not require expansive work area, benefit from occasional communication with nearby colleagues, and prefer a degree of privacy while working.

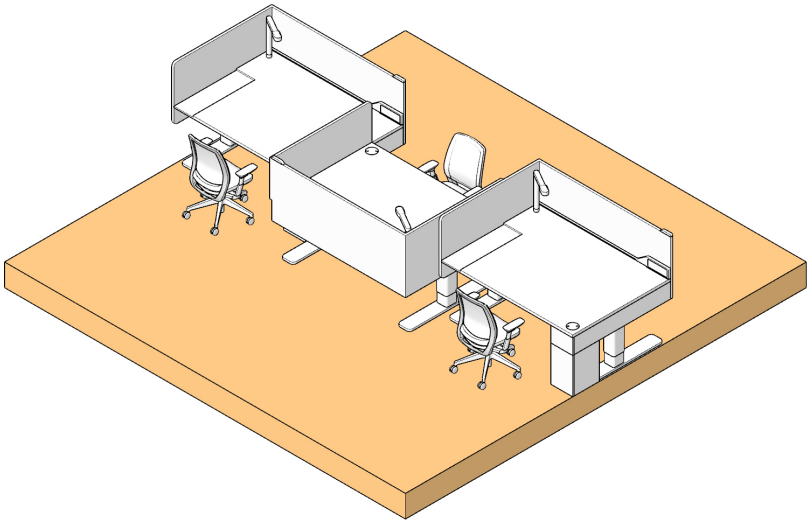


Fig. 4.2.13 Axonometric of Standard Workspace A.

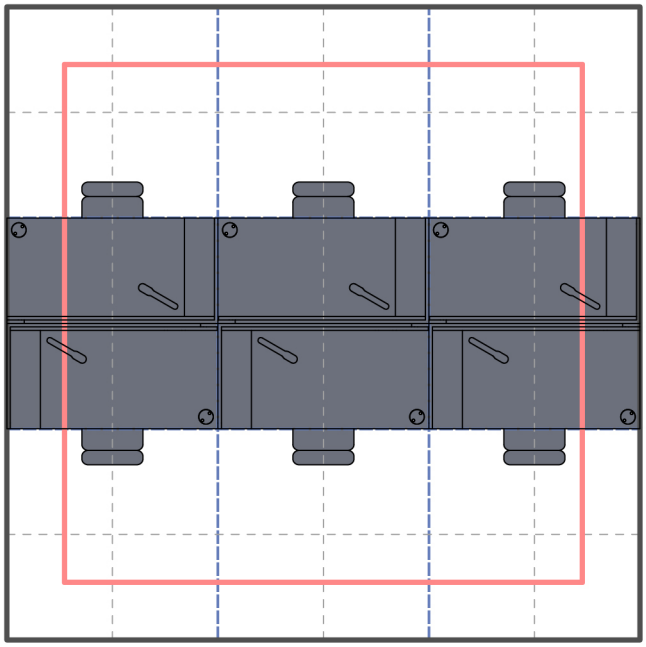


Fig. 4.2.14 Placement plan for Standard Workspace A.

5.5 X 5.5M

STANDARD WORKSPACE B

INDIVIDUAL DAY-USE SPACES

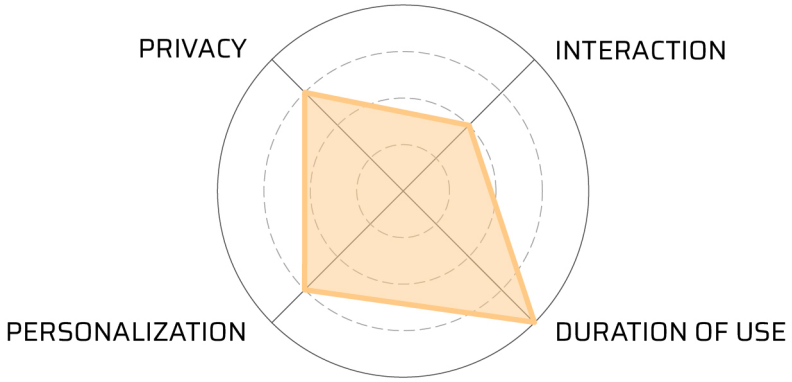


Fig. 4.2.15 Spider graph showing the Standard Workspace B's performance across key criteria.

A variation of Standard Workspace A (Figure 4.2.16), this layout uses the same type of workstations but accommodates a maximum capacity of four people. The rotating arrangement provides enhanced concentration by minimizing visual contact with adjacent colleagues. As a result, there is no longer a direct line of sight to individuals seated nearby. This space is ideal for individuals who also do not require an expansive work area, benefit from occasional communication with nearby colleagues, and seek a higher level of privacy while working alone.

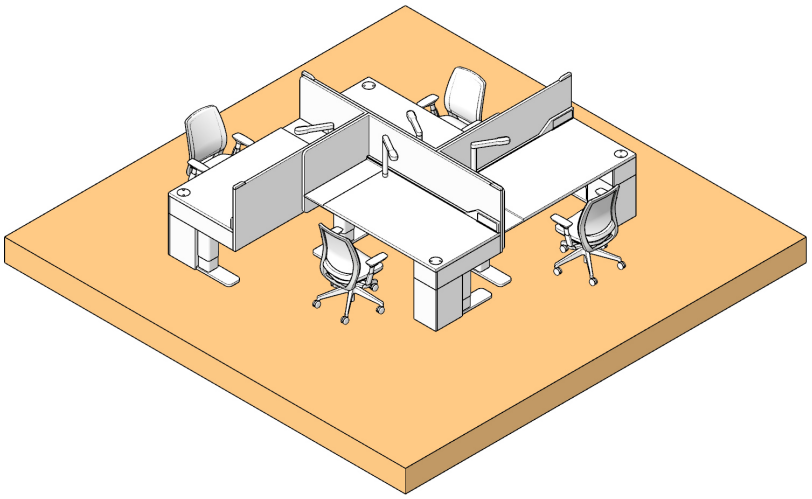


Fig. 4.2.16 Axonometric of Standard Workspace B.

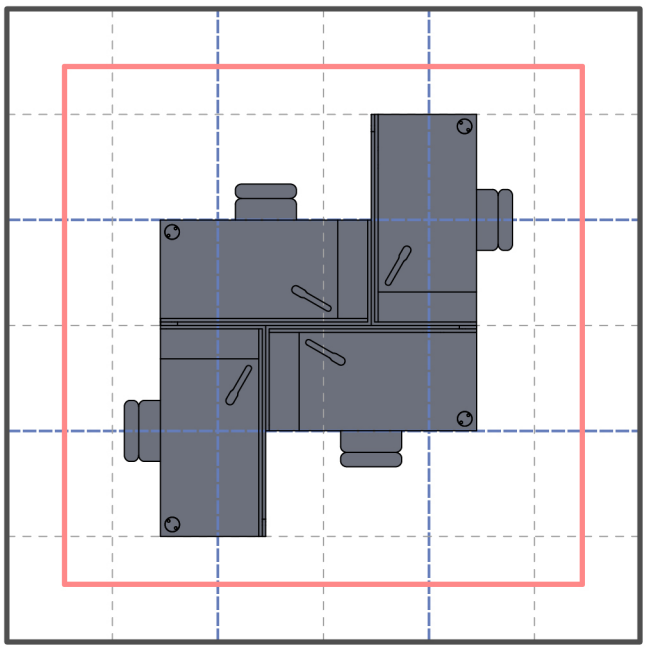


Fig. 4.2.17 Placement plan for Standard Workspace B.

5.5 X 5.5M

EXTENDED WORKSPACE

INDIVIDUAL DAY-USE SPACES

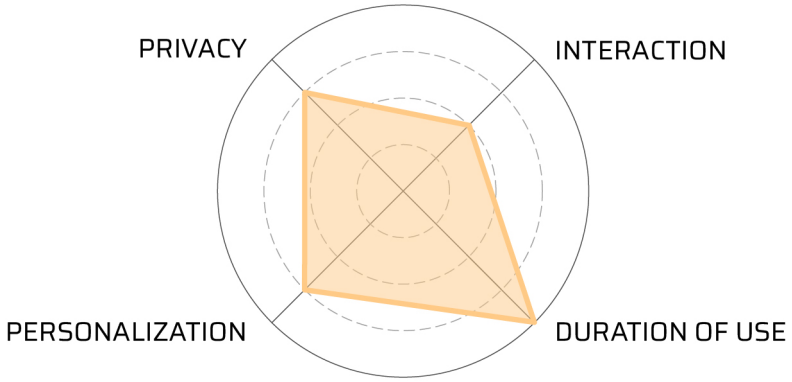


Fig. 4.2.18 Spider graph showing the Extended Workspace's performance across key criteria.

This workspace has a maximum capacity of three people (Figure 4.2.19). It offers a larger work surface for tasks that demand more space. The alternating orientation and staggered placement of the workstations enhances privacy for each individual aided with the inclusion of extended privacy panels. This space is ideal for individuals work on space demanding tasks, benefit from occasional communication with nearby colleagues, and prefer a degree of isolation while working on individual assignments.The Extended

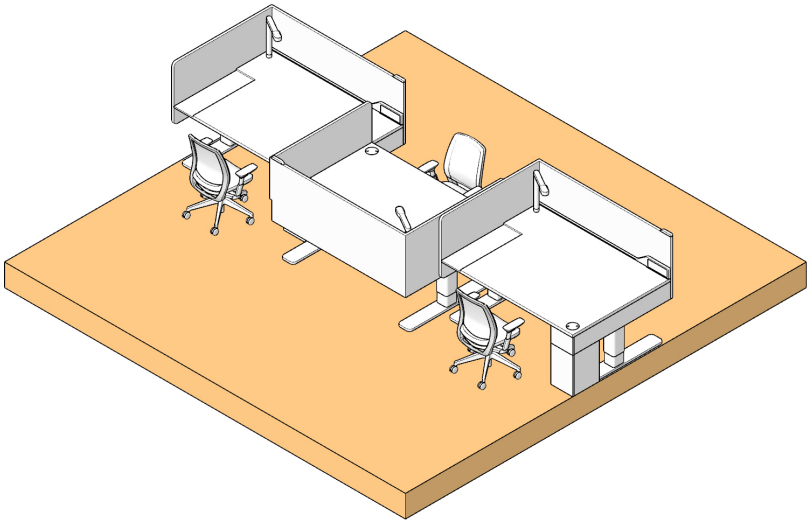


Fig. 4.2.19 Axonometric of Extended Workspace.

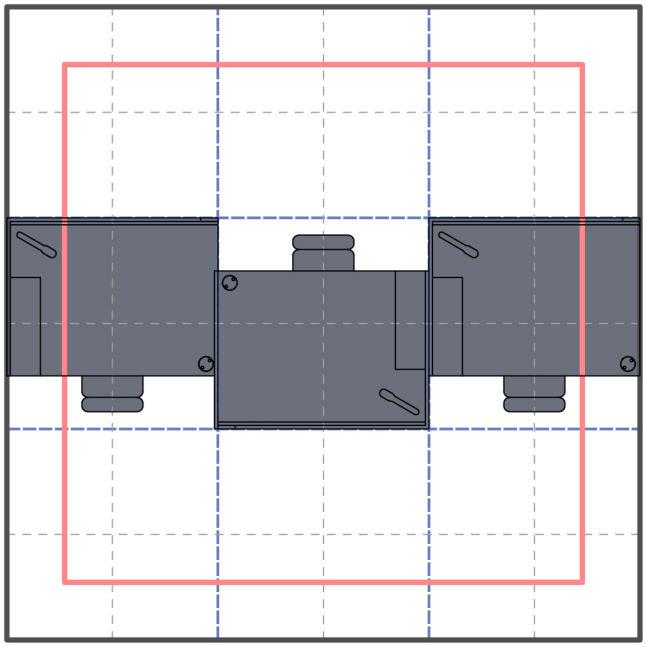


Fig. 4.2.20 Placement plan for Extended Workspace.

5.5 X 5.5M

EXTENDED WORKSPACE

GROUP DAY-USE SPACES

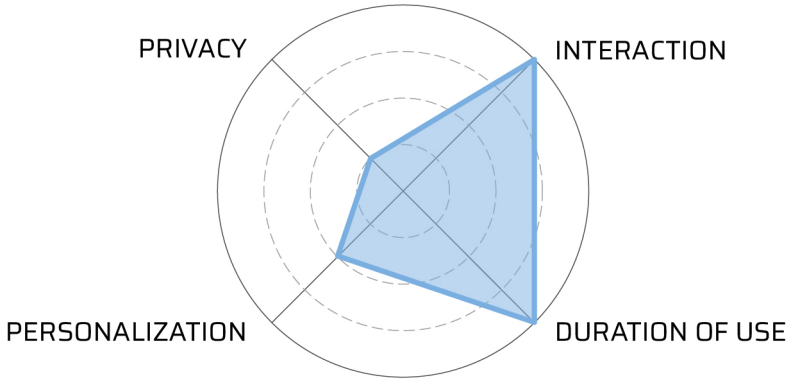


Fig. 4.2.21 Spider graph showing the Extended Workspace's performance across key criteria.

Workspace type has a maximum capacity of four people. As there are four people sharing the same table, some elements of personalization present in the Individual Day-Use Spaces have been removed. An example of this would be individual control of the desk height. Instead, the desk height must be agreed upon by all users. Sharing the same table with others promotes collaboration and streamlines the ease of communication with colleagues. This space is best suited for groups of four that are engaged in projects that require continuous teamwork and collaboration throughout the day while also necessitating an extended work surface.

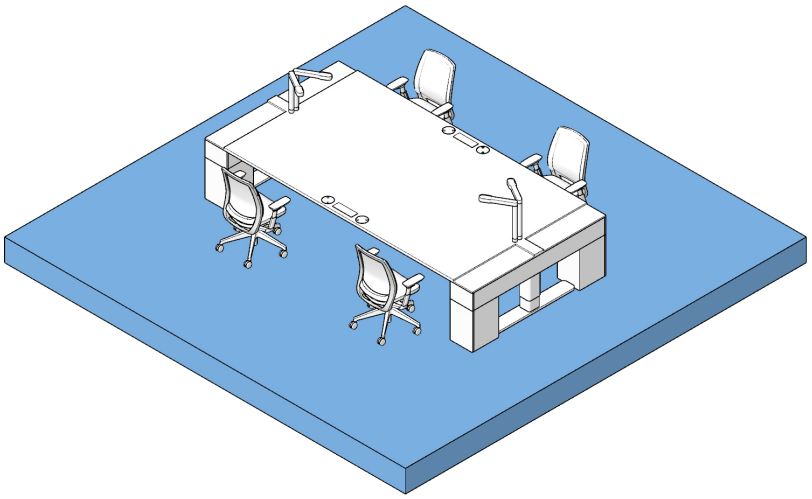


Fig. 4.2.22 Axonometric of Extended Workspace.

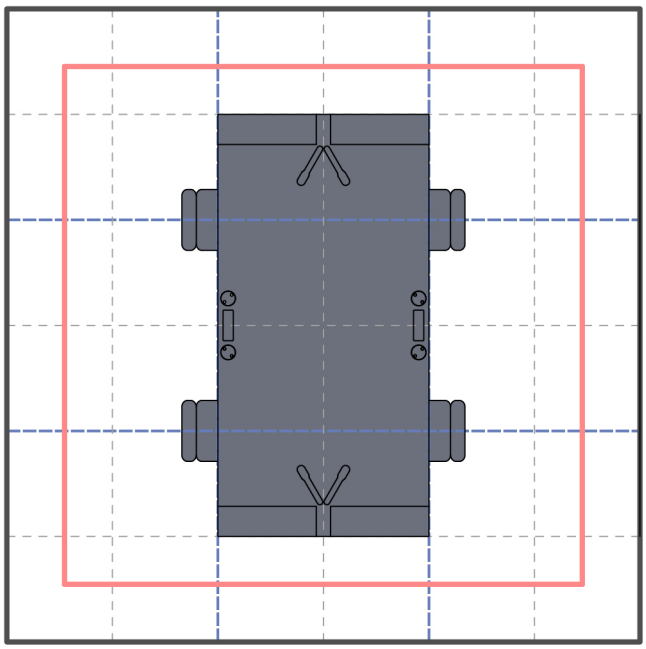


Fig. 4.2.23 Placement plan for Extended Workspace.

5.5 X 5.5M

RECONFIGURABLE WORKSPACE

GROUP DAY-USE SPACES

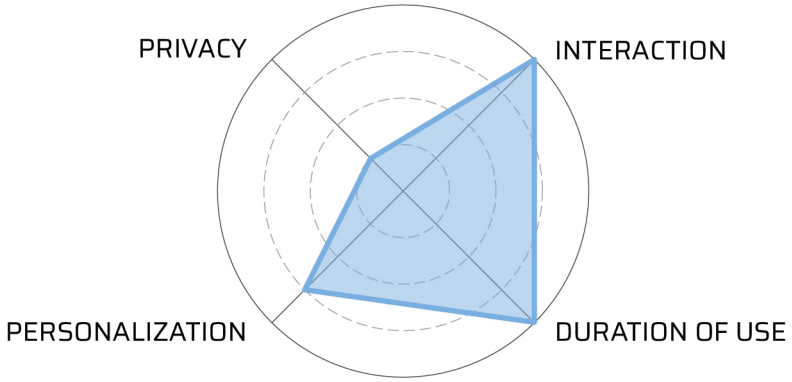


Fig. 4.2.24 Spider graph showing the Reconfigurable Workspace's performance across key criteria.

This layout permits a level of reconfiguration from the user (Figure 4.2.25). Unlike Extended Group Workspace, which is optimized for a single group, this design can accommodate groups of varying sizes without underutilization. Desks can be repositioned along a rail to create separation between groups. Moreover, when the Reconfigurable Workspace blocks are positioned alongside one another, the potential number of combinations multiply, as the pair of blocks become one. This reconfigurability improves the utilization of these layouts, effectively adapting to the fluctuations in team sizes driven by daily tasks and collaborative needs. This space is best suited for groups of varying sizes that are working on the same project that require ongoing teamwork and collaboration throughout the day without the demand for a larger work area.

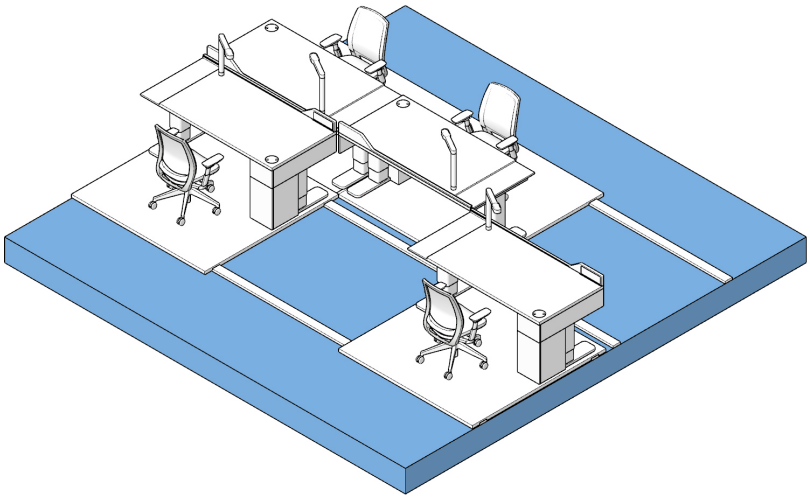


Fig. 4.2.25 Axonometric of Reconfigurable Workspace.

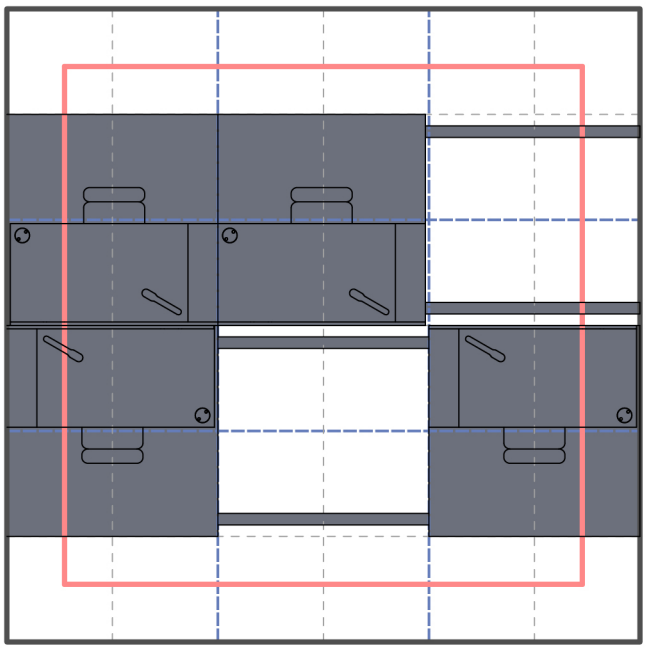


Fig. 4.2.26 Placement plan for Reconfigurable Workspace.

5.5 X 5.5M

GROUP OFFICE

PRIVACY DAY-USE SPACES

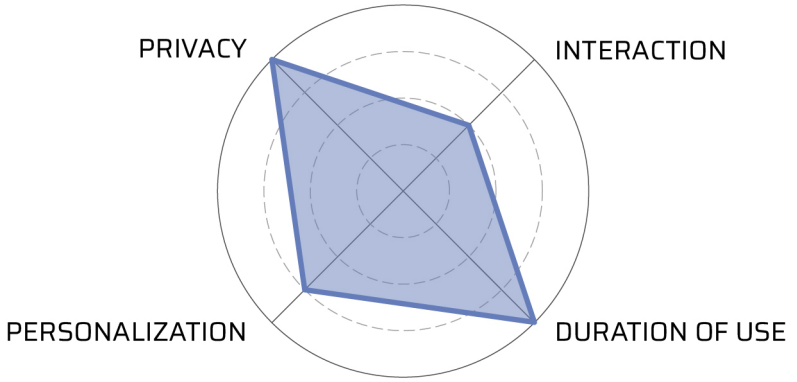


Fig. 4.2.27 Spider graph showing the Group Office's performance across key criteria.

Group Office, as shown here in Figure 4.2.28, shares all the same qualities as the Extended Group Workspace but with enhanced privacy. The layout is surrounded by walls with acoustic panels and active noise cancellation to dampen external noise. Additionally, a motorized privacy curtain is included. As the shell of the layout itself follows the size of the large grid, 5.5-meter x 5.5-meter, the block inside can be swapped out for other types. This room is best suited for groups that demand an extended work area, benefit from zero distractions, and require privacy due to confidentiality of the work being done.

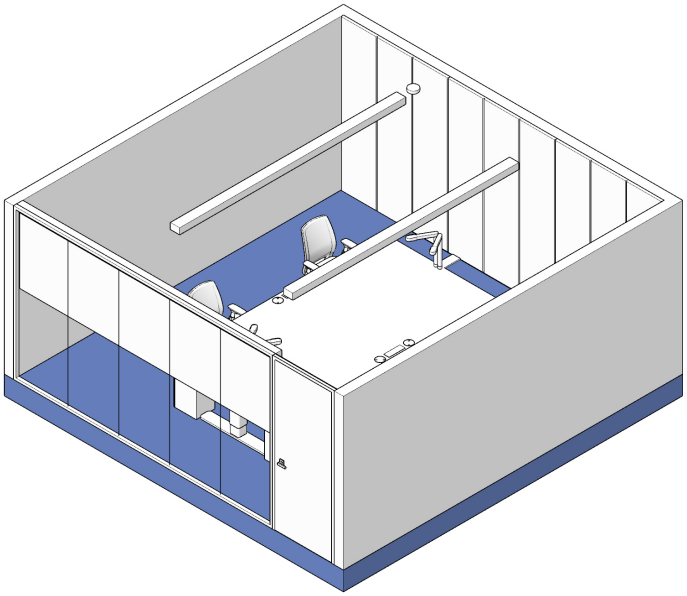


Fig. 4.2.28 Axonometric of Group Office.

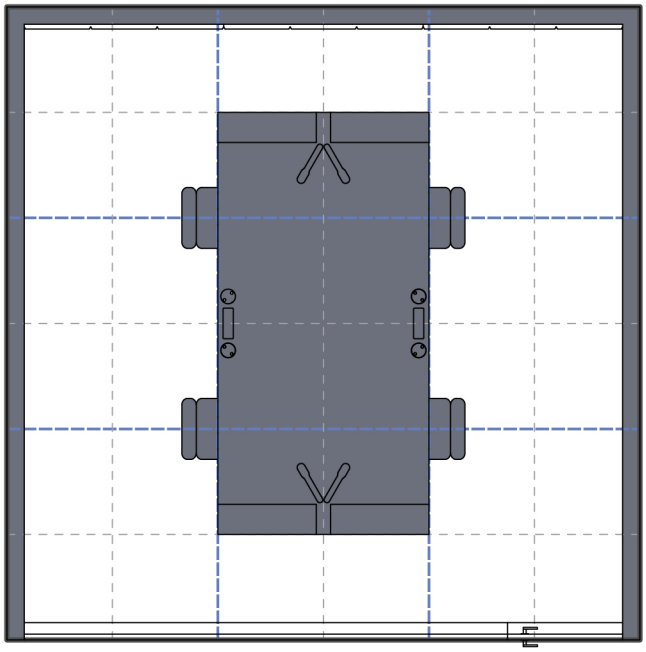


Fig. 4.2.29 Placement plan for Group Office.

5.5 X 5.5M

INDIVIDUAL OFFICE

PRIVACY DAY-USE SPACES

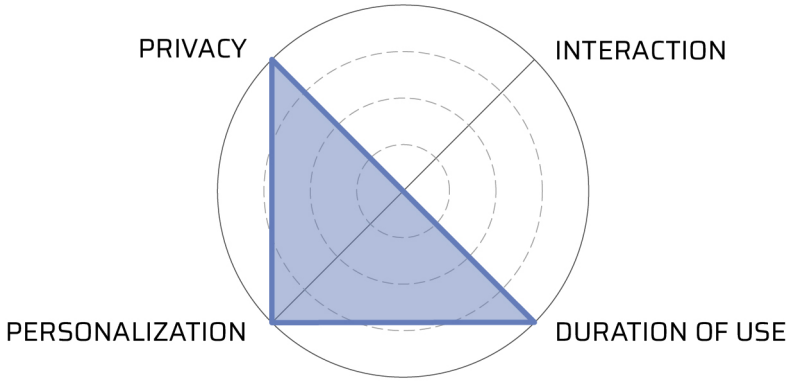


Fig. 4.2.30 Spider graph showing the Individual Office's performance across key criteria.

The Individual Office (Figure 4.2.31) is the only program with spatial qualities that allow it to be personalized with the most precision. As it is used by a single person, is contained, and isolated from its surroundings, the environment can be tuned to exactly to the preferences of its occupant. As all adjustments are contained, modifications inside will not distract others and solely enhance the experience of the intended user. These modifications can be classified under three categories: comfort, privacy, and personal items. Many of these components are automated, streamlining the setup process and allowing the space to revert to its original configuration when the occupant arrives or departs. The layout occupies two large grids forming a series of three individual private offices. This space is ideal for individuals that benefit from zero distractions, do not need frequent periods of communication with colleagues, and require privacy due to the confidentiality of the work being done.

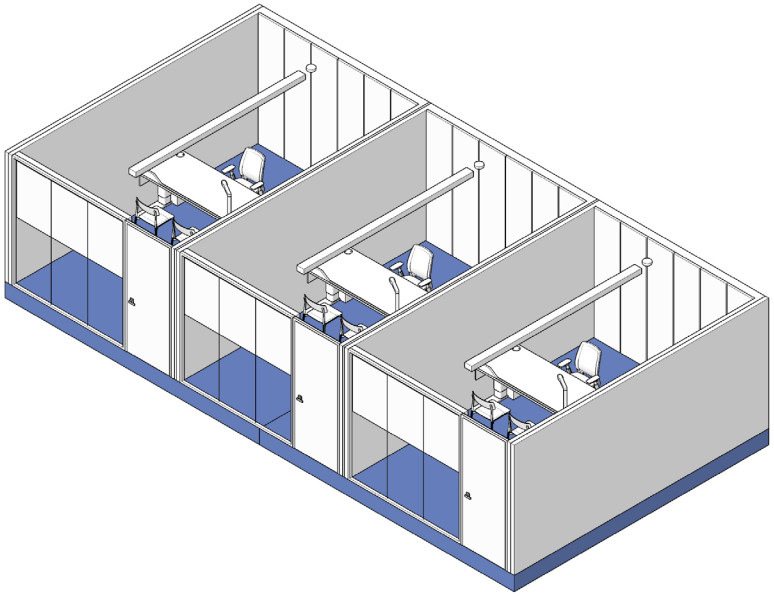


Fig. 4.2.31 Axonometric of Individual Office.

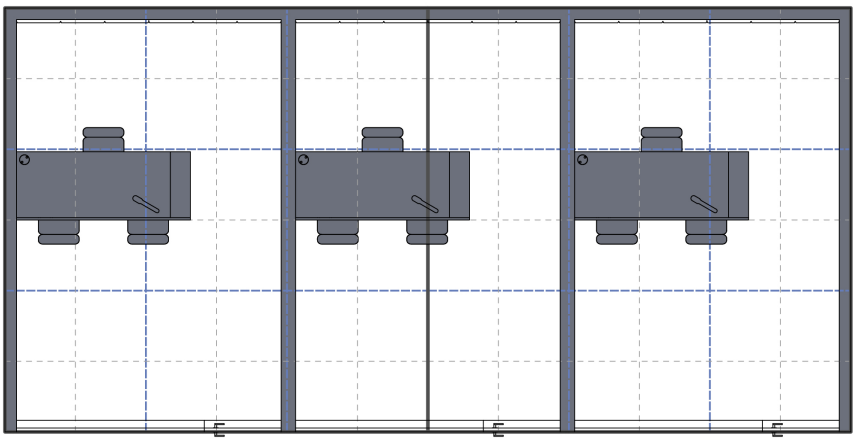


Fig. 4.2.32 Placement plan for Individual Office.

5.5 X 5.5M

INNOVATION SPACE
COLLABORATION SPACES

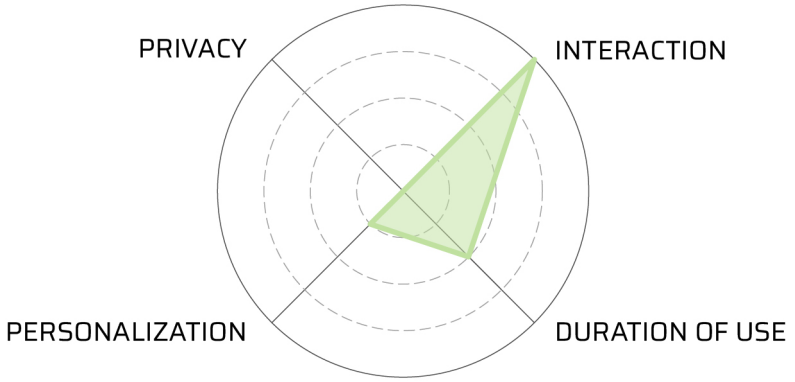


Fig. 4.2.33 Spider graph showing the Innovation Space's performance across key criteria.

The Innovation Space includes two whiteboards, two benches, and five repositionable seating elements (Figure 4.2.34). This space can support groups of varying sizes and is designed for to assist brainstorming and to encourage stimulation of new ideas. Notes on the whiteboards do not need to be removed after each use and can be a way of allowing ideas to spread throughout the neighbourhood as different members use the space.

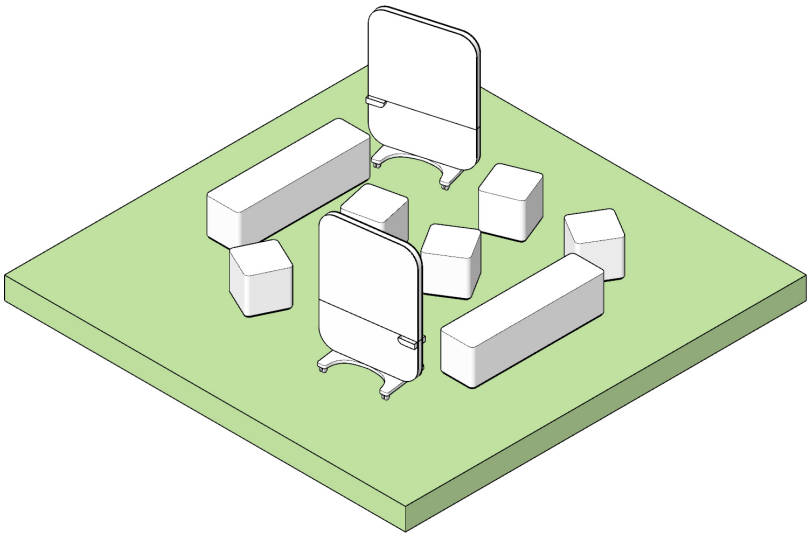


Fig. 4.2.34 Axonometric of Innovation Space.

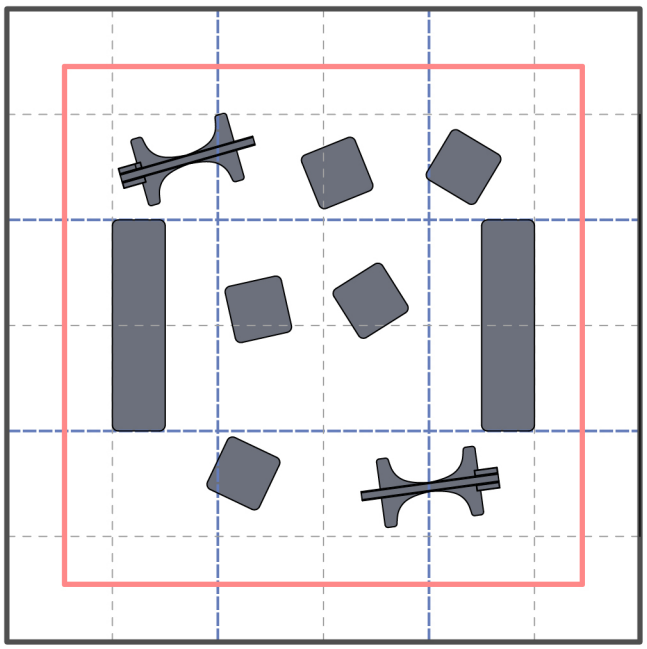


Fig. 4.2.35 Placement plan for Innovation Space.

5.5 X 5.5M

LARGE GROUP COLLAB

COLLABORATION SPACES

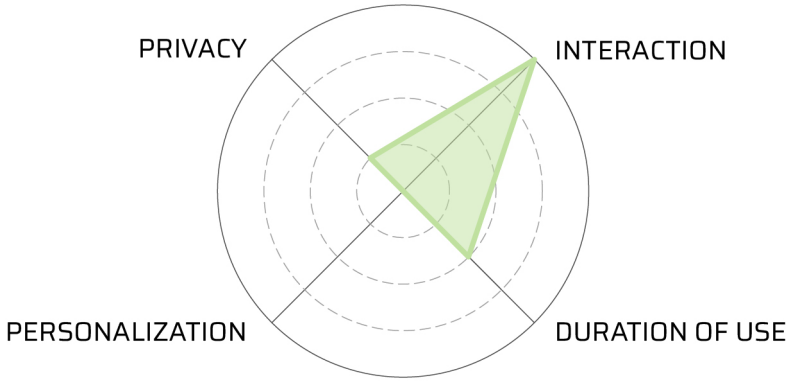


Fig. 4.2.36 Spider graph showing the Large Group Collab's performance across key criteria.

This layout (Figure 4.2.37) was created to support single groups of collaboration that require a physical working surface. It has a maximum capacity of eight people surrounding a single table. As they spaces are intended to be used for short sessions throughout the day, benches are put in place instead of chairs to differentiate these spaces from day-use spaces. If prolonged usage is needed, a group day-use space would be more appropriate. The space is best suited for single groups that would like to collaborate on a task that are of a size between four to six people with demand for a large work surface.

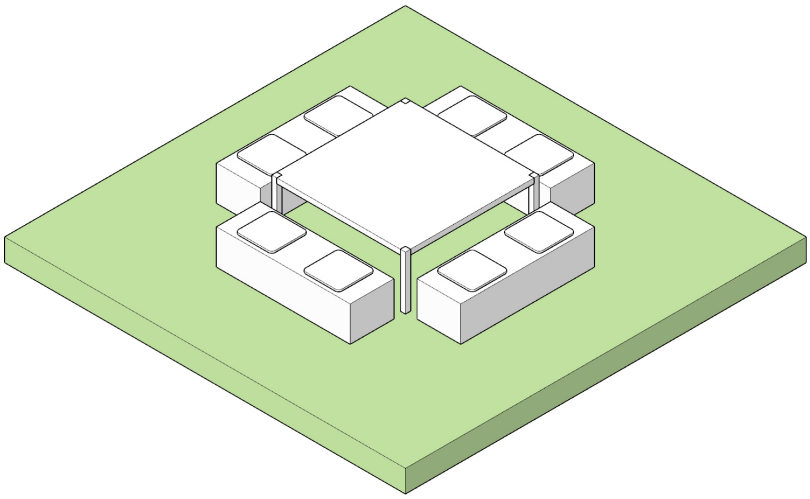


Fig. 4.2.37 Axonometric of Large Group Collab.

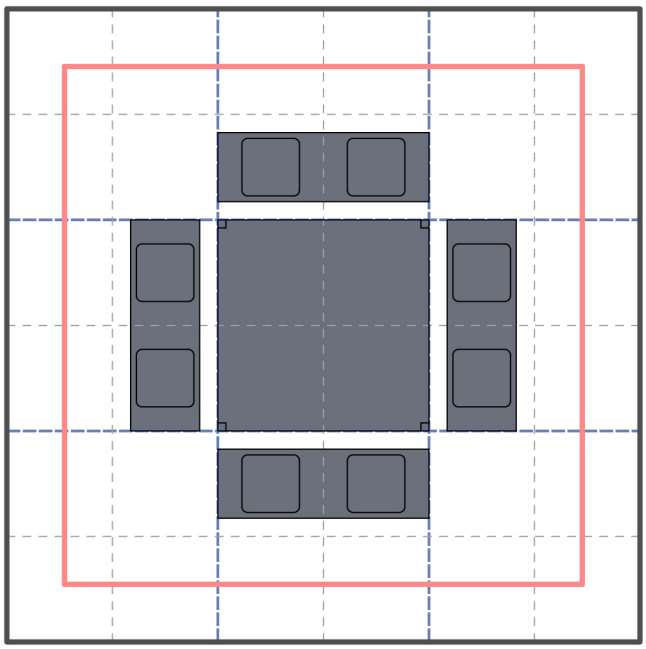


Fig. 4.2.38 Placement plan for Large Group Collab.

5.5 X 5.5M

SMALL GROUPS COLLAB
COLLABORATION SPACES

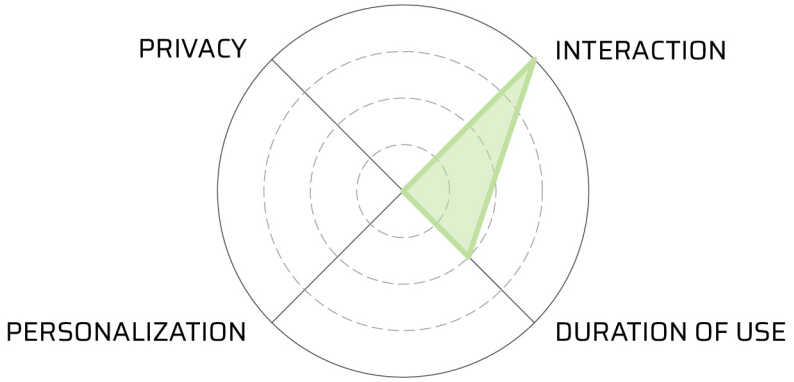


Fig. 4.2.39 Spider graph showing the Small Groups Collab's performance across key criteria.

This collaboration space includes capacity for four groups of people ranging from sizes of two to four people (Figure 4.2.40). Unlike the Large Group Collab space, the tables are smaller yet large enough for each person to bring a laptop. This space is ideal for smaller groups with less demanding space needs, and provides a convenient setting for quick and casual meetings with colleagues.

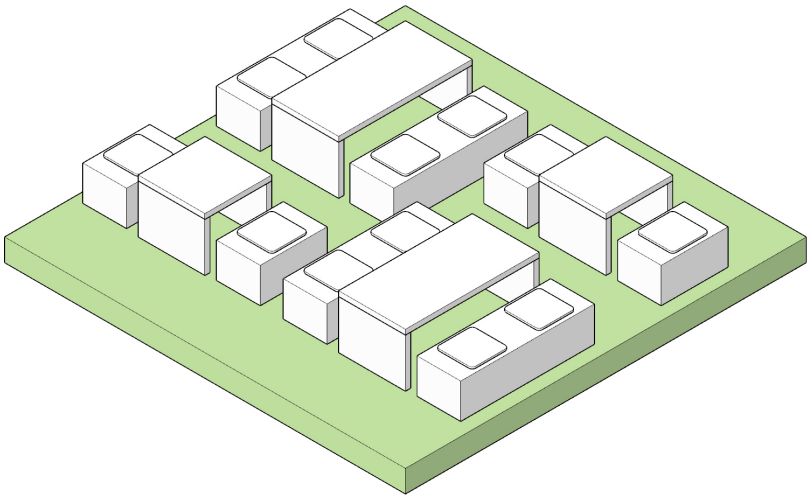


Fig. 4.2.40 Axonometric of Small Groups Collab.

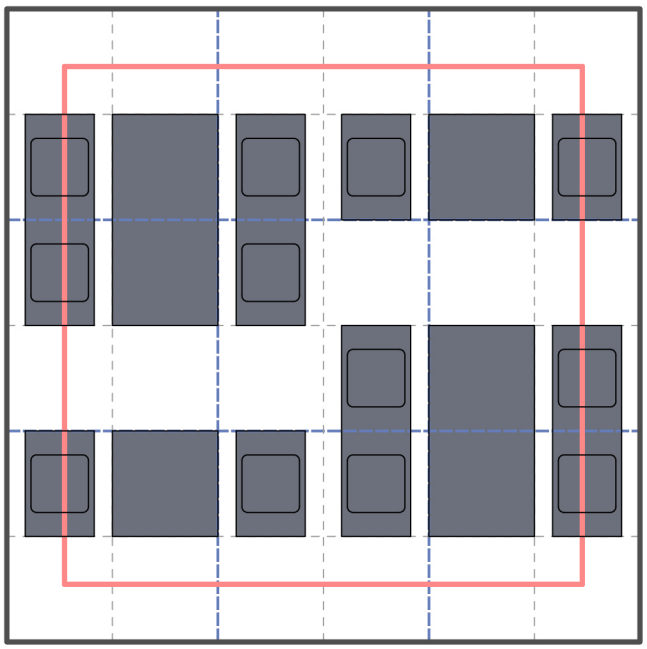


Fig. 4.2.41 Placement plan for Small Groups Collab.

5.5 X 5.5M

LOUNGE

COLLABORATION SPACES

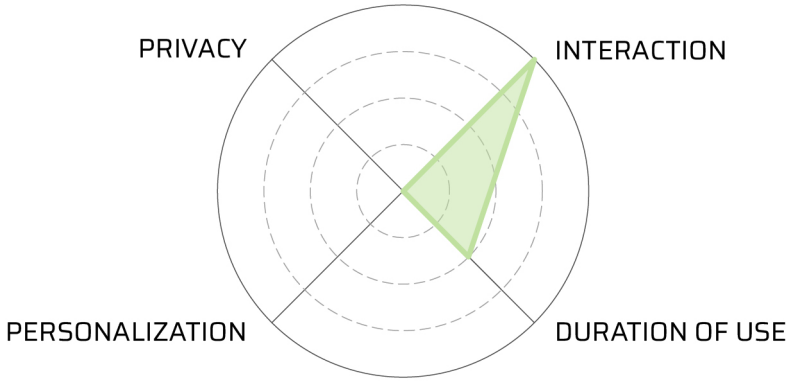


Fig. 4.2.42 Spider graph showing the Lounge's performance across key criteria.

This space emphasizes the importance of taking a break to refresh and recharge. It includes two long sofas, a coffee table, and three side seating elements creating an environment that is comfortable and inviting (Figure 4.2.43). This block is best for informal gatherings, relaxation, or casual conversations, allowing individuals to unwind or step away momentarily for a break.

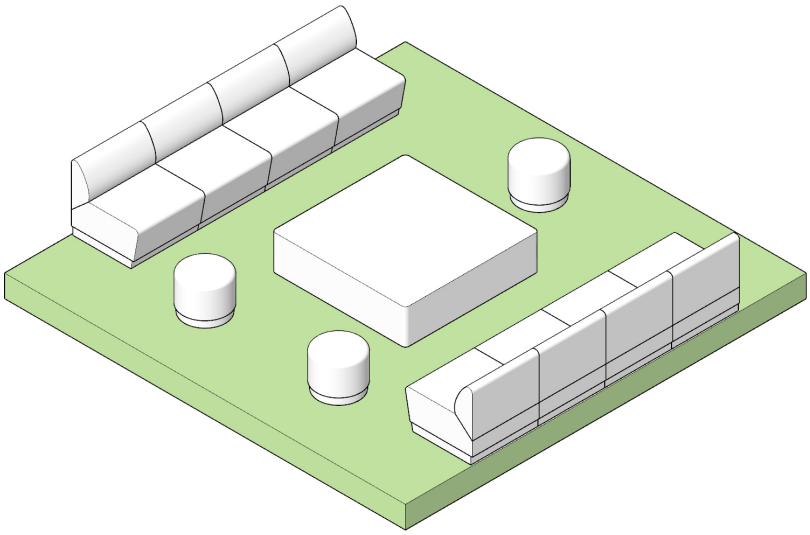


Fig. 4.2.43 Axonometric of Lounge.

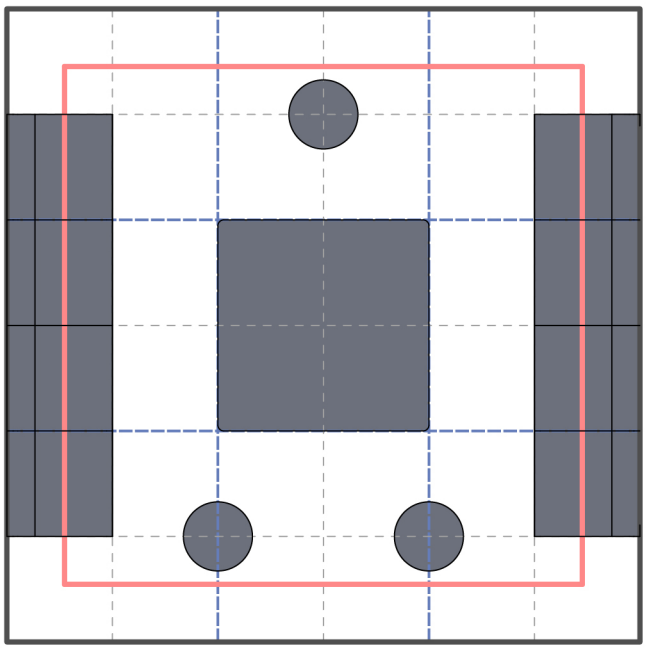


Fig. 4.2.44 Placement plan for Lounge.

5.5 X 5.5M

COLLAB + STORAGE

COLLABORATION SPACES

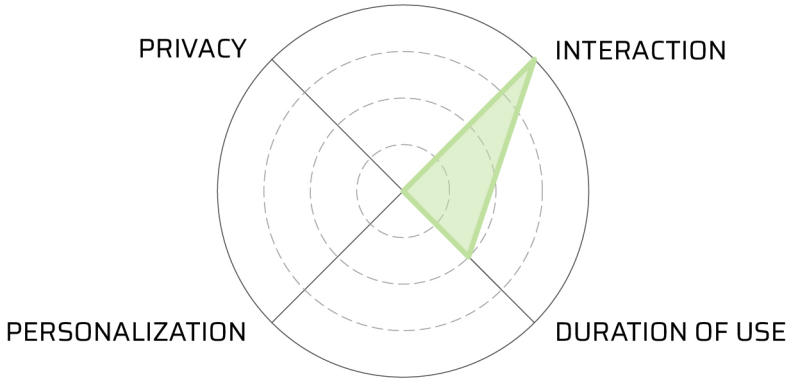


Fig. 4.2.45 Spider graph showing the Collab + Storage's performance across key criteria.

This block combines group collaboration and storage into a single element (Figure 4.2.46). Surrounding a table, a low storage unit doubling as a bench for seating up to fourteen people can be found. This block is best suited to be placed in central locations where multiple neighbourhoods with storage requirements can access it. By placing it in those locations, communication between neighbourhoods can be done in the boundaries of this block.

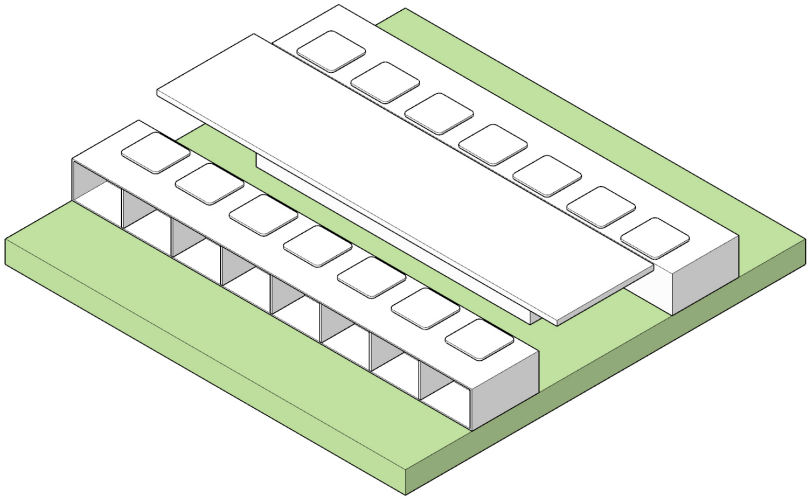


Fig. 4.2.46 Axonometric of Collab + Storage.

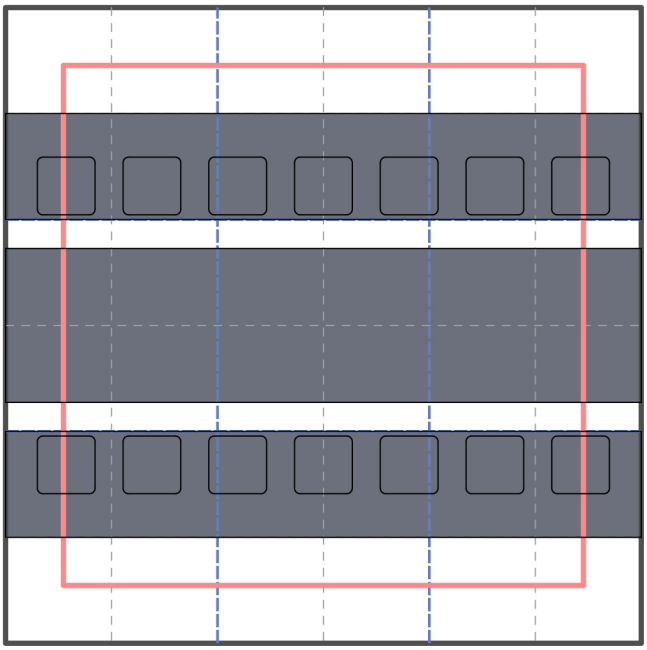


Fig. 4.2.47 Placement plan for Collab + Storage

5.5 X 5.5M

SMALL GROUPS COLLAB

COLLABORATION SPACES

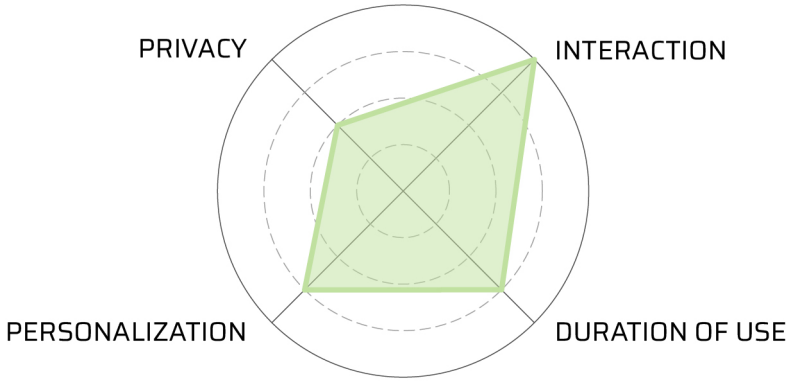


Fig. 4.2.48 Spider graph showing the Reconfigurable Meeting Space's performance across key criteria.

Similar to the Collab + Storage block, this block is intended to be placed in a central zone. This layout is designed to provide separation and space between groups of people looking to have quick casual meetings. A greater degree of isolation is provided over other informal collaboration spaces, effectively minimizing distractions. The setup is comprised of four pods each capable of seating two with a table in between (Figure 4.2.52). The pods are on rails, allowing them to be repositioned linearly. The arrangement of the pods is automatically moved into position based on the bookings for the space. Unlike other spaces in the office, users do not choose which pod they would like to use. Instead, when they book a pod, the group size would be specified along with when the meeting starts and the duration of the stay. Based on these bookings, the most optimized configuration can be computed.

If users were provided with the option to choose the pod at random, instances where a group of a specific size larger than

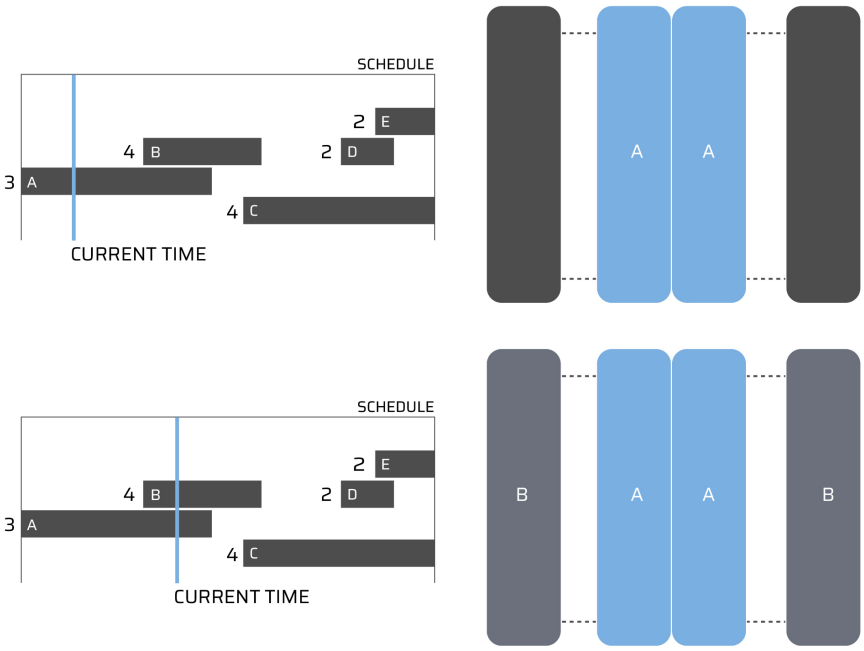


Fig. 4.2.49 Diagram showing potential results when users can select the pod they want to use.

two would find that no suitable configuration is possible for their needs. Figure 4.2.49 illustrates this issue. Group A has three people and chooses the middle two pods. When Group B, with four members, arrives at a later time while Group A is still in meeting. While there are four seats available, the pods are separated by the ones occupied by Group A rendering the remaining pods would be unusable for Group B. Figure 4.2.50 illustrates an example where users do not choose the pod, and the arrangement is computed. Before Group A arrives, the pods have already moved into place separating into two groups in anticipation for Group A and Group B. When Group A arrives, from the kiosk located at the first pod, they are able to easily identify which pods to use. This time, when Group B arrives, the pods are available for them. The schedule can then proceed without any interruptions. When Group C arrives, they take the first two pods. After Group B leaves, the pods that they were using are separated in anticipation for Groups D and E, each with two people.

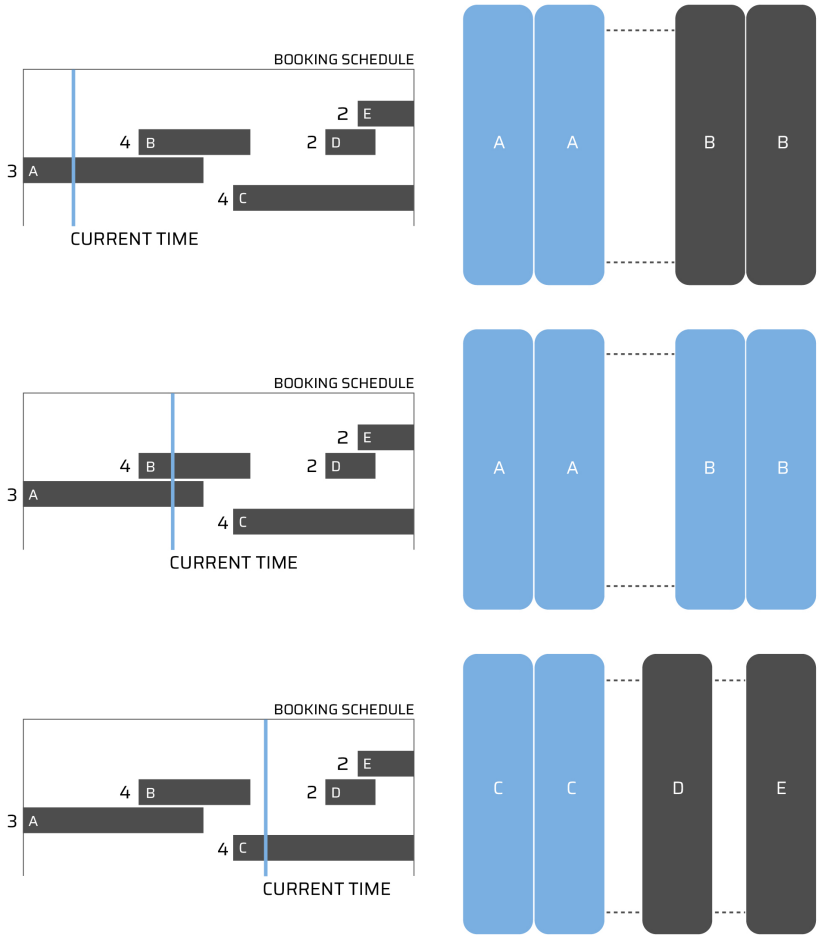


Fig. 4.2.50 Diagram showing results when the pods users use are computed.

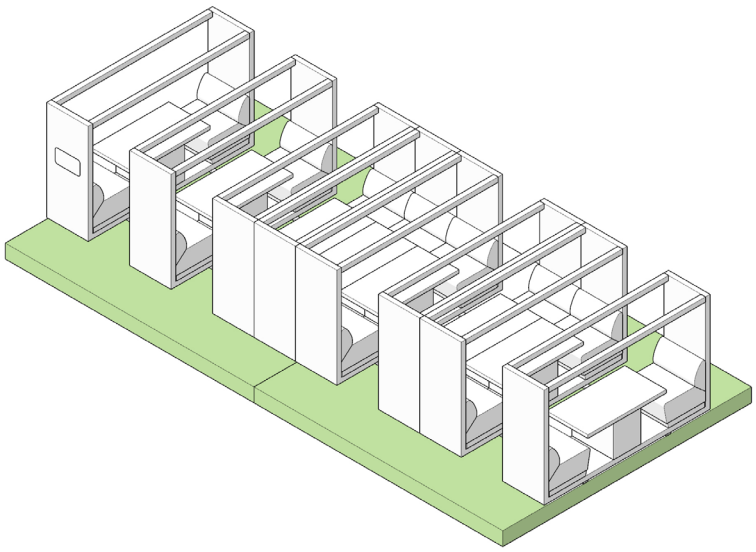


Fig. 4.1.51 Axonometric of two Reconfigurable Meeting Space blocks combined.

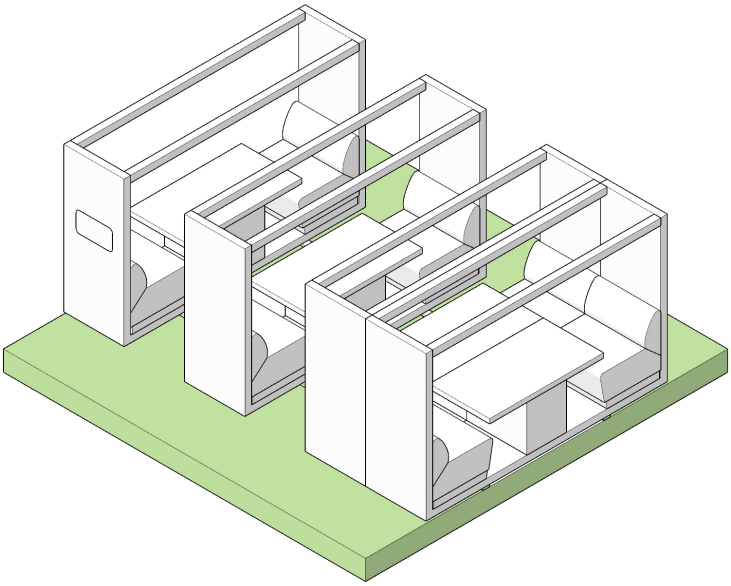


Fig. 4.2.52 Axonometric of Reconfigurable Meeting Space.

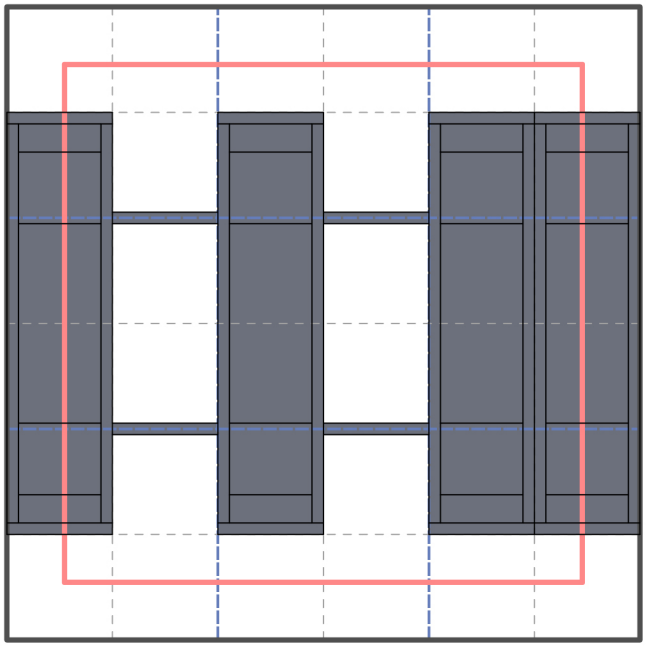


Fig. 4.2.53 Placement plan for Reconfigurable Meeting Space.

5.5 X 5.5M

PHONE BOOTH

PRIVACY SPACES

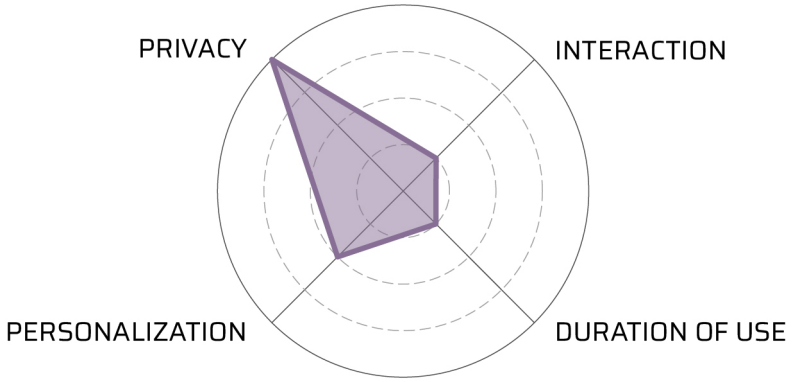


Fig. 4.2.54 Spider graph showing the Phone Booths's performance across key criteria.

This block is comprised of three pods, two with a capacity of two people, and a larger one with a capacity of four people (Figure 4.2.55). It is best to place this block in a centralized zone where many neighbourhoods can have access to it. These booths provide a quiet place that allows people to take phone calls without distracting those around them.

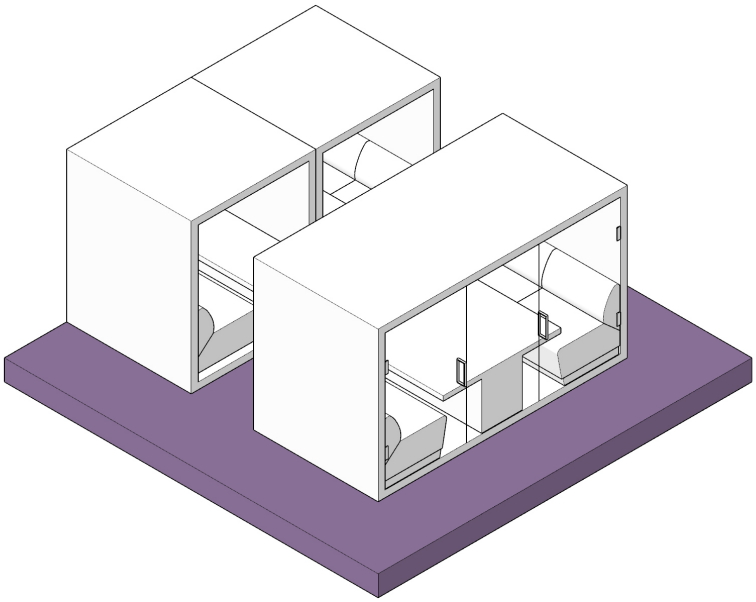


Fig. 4.2.55 Axonometric of Phone Booth.

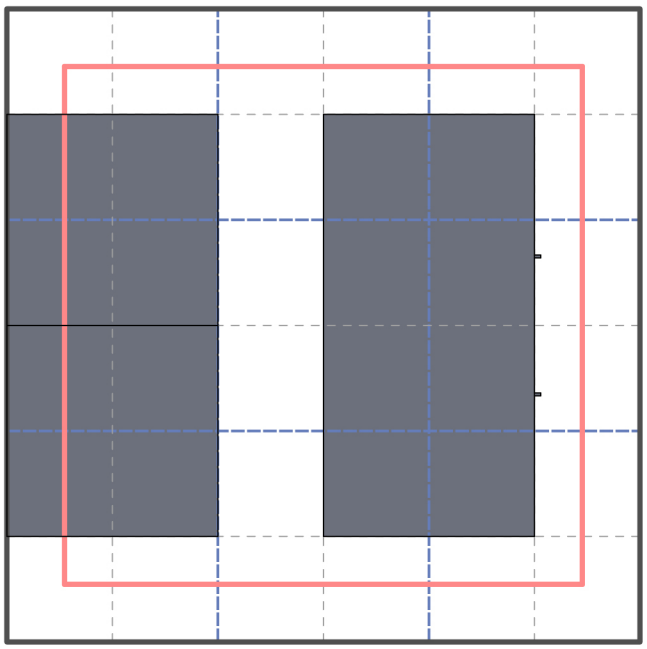


Fig. 4.2.56 Placement plan for Phone Booth.

2 X 5.5M
ACOUSTIC DIVIDER
PARTITIONS

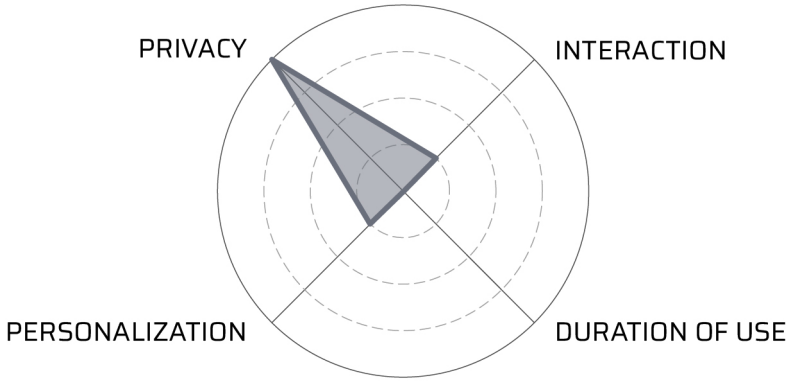


Fig. 4.2.57 Spider graph showing the Acoustic Divider's performance across key criteria.

The Acoustic Divider block has four types, each varying in length and position of the partition (Figure 4.2.58). These acoustic dividers serve as both a noise and visual barrier while also providing a vertical surface for pinning up materials to display within the neighbourhood.

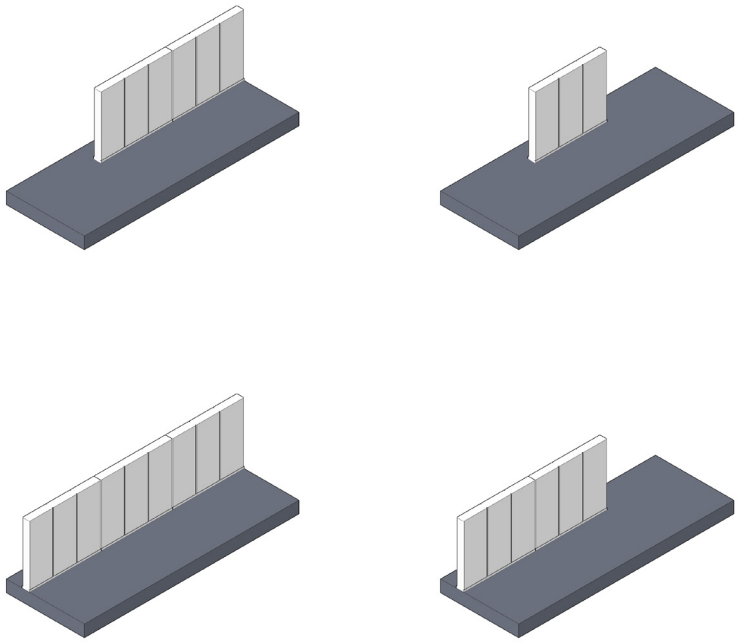


Fig. 4.2.58 Axonometric series of Acoustic Dividers.

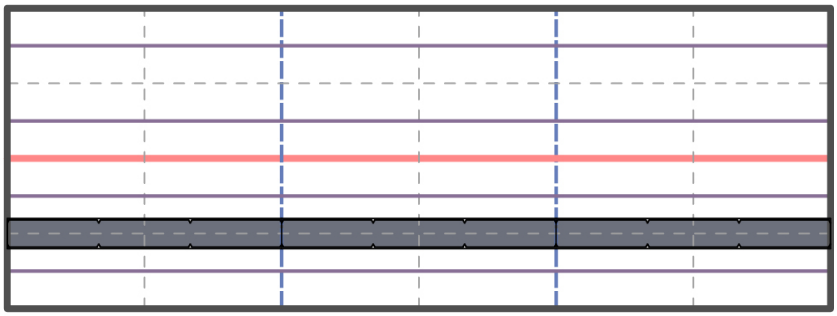


Fig. 4.2.59 Placement plan for Acoustic Dividers.

2 X 5.5M
PLANTER
PARTITIONS

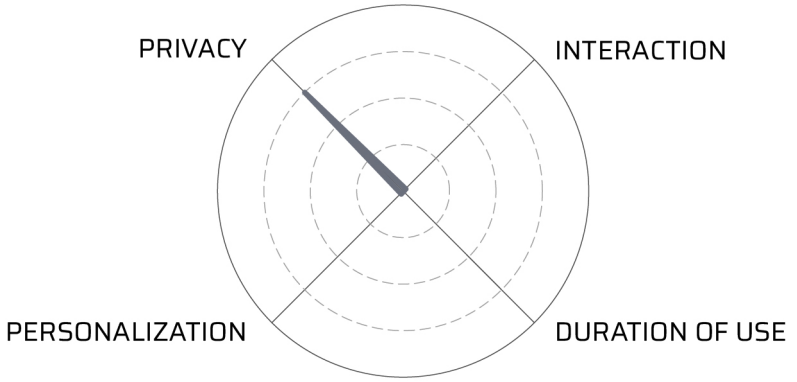


Fig. 4.2.60 Spider graph showing the Planters's performance across key criteria.

The Planter blocks, like the acoustic dividers, come in four varying lengths and placement (Figure 4.2.61). These dividers offer effective separation within the space while maintaining a lighter presence than its solid counterparts. They allow natural light to penetrate deeper into the space while introducing greenery into the environment.

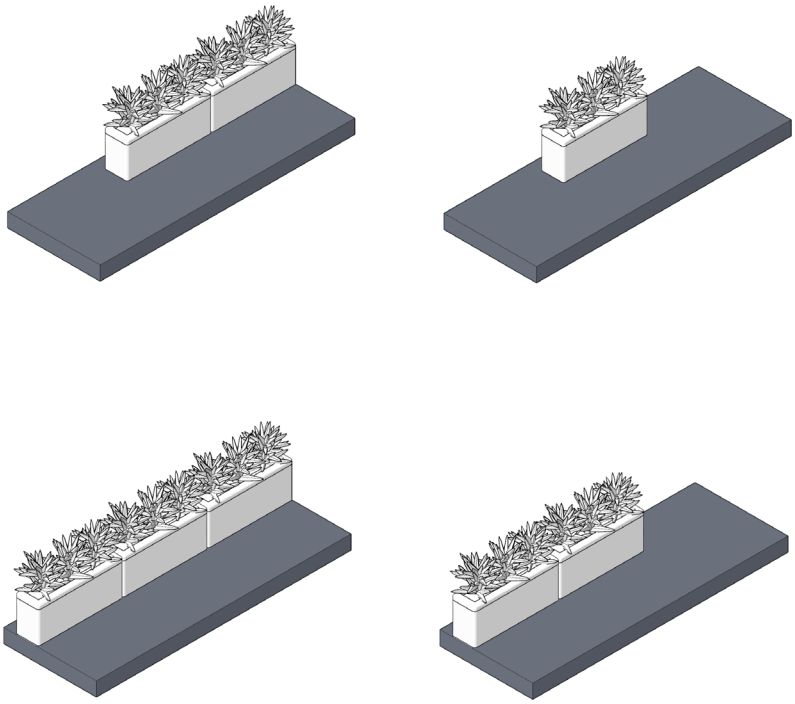


Fig. 4.2.61 Axonometric series of Planters.

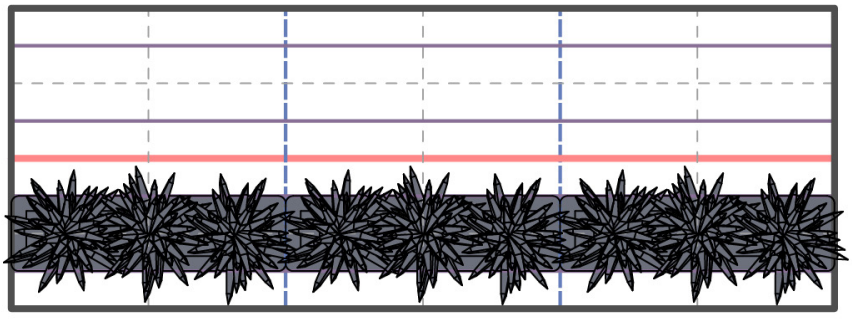


Fig. 4.2.62 Placement plan for Planters.

2 X 5.5M
EDGE SEATING
PARTITIONS

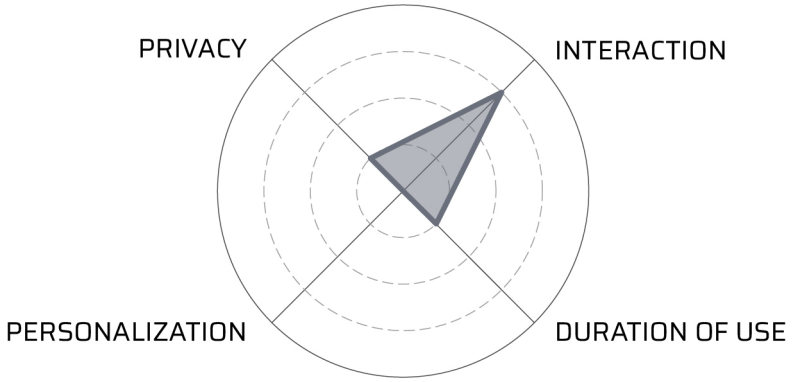


Fig. 4.2.63 Spider graph showing the Edge Seating's performance across key criteria.

This block has three types of two lengths and varying placements (Figure 4.2.64). These are designed to be placed at the perimeters of the plan in areas of low foot traffic such as near the windows. Depending on the length, a capacity of four to six people can use the block simultaneously.

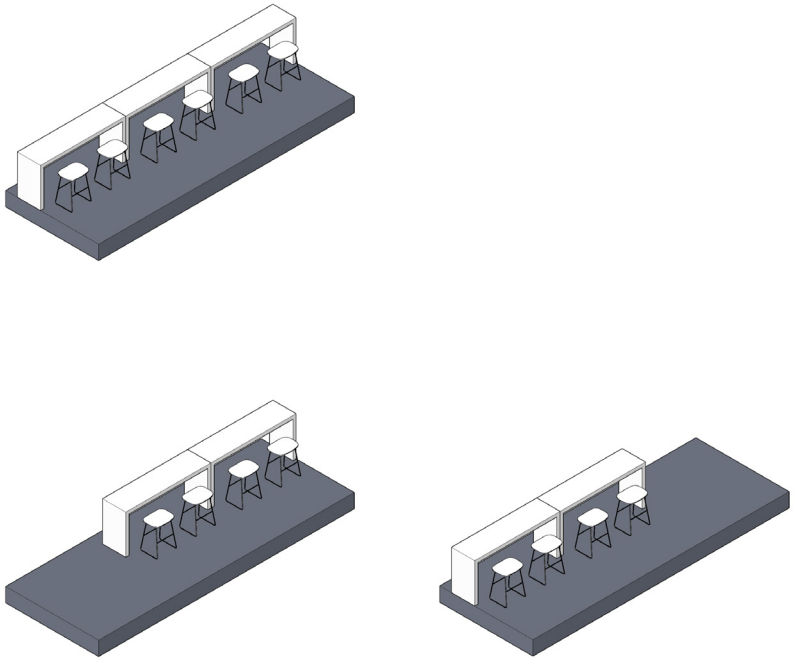


Fig. 4.2.64 Axonometric series of Edge Seating.

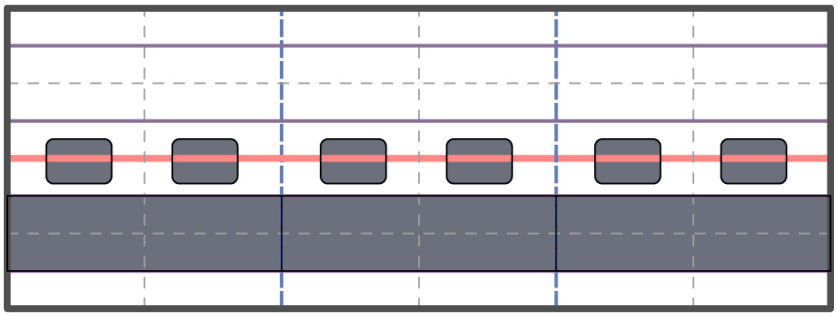


Fig. 4.2.65 Placement plan for Edge Seating

2 X 5.5M
PERSONAL CADDY STORAGE
PARTITIONS

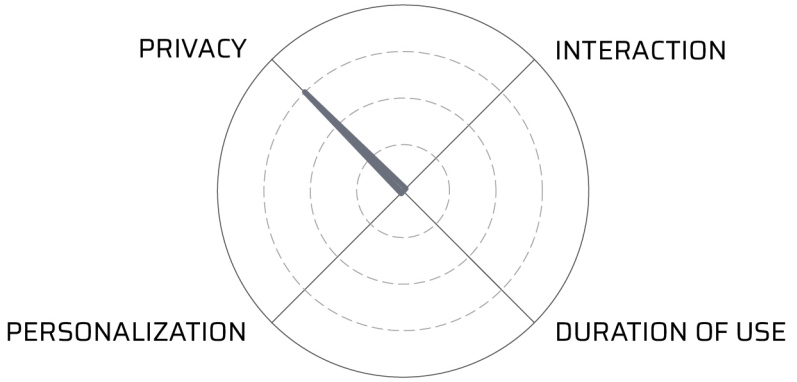


Fig. 4.2.66 Spider graph showing the Personal Caddy Storage's performance across key criteria.

Each compartment within the storage unit is allocated to a unique staff member to store their personal caddy when not in the office (Figure 4.2.67). The personal caddy functions as a portable storage solution for belongings that, in a traditional office, would be kept at an assigned desk. Further details on the role of the personal caddy and its integration into the overall office experience will be outlined in a later section. With different groups of people using the office each day, the removal of caddies creates a dynamic and continuous changing pattern of empty spaces, transforming the partition into a unique visual element that evolves daily.

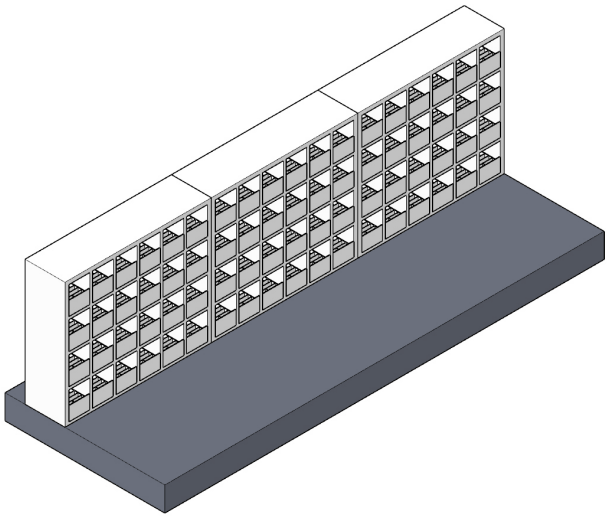


Fig. 4.2.67 Axonometric of Personal Caddy Storage.

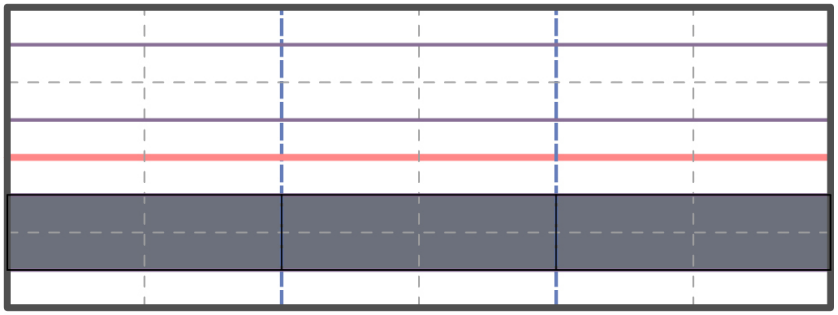
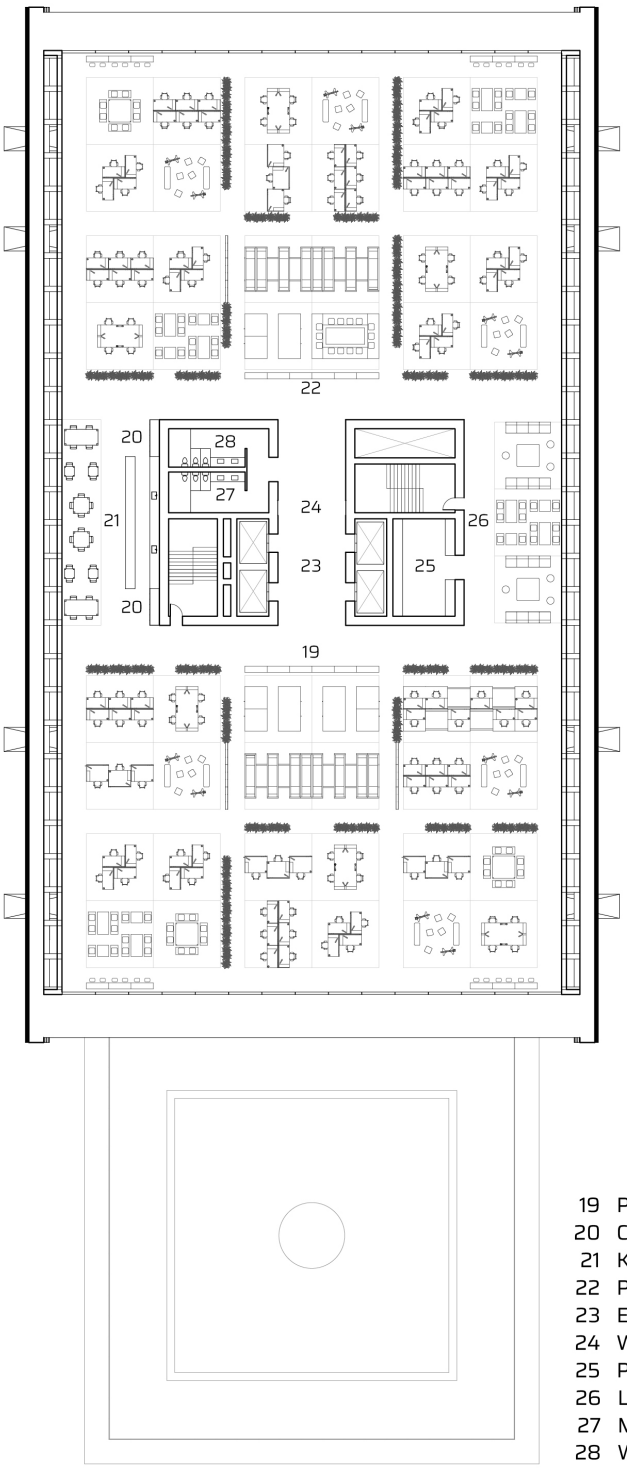


Fig. 4.2.68 Placement plan for Personal Caddy Storage.

With the plans filled with the blocks (Figure 4.2.69), a complete layout of the plan is formed. While most of the floor plan uses the modular system, the new kitchenette area to the left of the core has been excluded. The blocks in the plan, placed together, form the sub regions of the neighbourhoods in the plan. The orientation of them is flexible, but certain orientations may improve circulation within the neighbourhoods or better visibility of the windows to the outside. In this specific arrangement, as shown in (Figure 4.2.71), has a total of six neighbourhoods with three on each side. The dark blue regions are shared by all neighbourhoods, containing reconfigurable meeting spaces, phone booths, and storage units. Partitions are placed to provide a visual separation between neighbourhoods and are spaced to effectively allow movement between the main circulation and working areas.

Each neighbourhood has a combination of day-use blocks and collaboration spaces. The type of block used is dependant on the type of work a team in the neighbourhood is working on. If a particular configuration proves ineffective, blocks can easily be replaced without other layouts to improve the working experience. A supply of additional furniture that make up the components of each block are stored in the storage unit on the ground floor. These components are shared between tenants as well. To further define the boundaries of each neighbourhood with visual ques, the floor uses a checkered pattern of carpet tiles illustrated in Figure 4.2.73, reinforcing the spatial organization as well as maintaining visual cohesion.



19 PERSONAL CADDY STORAGE
20 COAT CLOSET
21 KITCHENETTE
22 PERSONAL CADDY STORAGE
23 ELEVTAOR LOBBY
24 WAYFINDING KIOSKS
25 PRINT ROOM
26 LOUNGE
27 MEN'S WASHROOM
28 WOMEN'S WASHROOM

Fig. 4.2.69 Typical floor plan of level 3, 4, 6, and 7 with a possible arrangement.

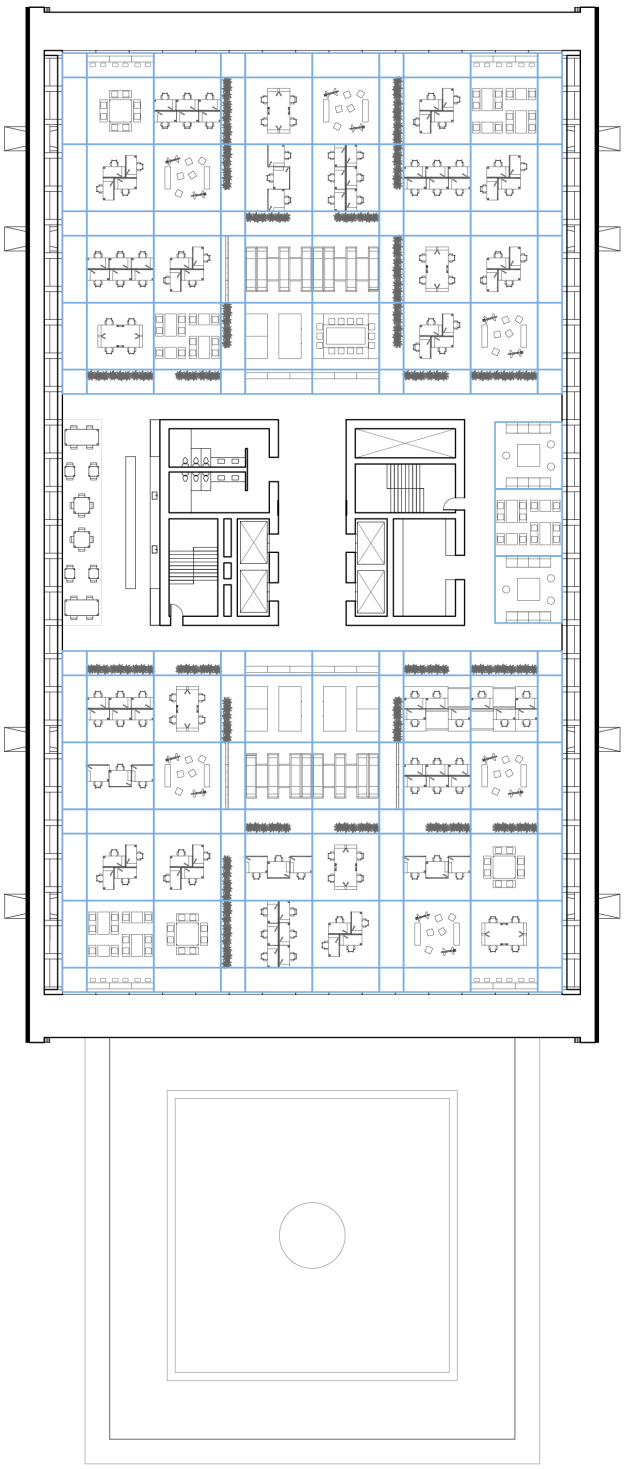


Fig. 4.2.70 Typical floor plan of level 3, 4, 6, and 7 with modular grid overlaid.

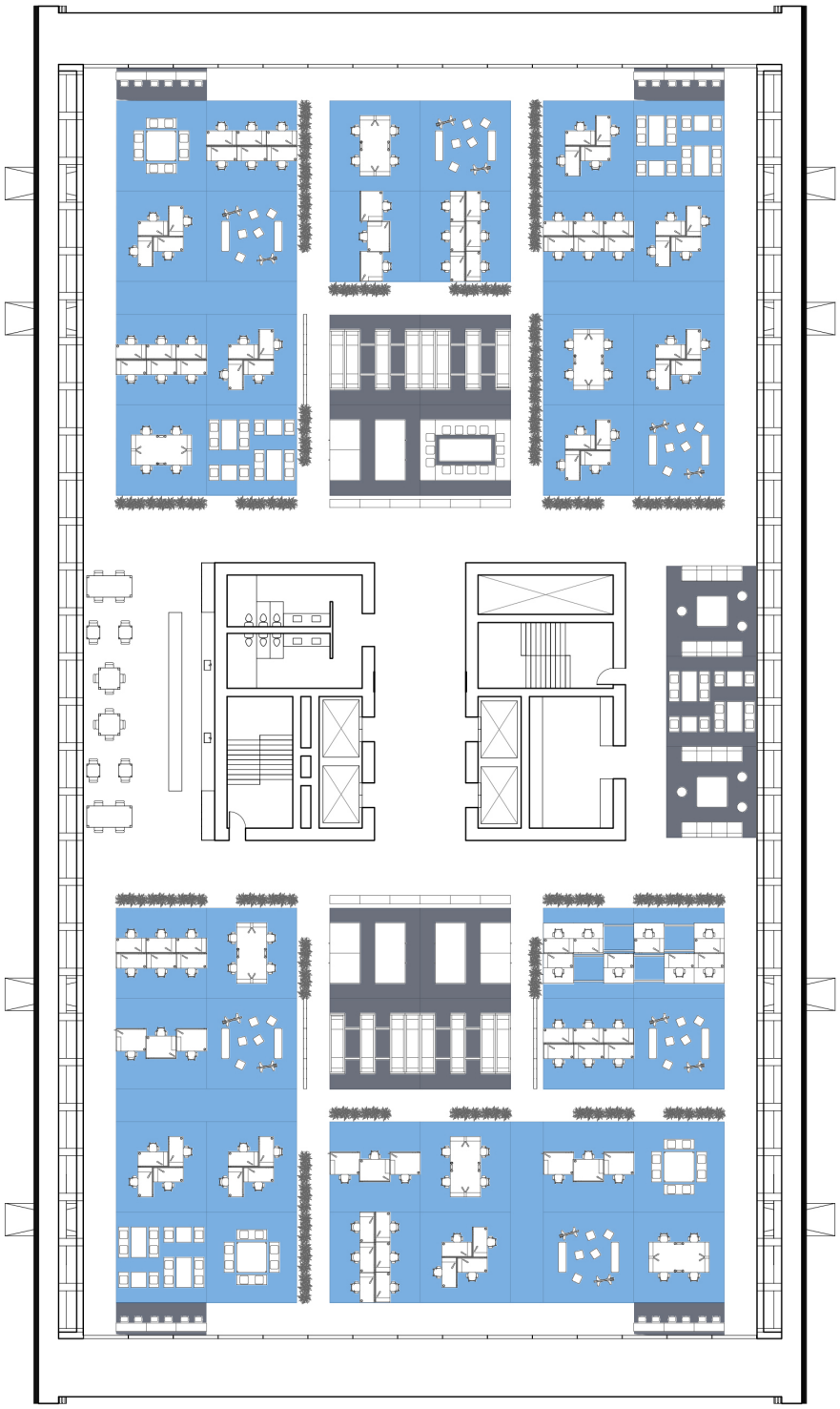


Fig. 4.2.71 Typical floor plan of level 3, 4, 6, and 7 with unique neighbourhoods highlighted.



Fig. 4.2.72 Typical floor plan of level 3, 4, 6, and 7 with block types used colour coded.

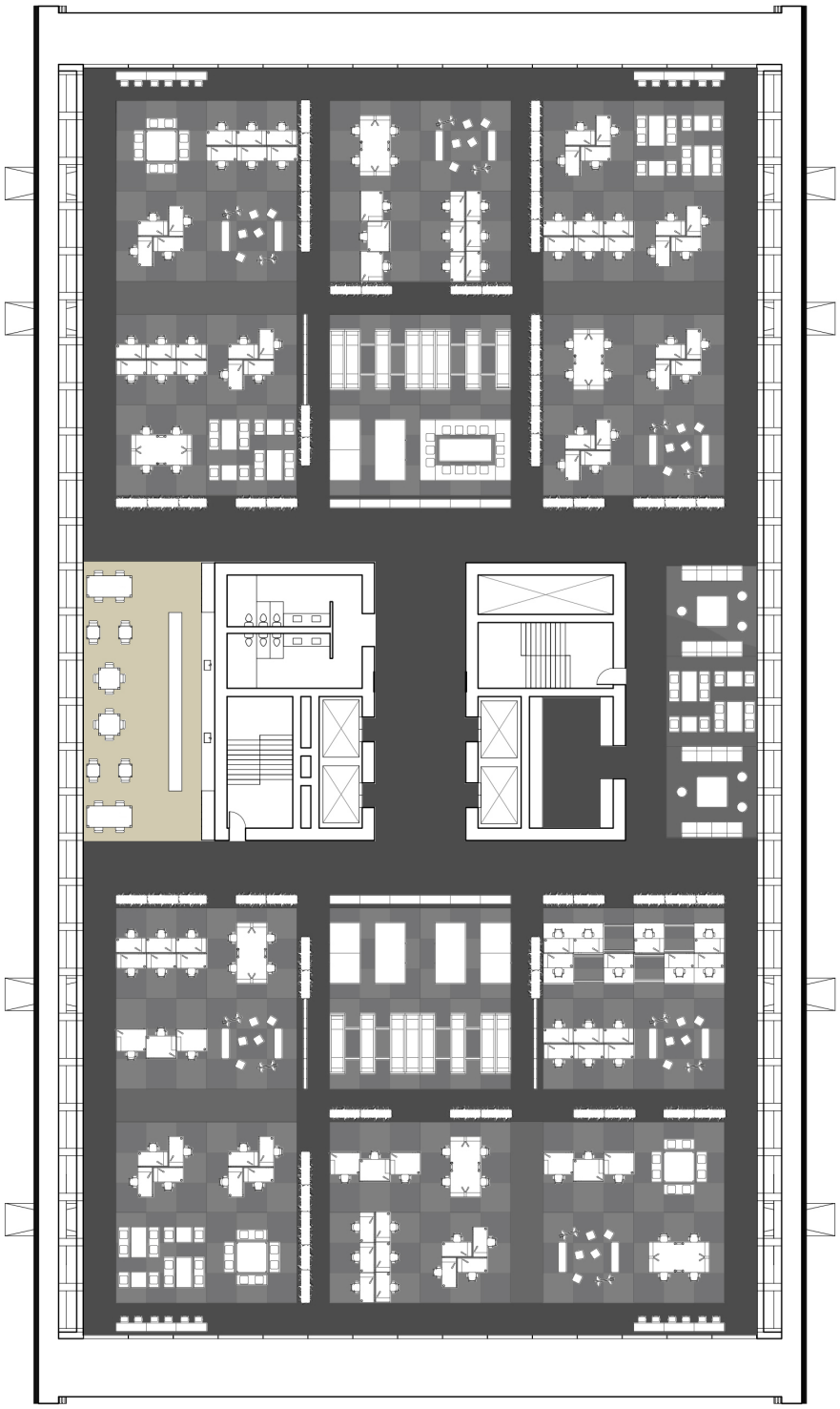


Fig. 4.2.73 Typical floor plan of level 3, 4, 6, and 7 illustrating the different flooring material.



Fig. 4.2.74 Typical rendering of level 3, 4, 6, and 7.



Fig. 4.2.75 Typical rendering of level 3, 4, 6, and 7.

LEVEL 5

This floor illustrated in Figure 4.2.76 and Figure 4.2.77, being shared with all tenants, contains private offices, meeting rooms, and active collaboration spaces. Private offices were selected to be shared due to them having strong isolation qualities. Individuals typically only choose to work in a private office if they need the isolation to focus, suggesting that limited interaction with colleagues is expected. As a result, locating these offices on a different floor from an individual's team will not hinder productivity. Additionally, because these rooms provide the maximum level of privacy (Figure 4.2.78), there is minimal risk of sensitive information being exposed to other tenants on the same floor. This makes it feasible for multiple tenants to utilize these spaces simultaneously without concern for confidentiality.

Meeting rooms have been centralized to this floor as they tend to be underutilized spaces in a traditional office. Typically, they are only used 40% of the day.[1] Additionally peak utilization typically occurs during short periods within the day. In an effort to increase the utilization of these spaces, reducing the number of meeting rooms available while increasing the number of tenants sharing these spaces would be an effective approach. Furthermore, the inclusion of casual meeting spaces on the main working floors further helps ease usage during peak hours, effectively spreading utilization evenly throughout the building.

1 Robin, "How to Calculate Office Space and Meeting Room Utilization."

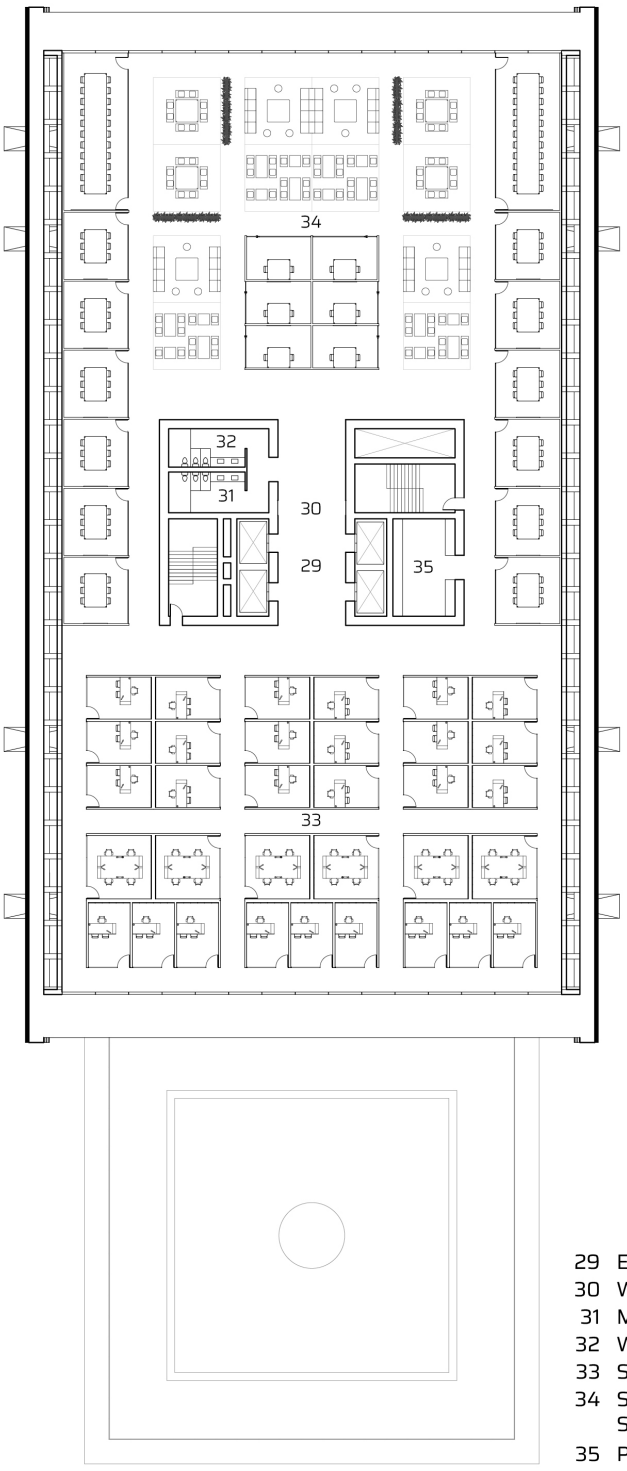


Fig. 4.2.76 Floor plan of level 5.

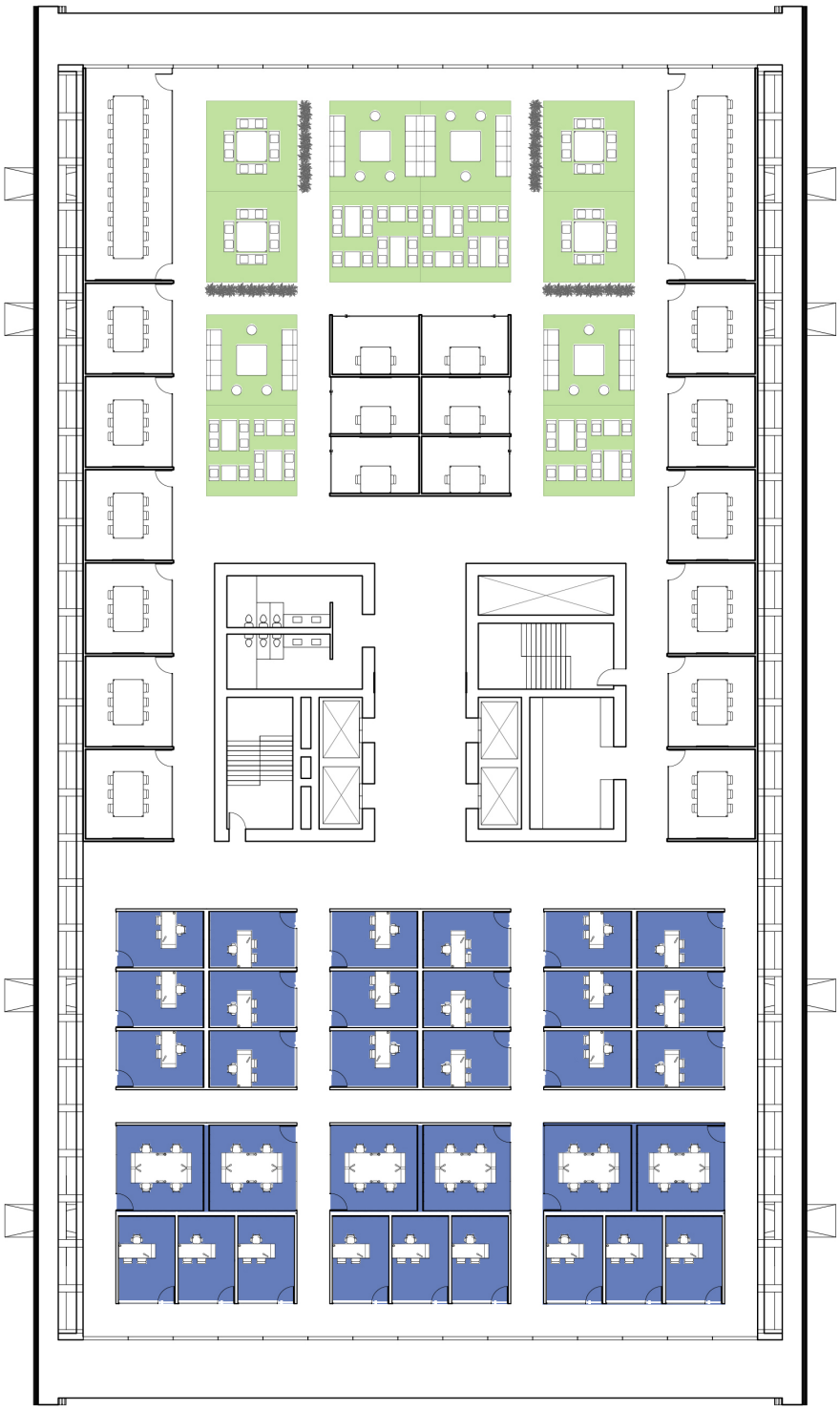


Fig. 4.2.77 Floor plan of level 5 with block types used colour coded.



Fig. 4.2.78 Rendering of level 5 at the private offices.

LEVEL 8

Upon leaving the elevators, an individual is greeted with two multipurpose rooms located at opposite ends of the building, each serving as flexible, adaptable spaces (Figure 4.2.79). The smaller of the two, positioned towards the rear of the building, is equipped with storage rooms containing chairs, tables and dividers, allowing users to easily reconfigure the room for various purposes. This can range from company workshops and presentations to social events (Figure 4.2.80). A kitchenette is also included, facilitating the preparation and serving of refreshments and light catering.

At the opposite end of the building, a larger multipurpose room is designed to accommodate all-staff events. Like the smaller room, it features a storage room and kitchenette, but also includes a full-size kitchen, making it ideal for events that require on-site food preparation, such as company dinners or larger catered events.

Both rooms are available to book by the employees of any tenant and can also be rented by the public. Given the large space with generally infrequent use, opening them to public rentals not only maximizes utilization but also helps offset overhead costs. Through the use of this method, the building serves both the private and the surrounding community needs effectively.

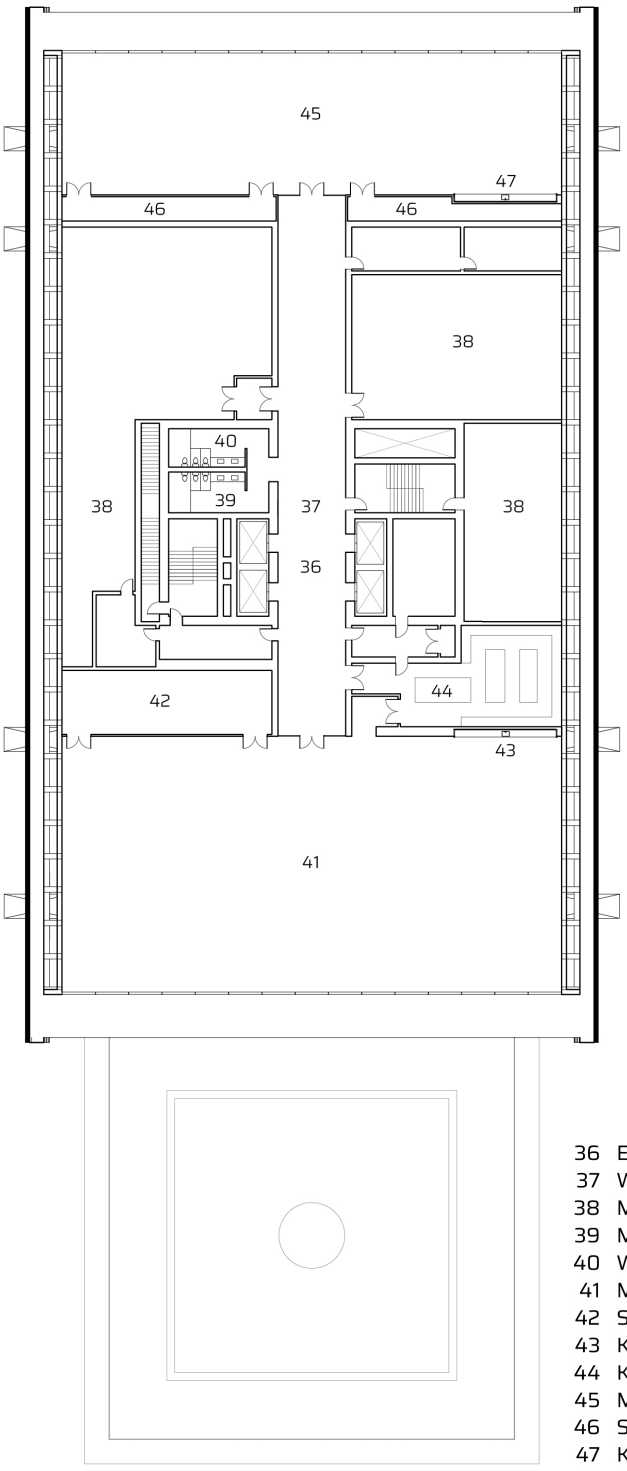


Fig. 4.2.79 Floor plan of level 8



Fig. 4.2.80 Rendering of the large multipurpose room setup for a company event.

4.3 ADAPTING TO CHANGE

This section illustrates a hypothetical scenario in how the floor plan can evolve over time using the modular system to adapt to the changing needs of teams. A series of four snapshots over the course of four months is presented.

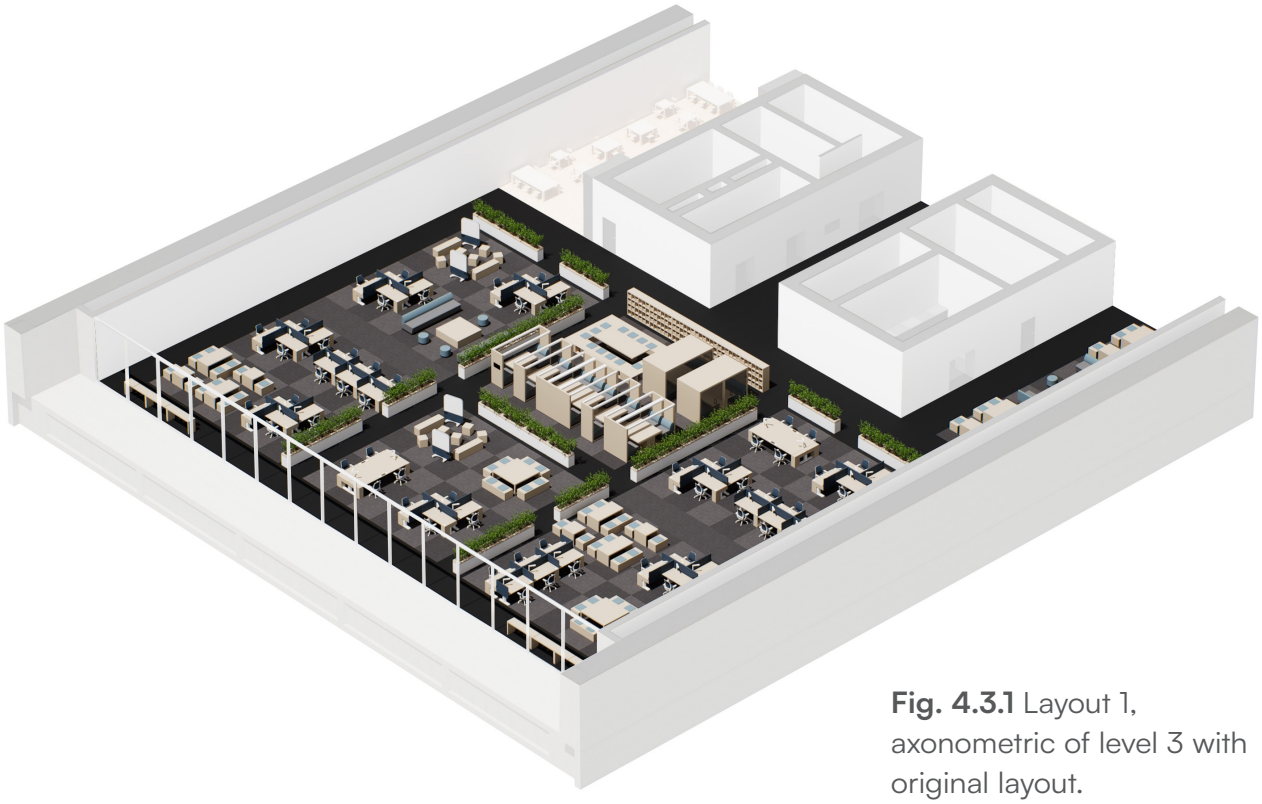


Fig. 4.3.1 Layout 1, axonometric of level 3 with original layout.

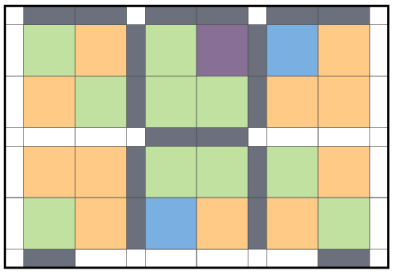


Fig. 4.3.2 Diagram of block types used in layout 1.

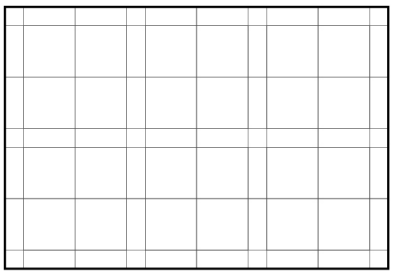


Fig. 4.3.3 Diagram of changes made in layout 1 from previous.

The first layout (Figure 4.3.1-4.3.3) is comprised of three neighbourhoods designated as A, B, and C. This will mark day one of the staff moving into the office. The building managers chose these specific layouts based on feedback from the teams on what their working styles were and their sizes. As a result, the first layout was created with many assumptions without any additional data to rely on.

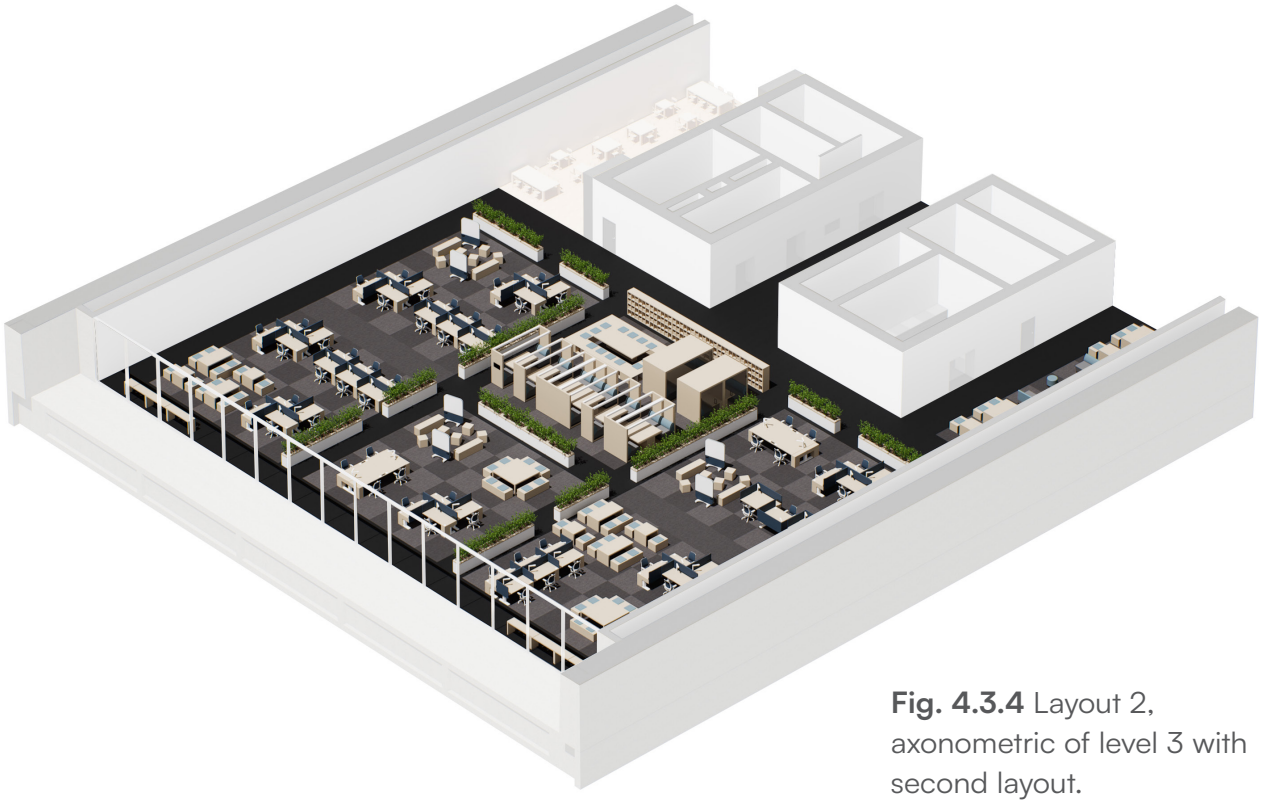


Fig. 4.3.4 Layout 2, axonometric of level 3 with second layout.

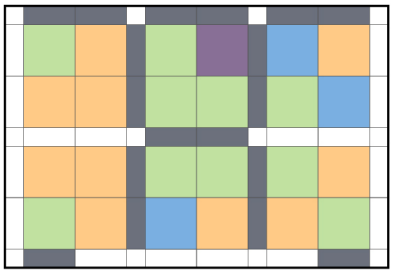


Fig. 4.3.5 Diagram of block types used in layout 2.

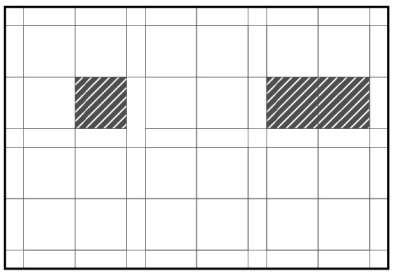


Fig. 4.3.6 Diagram of changes made in layout 2 from previous.

A month later, in the second layout (Figure 4.3.4-4.3.6), neighbourhood A has learned that some members from neighbourhood C will be moving to their team. As such, they require more day-use stations. Based on the data the building had collected over the course of the month, it was found that the lounge space was severely underutilized. Based on this knowledge, they decided to swap the Lounge block with a Standard Workspace Type A block. This addition effectively adds six additional workstations to the neighbourhood. Neighbourhood B had been satisfied with their layout resulting in no necessary changes there. Collected data also reveals that all blocks had good utilization rates. No changes were made to this neighbourhood. With some team members from neighbourhood C moved to A, they now have too many workstations. People have also voiced concerns due to the lack of space for demanding tasks. One of the Standard Workspace Type A blocks was swapped to an Extended Workspace Block from the Individual Day-Use Spaces category, reducing the capacity by three seats. Additionally another block, Standard Workspace Type B, was replaced with an innovation space. This was done to resolve an issue of high utilization rates in other collaborative spaces.

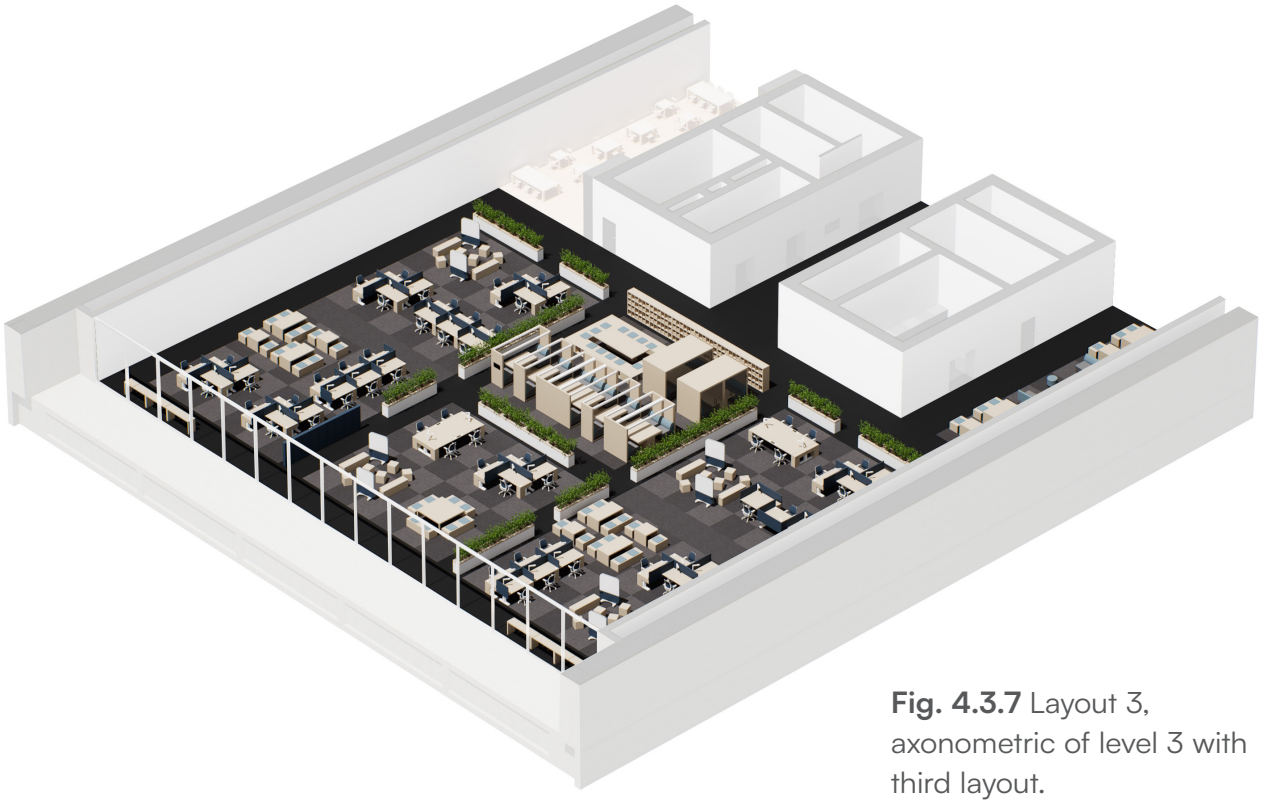


Fig. 4.3.7 Layout 3, axonometric of level 3 with third layout.

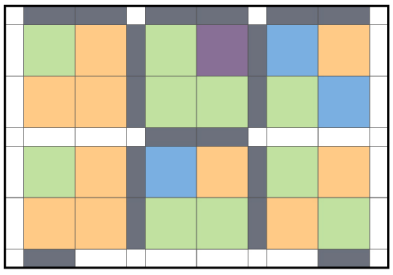


Fig. 4.3.8 Diagram of block types used in layout 3.

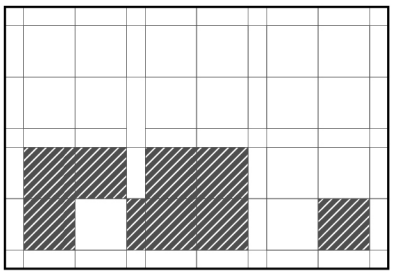


Fig. 4.3.9 Diagram of changes made in layout 3 from previous.

Following the most recent reconfiguration, neighbourhood A has been functioning well and no changes were needed. Neighbourhood B wanted somewhere to pin up materials they were working on. To resolve this, a planted partition was replaced with an acoustic panel divider (Figure 4.3.7-4.3.9). They also realized that they have been using the shared reconfigurable meeting spaces in the center a lot and wanted them to be in closer proximity to the day-use stations. The neighbourhood was then reorganized with the workstation blocks placed closer to the reconfigurable meeting spaces. The Innovation Space block added in the last reconfiguration for neighbourhood C was very well accepted. Data revealed that it became the primary collaboration space, leaving the others underutilized. A Large Group Collab space was then replaced with another Innovation Space to even out the utilization.

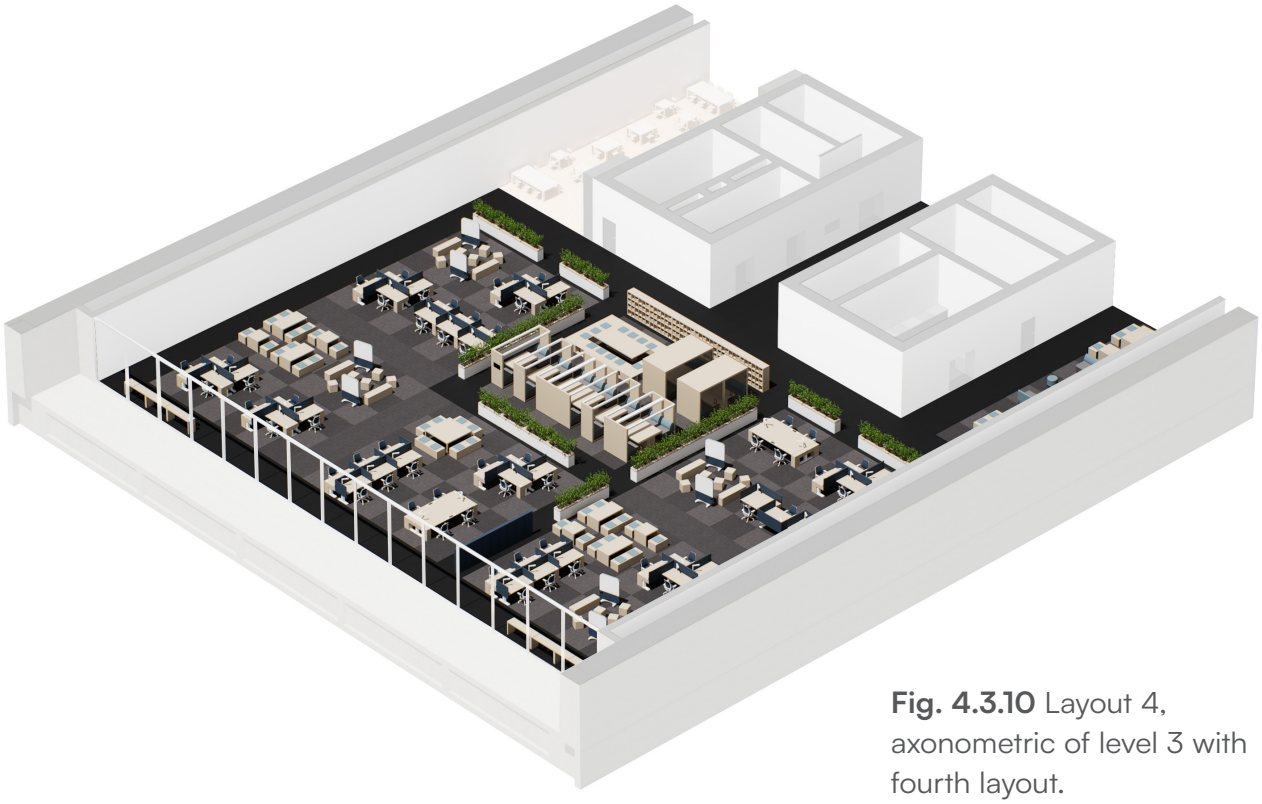


Fig. 4.3.10 Layout 4, axonometric of level 3 with fourth layout.

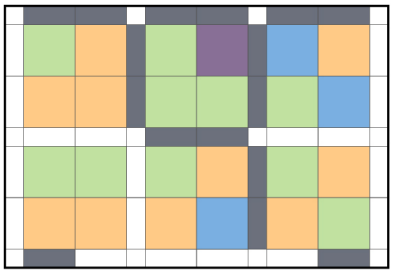


Fig. 4.3.11 Diagram of block types used in layout 4.

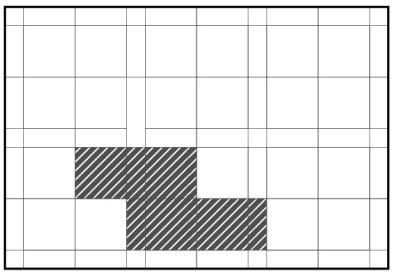


Fig. 4.3.12 Diagram of changes made in layout 4 from previous.

The final snapshot (Figure 4.3.10-4.3.12) illustrates the merging of two neighbourhoods. Following changes in teams, the teams from A and B were merged. To improve the workflow between the newly formed team, neighbourhood A and B were merged. The partitions between the two neighbourhoods were removed and the carpet tiles were replaced with an inner neighbourhood circulation tile. The placement of blocks was also shifted around to improve access to collaboration spaces within the neighbourhood.

As illustrated, the modular elements of the space allow for frequent adjustments to isolated areas. The layout is capable of accommodating to the internal forces that necessitate change to occur within the organization. Utilizing this system, permanent adaptability becomes an integral aspect of the building's operation.

4.4 WORKSTATION DESIGN

In an office where a hot desking system is implemented, workstations are no longer personal as they must be generalized to accommodate a range of people. Any personal belongings placed on a desk must be removed by the end of the day, effectively resetting the station for the next person. The positioning of these items on a desk are specific to each individual. Having to reposition these elements every time an individual goes to work would be a hassle and there would also be difference between the arrangements of one day to another making it difficult to build familiarity with the working environment. By designing a system of a workstation with an integrated caddy that can be moved around the office, familiarity can be maintained.

The caddy is designed to be portable. A sliding handle can be pulled out from the center, allowing the caddy to be carried to and from the main storage area (Figure 4.4.1). When docked at a workstation, the handle can be retracted, allowing unobstructed access to the items stored or displayed inside. The caddy contains six compartments, ideal for organizing various belongings but not limited to items such as notebooks, sticky notes, and a mouse. Additionally, a pull-out tray beneath these compartments can hold larger items or items that a user wants out of sight. Recognizing the common practice of keeping plants at desks, the caddy includes a dedicated space for a small plant. For those without one, this area can serve as an extra compartment for miscellaneous items. A key element of the caddy is its slide-out panel, which becomes flush with the desk surface when fully extended.

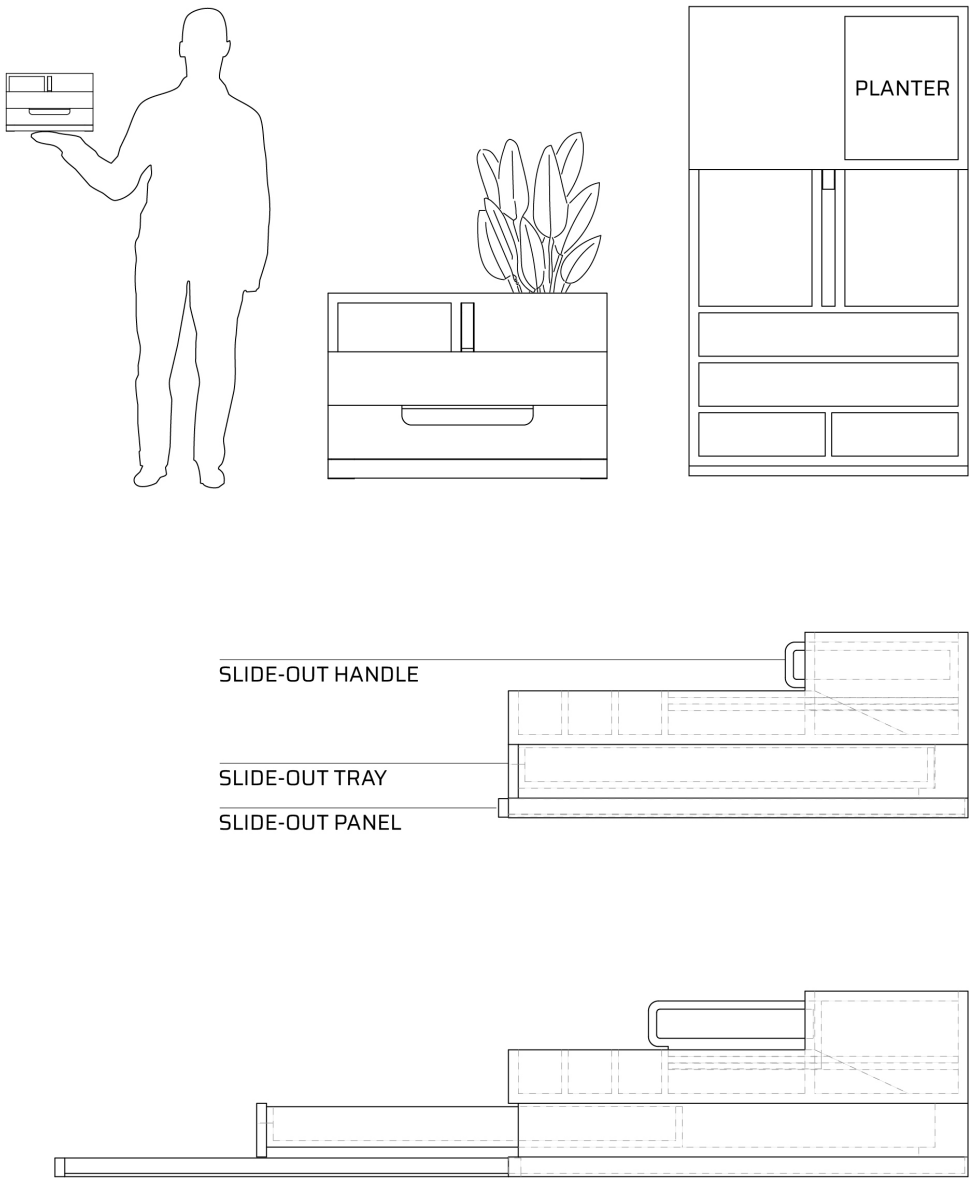


Fig. 4.4.1 Series of elevations of the personal caddy.Top Left: Scale figure, Top Middle: Front elevation, Top Right: Plan, Middle: Left elevation with slide-out panel and handle retracted, Bottom: Left elevation with slide-out panel and handle extended.

This panel offers an additional customizable element, allowing users to swap it with different coloured panels for an added level of personalization (Figure 4.4.2). Physical items, like notes or reminders, provide a tangible immediate reference that is often quicker and more accessible and distraction-free than digital alternatives. Additionally, retention of information improves when written out by hand.[2] In line with this, the panel can also be replaced with a whiteboard surface, enabling notes or reminders to be displayed directly at the desk, similar to how people post notes at permanently assigned locations. These notes can then follow the individual as they book different spaces to work at.

The caddy is directly integrated into the experience of working in this office. Upon arrival, the personal caddy can be found at a Personal Caddy Storage block located on the floor where the individual works (Figure 4.4.3). A door securing the caddy inside can be opened and the caddy can be slid out with the use of the handle (figure 4.4.4). The caddy can then be brought to the workstation the individual booked and be placed onto the caddy dock. The handle can be retracted and then the slide-out panel is pulled out to integrate the caddy into the workstation.

The personal workstation design is intended to be used for the standard workspace blocks (Figure 4.4.5-4.4.8). However, many of the qualities of this design apply to the other day-use blocks as well. The workstation includes a privacy panel, breaking the line of sight between the user and adjacent colleagues. Positioned to the right of the personal caddy dock is an integrated desk lamp, which can be configured to a specific angle, temperature, and brightness These settings are stored in the user's digital profile, accessible via a dedicated

2 Tindle and Longstaff, "Working Memory and Handwriting and Share a Common Resource."

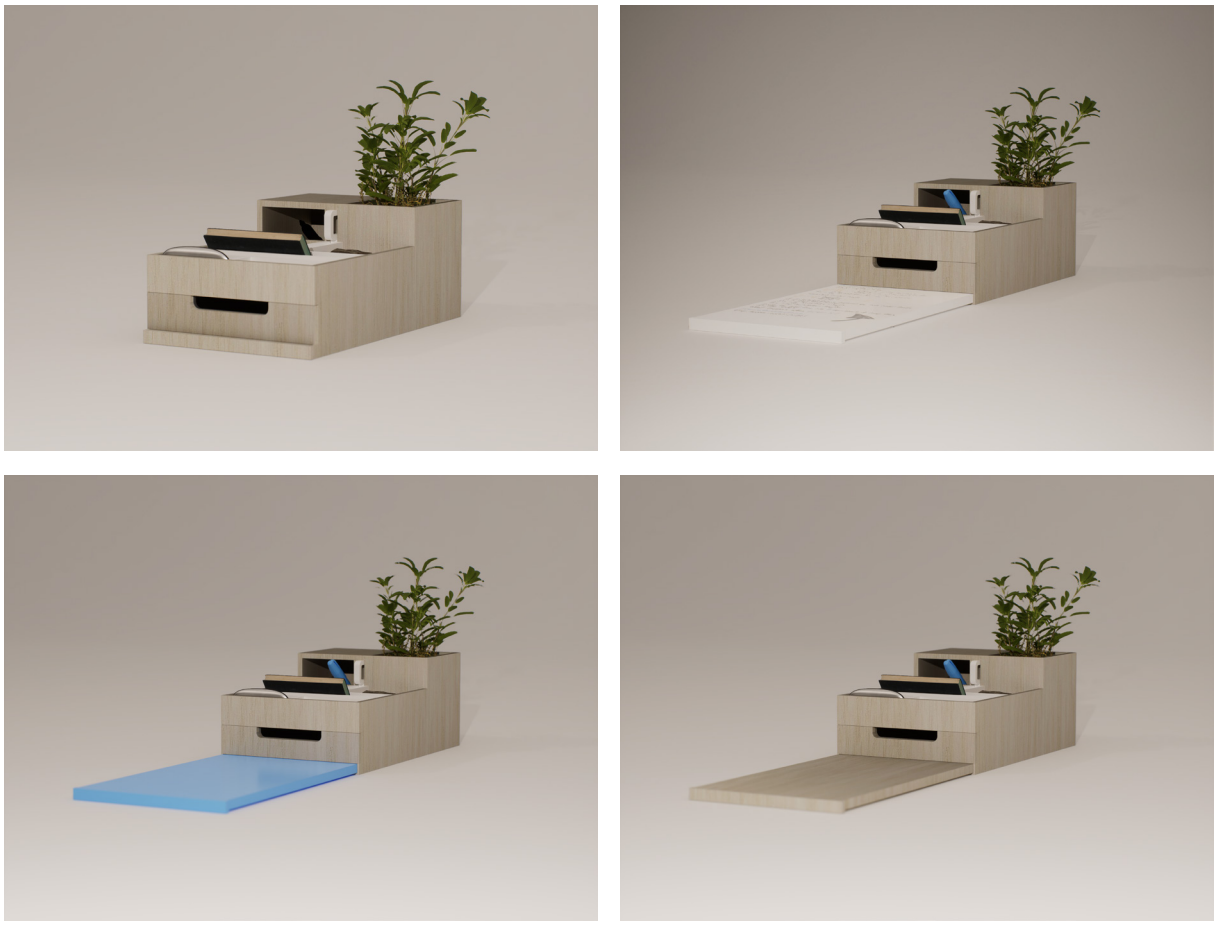


Fig. 4.4.2 Series of renderings illustrating the different possible variations of slide-out panels for the personal caddy.

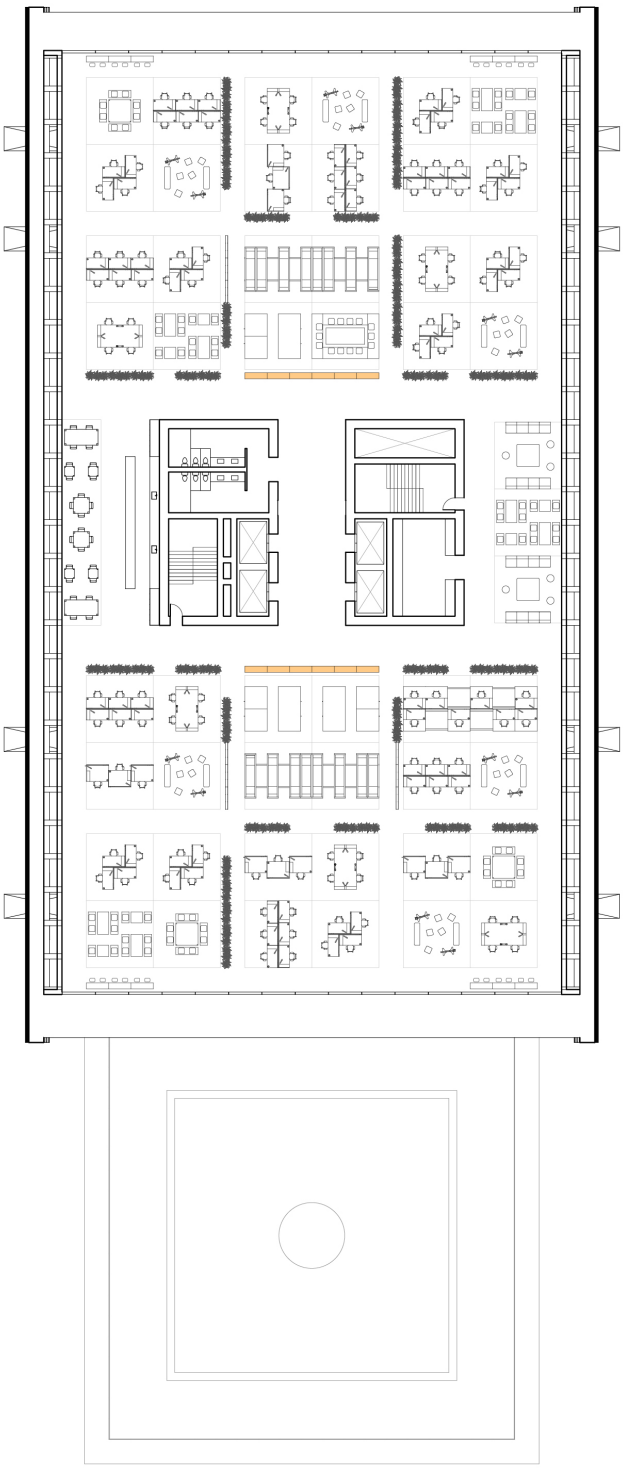


Fig. 4.4.3 Floor plan with location of personal caddy storage highlighted in orange.

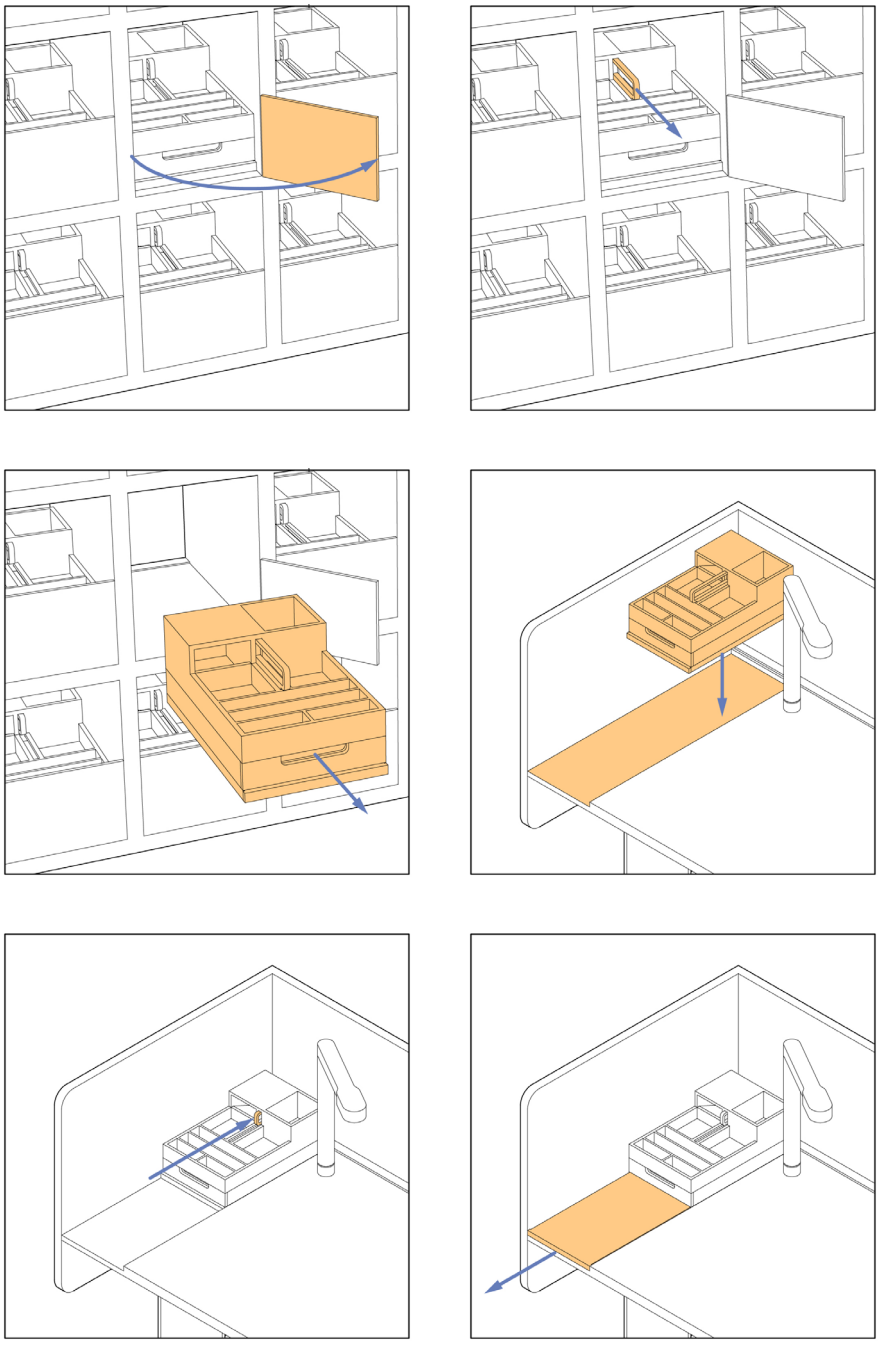


Fig. 4.4.4 Series of illustrations showing the retrieval and docking of the personal caddy onto the workstaiton.

app, allowing the lamp to automatically adjust to the user's preferences upon arrival. Other features such as the display, display personal photos and the color and brightness of ambient lighting are also automatically configured when the user checks in at the workstation. Furthermore, the height of the desk adjusts automatically in advance, ensuring the user can seamlessly begin work without the need for manual adjustments.

While all of the configurable elements of the workstation are automated, a rotary dial—an input device that allows users to interact with electronics through circular motion—remains present at the right edge of the desk. This physical and manual control over these elements is solely meant for changes to be done on-the-fly without having to open up an application. A rotary controller allows users to modify various settings at the workstation that are different from what was set in their profile. By cycling through a menu displayed on the screen, the controller can adjust features such as the desk height, the angle of the desk lamp, and other elements of the desk, providing intuitive and immediate control over the workstation. The final element, the wayfinding light, helps individuals easily navigate the space to find their booked desk or locate colleagues. The light blinks in a specific color when someone is searching, making it instantly recognizable in a large space.

The space is designed to feel familiar not through standardization, but by being uniquely tuned to each individual's preferences. The workstation and caddy addresses the challenge of maintaining familiarity within a shared space. These two items are interconnected, working together as a system to create a consistent experience no matter the desk an individual chooses to work at. These automated features allow staff members to work at different locations within the office while still maintaining a sense of familiarity.

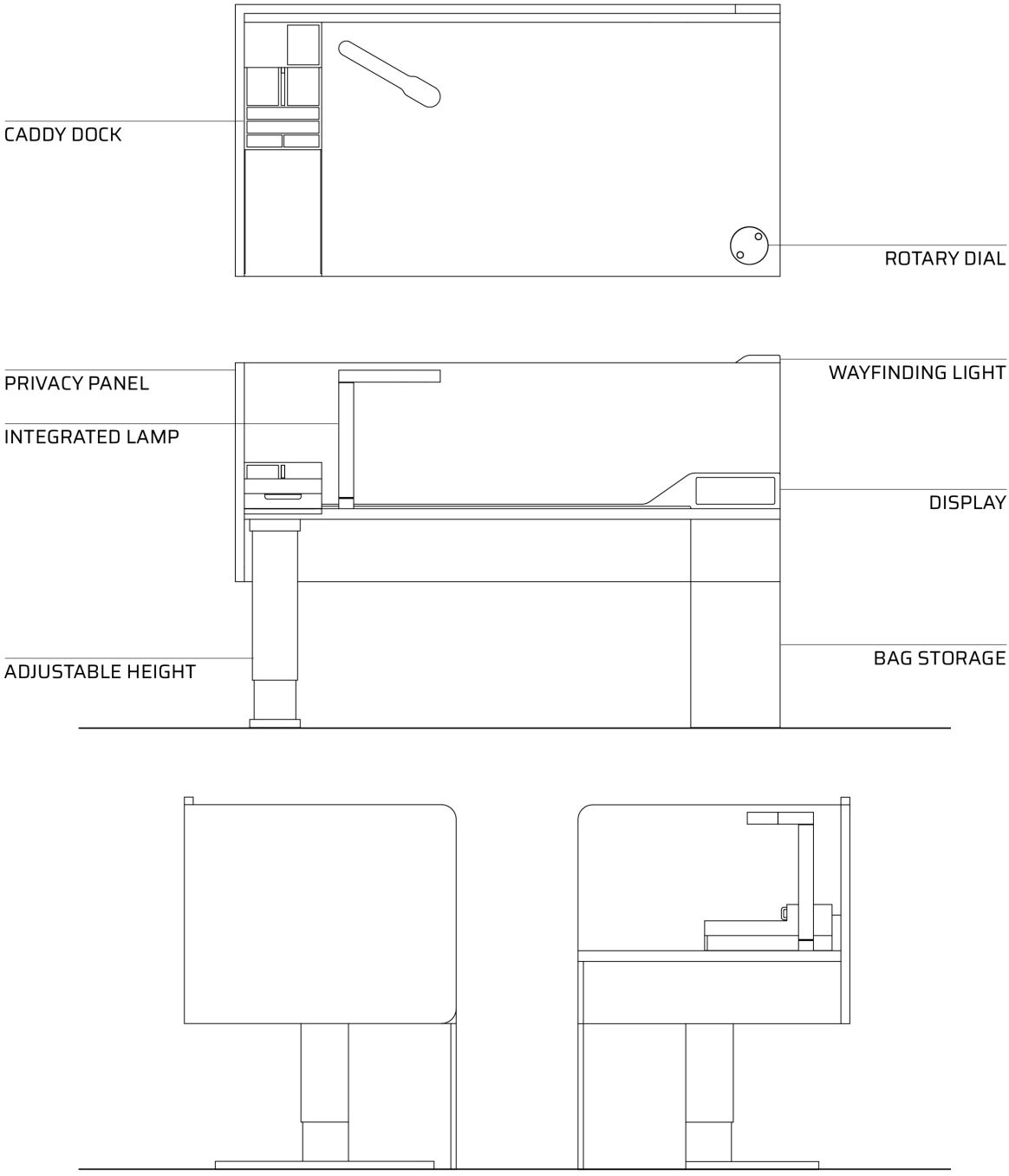


Fig. 4.4.5 Series of elevations of a workstation. Top: Plan, Middle: Front elevation, Bottom Left: Left elevation, Bottom Right: Right elevation.



Fig. 4.4.6 Rendering of a typical workstation at its lowest setting with personal caddy placed on docking area.



Fig. 4.4.8 Rendering of a raised workstation with unique configurations and wayfidning light indicator turned on.

4.5 USER EXPERIENCE

This office design contains numerous customizable elements that can be fine-tuned to bridge the gap between the familiarity of working in a traditional office with assigned desks and spaces to that the flexibility of hot desking and shared spaces. However, requiring individuals to manually configure these parameters each time would degrade the overall experience. Instead, automating these settings would relieve users of this burden, allowing the workspace to feel personalized and consistent, as if they are working at a permanently assigned desk, even when frequently changing seats in the office.

For these adjustments to happen automatically, the office must collect real-time data on the presence and location of each individual. This would allow the environment to adjust as a person approaches a workspace. Using a combination of data from a desk booking system with positional data captured via UWB beacons and tags, the system can accurately track an individual's intent and movement. As a result, when someone moves near key spaces, the environment can wake up with their personalized configuration applied.

UWB technology is extremely good at applications that require precise positioning of objects in a space. It works by sending out radio signals and measuring the time it takes for them to bounce back in relation to the speed of light through

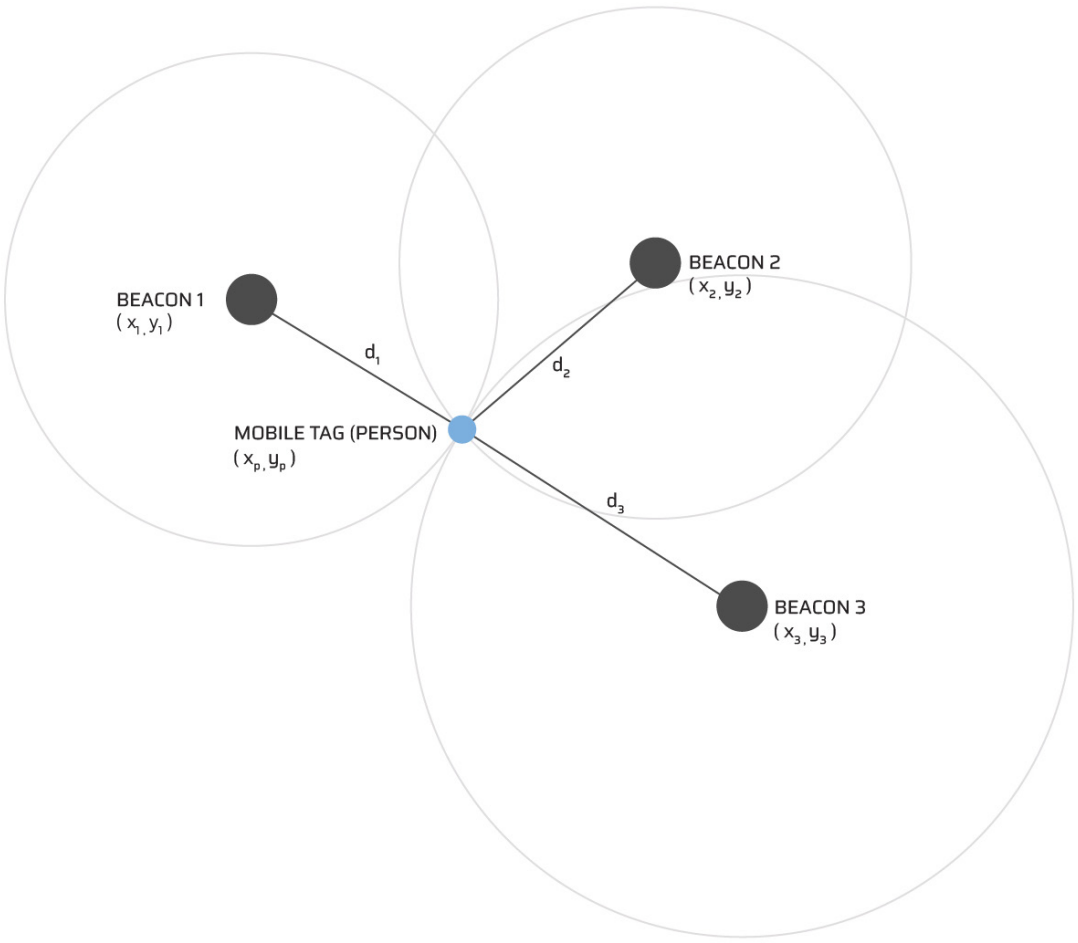


Fig. 4.5.1 Represenation of mapping the position of a person using UWB in two dimensions using trilateration.

a measurement called time-of-flight (ToF).[3] UWB devices can be identified as two types. The "anchors" are fixed in space and typically attached to ceilings. Then there are the "tags" which are tracked devices that move around in the space. The anchors send out signals and the tags bounce them back. When there are a minimum of three anchors in a space, the two-dimensional position of a tag can be retrieved in real-time by combing ToF and trilateration as illustrated in Figure 4.5.1.

3 Qorvo, "Ultra-Wideband - Qorvo."

To ensure the system works effectively, UWB devices must be carried by employees throughout the day. The low power consumption and compact form factor of these devices allow them to be integrated into employee identification tags or wristbands. Alternatively, many modern smartphones come equipped with UWB capability, removing the need to carry any additional devices. An onboard app can then utilize the phone's built-in UWB antenna. Positioning data recorded over a period of time provides significant insight to building management by enabling them to analyze the utilization rates and patterns of different areas in the office (Figure 4.5.2), thereby optimizing space allocation and improving overall efficiency. The recorded data for the purposes of utilization insights do should not be tied to the names of staff members, alleviating privacy concerns.

Real-time positioning of the employees within the office also enhances wayfinding experiences. As seating arrangements vary throughout the week, employees can access a floorplan displaying real-time locations of each staff member within the office. Kiosks are located at the central core on each floor, allowing convenient access to this information (Figure 4.5.3 and Figure 4.5.4). Using these kiosks, staff members can search for colleagues by name or sort by neighbourhood and department. If the person is seated at a desk equipped with a wayfinding light, the light will illuminate to the colour specified to facilitate easy identification. Additionally, the person at the desk will receive a notification on their screen informing them of who is looking for them and their proximity away. In the scenario where an individual arrives at the office without booking a desk, immediate booking can also be done at the kiosks.

With the wide range of possibilities for configuration, the process of preconfiguring these settings into each person's

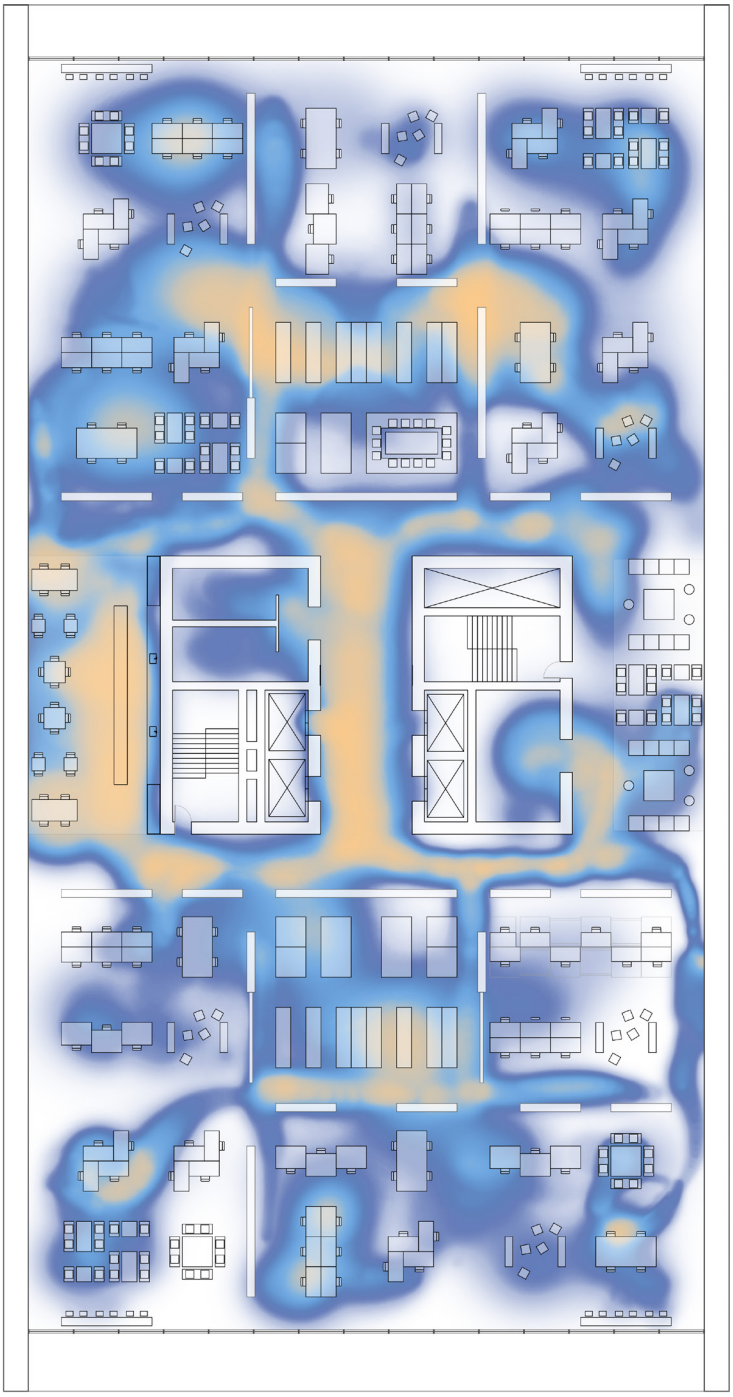


Fig. 4.5.2 Illustration of a heat map of the office floor plan showing utilization of different spaces from data collected through UWB positioning.

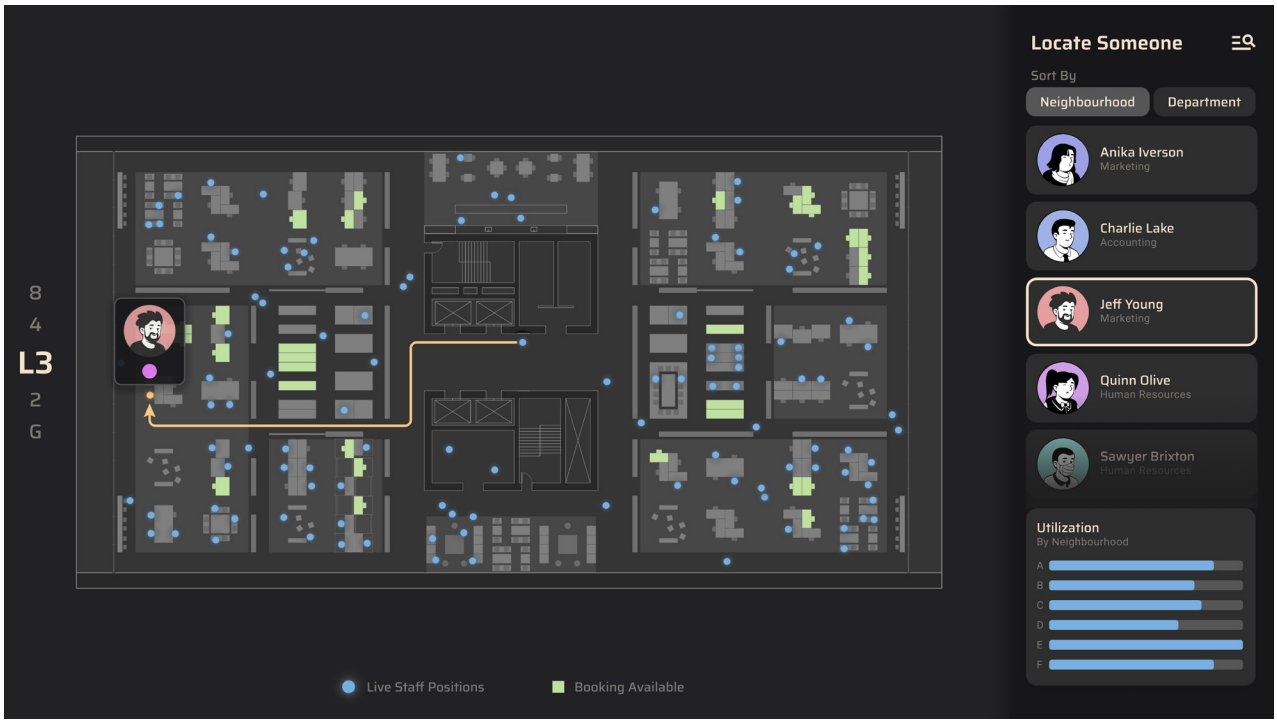


Fig. 4.5.3 User interface of wayfinding kiosks.



Fig. 4.5.4 Rendering of a typical wayfinding kiosk located near the elevators.

digital profile should be made simple and intuitive. For ease of configuration, each person would be granted access to an app where they can create, configure, and update their profile. The app is divided into two sections: a page for configuring settings related to rooms and another for the workstation. A three-dimensional rendering of the space or desk is shown as a preview as a representation of their settings. This interactive model allows users to visualize their adjustments in real-time, enhancing clarity and ease of use.

For the room configurations—to be used for private offices, private group offices, and meeting rooms—the settings are divided into five categories which can be accessed from the bottom menu.

1. **Climate:** This category allows users to adjust cooling, heating, and humidity levels.
2. **Ceiling Light:** Provides controls for the temperature and brightness of lighting in the room.
3. **Privacy Curtain:** This feature enables users to set a default position for the curtain when booking a room.
4. **Acoustics:** Users can fine-tune white noise levels and adjust noise cancellation in the room.
5. **Scent:** This category provides users with options for different fragrances to be released into the room.

In the next section, workstation, there are five menu items in the bottom menu that provide control over various elements (Figure 4.5.5 and Figure 4.5.6). These settings would be primarily applied to day-use spaces.

1. **Workstation Height:** User can set their preferred standing and sitting height of their desks and cycle between them.
2. **Ambient Lighting:** The colour, brightness, and the effect of the ambient light.
3. **Desk Lamp:** This category provides controls for adjusting the angle, brightness, and colour temperature of the integrated desk lamp.
4. **Display:** Users can upload photos to be displayed at their desk and adjust the duration of each photo displaying before cycling to the next when multiple photos are provided.
5. **Wayfinding Indicator:** The colour of the indicator light can be chosen, to be used when other colleagues are locating them.

The integration of real-time data and automated processes allow users to effectively move around the space yet always maintain a feeling of working in a place that is familiar to them. These systems and applications enhance the user experience and provide valuable insight into how the space is performing. The inclusion of additional tenants, a modular design, and the inclusion of technology-driven systems, all play vital roles in shaping the overall user experience.

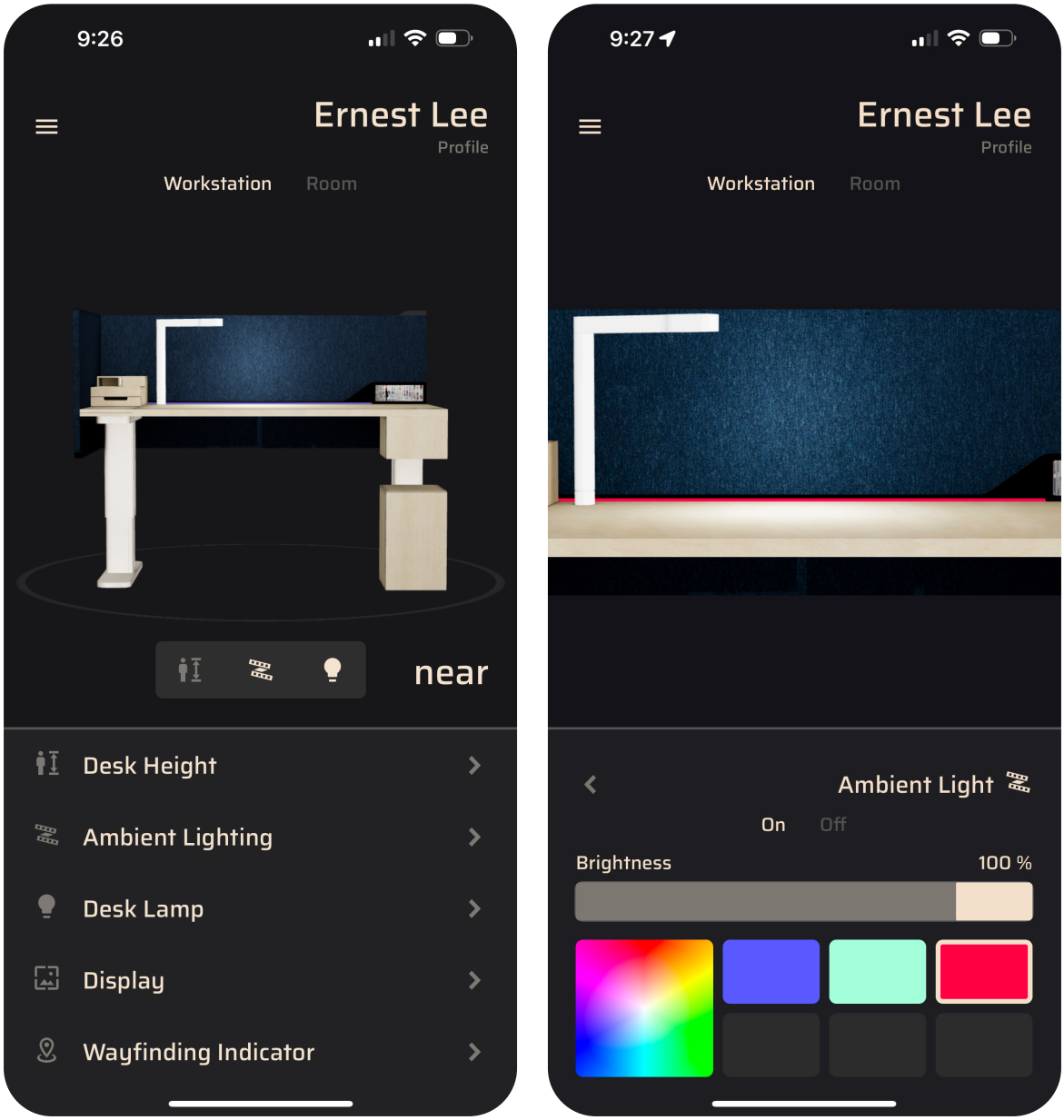


Fig. 4.5.5 User interfaces for a workspace configuration app. Left: Homepage of workstation settings. Right: Configuration settings for ambient light colour.

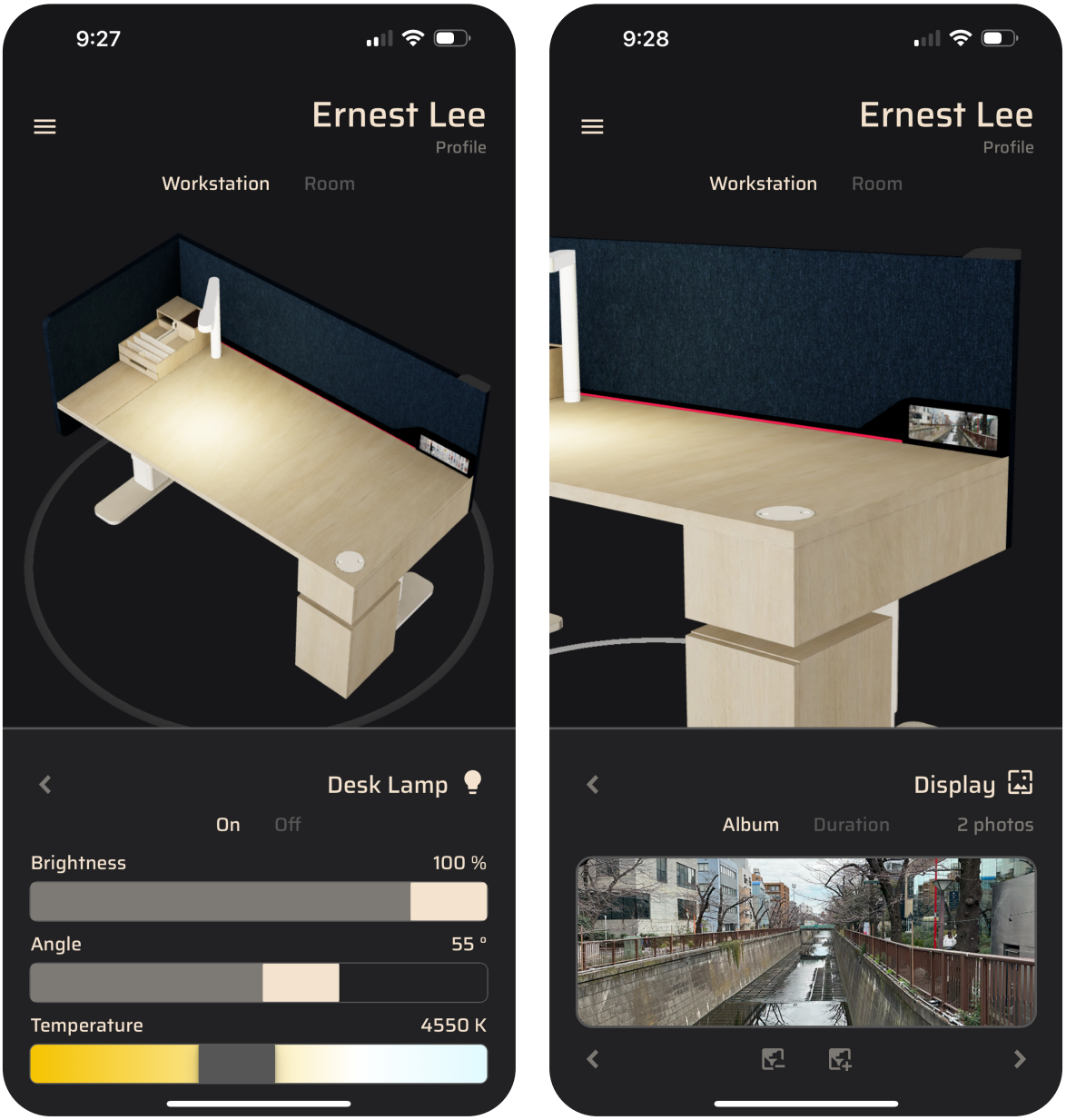


Fig. 4.5.6 User interfaces for a workspace configuration app. Left: Configuration of desk lamp. Right: Configuration of picture shown on display.

4.6 PROTOTYPE

A 1:3 scale functional prototype of a workstation (Figures 4.6.1-4.6.2) along with a mobile app, has been developed to demonstrate user-specific automated personalized configurations. This section provides a summary on how the system functions, and the technologies used.

The workstation hardware includes several key components. An illustration of all the components used in the system can be seen in Figure 4.6.3. A main control board consisting of a single microcontroller, manages the low-level control of various hardware components such as motors and LEDs. Other key hardware elements externally connected or present on the main control board include:

1. **Lighting:** Addressable RGB LEDs, which are individually controllable LEDs that allow unique colour and brightness control, are used for both the ambient light strip and the light in the desk lamp.
2. **Lamp Rotation:** A servo, a type of motor that allows for precise control of its angular position, is used at the base of the desk lamp.
3. **Workstation Height:** A leadscrew-driven linear motion system is designed, comprised of a stepper motor—a motor that allows for precise control over position, speed, and torque—a smooth rod, and a threaded rod to move each of the table legs.

4. **User Proximity:** Onboard, a UWB transceiver module is present allowing the workstation to function as a UWB anchor for precise positioning of the user. The user's proximity is displayed in the mobile app (Figure 4.6.4) and used to detect whether the user is near the desk. When the user is away, the workstation enters sleep mode, turning off the lights and display. When the user approaches, the workstation wakes up, activating the lights and display.

These components provide the workstation's physical functionality. To control these components and to enable dynamic, personalized configurations, a two-tier software architecture is employed, consisting of a frontend user interface and a backend server.

The user interface is developed using React, a JavaScript library that enables the development of interactive user interfaces[1]. It is developed as a Progressive Web App (PWA), allowing the app to be installed and run cross-platform, including on iOS and Android. The mobile app communicates user inputs wirelessly via WebSocket, a communication protocol that provides a single persistent connection between the client and sever that allows for real-time bidirectional data exchange[2], to the backend sever ran on a Raspberry Pi, a single-board computer commonly used for prototyping.

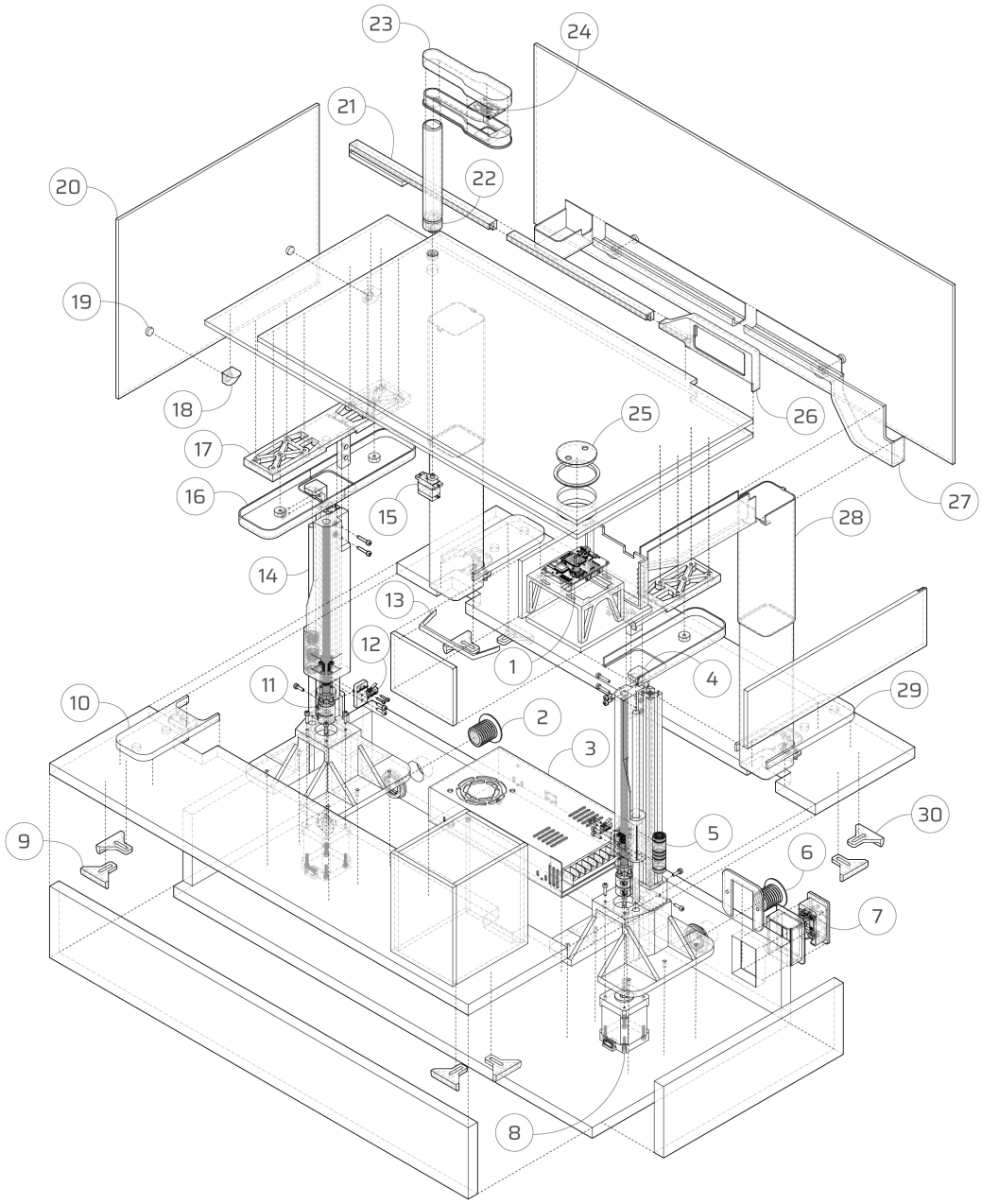
1 React, "React."
2 FastAPI, "WebSockets - FastAPI."



Fig. 4.6.1 Photograph of the workstation prototype in a unique configuration.



Fig. 4.6.2 Photograph of the workstation prototype in a unique configuration.



1 MAIN CONTROL BOARD
2 COOLING BULKHEAD
3 POWER SUPPLY
4 SMOOTH ROD MOUNT
5 LINEAR BEARING
6 MAIN WIRE HARNESS INLET
7 AC POWER PLUG
8 STEPPER MOTOR
9 FRONT COVER ALIGNER
10 LEG BASE COVER
11 FLEXIBLE COUPLING
12 MICRO LIMIT SWITCH
13 CABINET EXANSION MOUNT
14 SMOOTH ROD
15 SERVO
16 LEG MOUNT FRAME COVER
17 LEG TABLE MOUNT
18 MAGNETIC MOUNT
19 MAGNET
20 PRIVACY PANEL
21 LINEAR LED HOUSING ASSEMBLY
22 LAMP TOWER MOUNT
23 LAMP COVER
24 LED MODULE
25 ROTARY DIAL
26 DISPLAY AND HOUSING
27 CABLE RACEWAY ASSEMBLY
28 LEG SLEEVE ASSEMBLY
29 LEG SLEEVE LOCK
30 REAR COVER ALIGNER

Fig. 4.6.3 Exploded axonometric diagram of the different parts used in the workstation prototype.



Fig. 4.6.4 Screenshot taken within the mobile app showing the proximity of the user from the targeted workstation prototype.

The backend is developed using FastAPI, a high-performance Python based web framework for building application programming interfaces (API)[3]. APIs act as messengers, allowing separate applications to communicate with each other. The server manages user account logins, logs and retrieves preferences from a database, and acts as a bridge, relaying data between the mobile app and the microcontroller in the workstation. An illustration of how data moves around in the system can be seen in Figure 4.6.5.

This prototype demonstrates a tangible representation of a workstation design that offers personalized experiences. After the initial configuration of user preferences, changes occur automatically assisted with the use of technology.

3 FastAPI, "FastAPI."

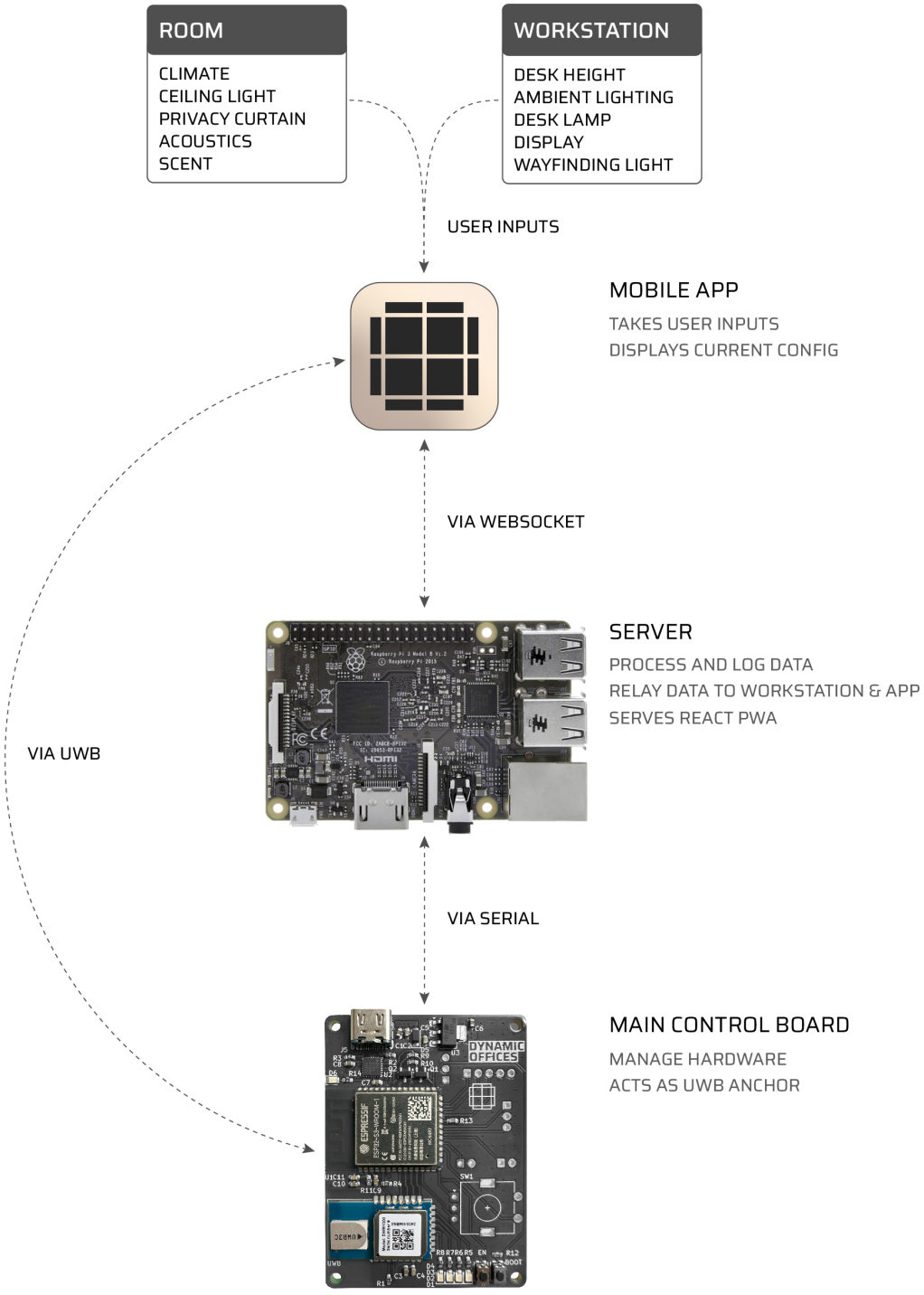


Fig. 4.6.5 Diagram of the flow of data between the mobile app, server, and main control board.

CONCLUSION

CONCLUSION

Hybridity has existed within the workplace for a long time. However, in recent years, hybridity has evolved to include the concept of location, changing the routine of employees by offering more freedom in where they work while compromising on the purpose and function of a physical office space. Strategies like hot desking and maintaining a percentage of staff on-site have been introduced to improve space utilization but they create a new set of challenges. The office is an evolving landscape facing constant uncertainty and it needs to be able to adapt quickly to these changes. Complete renovations are costly and occur too infrequently to keep pace with the evolving demands of a workforce.

The modular system as proposed in this thesis tackles this issue directly. The system empowers users, even those without expertise in space planning, to make meaningful adjustments to the workplace to suit the needs of staff members. Automated processes allow furniture and other elements to adapt to personalized configurations. This creates the perception of a workspace that feels personal and familiar, despite being part of a shared hybrid office environment. With the building being able to sense and react to individual users, the office enhances the user experience in ways traditional layouts are unable to. Furthermore, the building's ability to gather data through sensors offers valuable feedback allowing for continuous optimization of the space's performance.

The use of sensors for immediate reconfigurations and data collection to optimize the space for efficient and personalized experiences is a fine balance between convenience and surveillance. As more technology is integrated into buildings and workspaces, data privacy and security must be prioritized to ensure the benefits of these approaches do not come at the cost of individual privacy. Moreover, while technology enables a level of customization in applications not possible without, the inherent value of tangible, physical, controls and interactions must not be lost.

Moving forward, several key areas need improvement to fully realize the potential of a hybrid workplace of this nature. This approach requires for there to be a shift in design approaches, adopting layouts that have reconfigurable zones. Furniture systems need to be designed to accommodate these applications and be able to transform to meet the needs of varying users. Furthermore, ensuring the scalability of these systems is crucial so that they can work effectively in different offices.

In conclusion, this thesis presents a vision for what office design could become in the scenario where the architecture evolves to support the transition to a hybrid work model by leveraging modularity, user-centered design, and technology to overcome the limitations of traditional approaches.

BIBLIOGRAPHY

AHH. “AHH - Centraal Beheer Offices, Apeldoorn.” Accessed October 9, 2024. https://www.ahh.nl/index.php/en/projects2/12-utiliteitsbouw/85-centraal-beheer-offices-apeldoorn.

Aki Hamada Architects. “Substrate Factory Ayase.” Accessed November 13, 2023. https://aki-hamada.com/projects/substrate-factory-ayase/.
Allstate. “For Allstate, the Future of Work Is Virtual.” Allstate, October 28, 2021. https://www.allstate.jobs/2021/10/28/for-allstate-the-future-of-work-is-virtual/.

Archdaily. “Macquarie Bank / Clive Wilkinson Architects.” ArchDaily, April 2, 2010. https://www.archdaily.com/54544/macquarie-bank-clive-wilkinson-architects.

Arlinghaus, Katherine R., and Craig A. Johnston. “The Importance of Creating Habits and Routine.” American Journal of Lifestyle Medicine 13, no. 2 (December 29, 2018): 142—44. https://doi.org/10.1177/1559827618818044.

Augustin, Sally. “New Evidence That Having a Variety of Spaces Boosts Creativity.” WORKTECH Academy (blog), February 8, 2024. https://www.worktechacademy.com/access-to-spatial-variety-boosts-creativity/.

Basecamp. “The 37signals Guide to Internal Communication.” Basecamp. Accessed October 6, 2024. https://basecamp.com/guides/how-we-communicate.

Bernstein, Ethan, and Ben Waber. “The Truth About Open Offices.” Havard Business Review. Accessed March 1, 2024. https://hbr.org/2019/11/the-truth-about-open-offices.

Bishop, Caitlin. “What Is Hot-Desking and What Are the Benefits?” Ideas, March 31, 2021. https://www.wework.com/ideas/workspace-solutions/flexible-products/what-is-hot-desking.

Borzykowksi, Bryan. “What’s so Wrong with Dressing up Your Desk?” Accessed June 5, 2024. https://www.bbc.com/worklife/article/20170202-whats-so-wrong-with-dressing-up-your-desk.

Brown, Graham. “Claiming a Corner at Work: Measuring Employee Territoriality in Their Workspaces.” Journal of Environmental Psychology 29 (March 1, 2009): 44—52. https://doi.org/10.1016/j.jenvp.2008.05.004.

Canada, Public Health Agency of. “COVID-19 for Health Professionals: Transmission.” Education and awareness, February 15, 2021. https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/transmission.html.

Carl. “The Edge, Amsterdam, The Netherlands.” PLP Architecture (blog), September 8, 2022. https://plparchitecture.com/the-edge/.

Ching, Francis D. K. Interior Design Illustrated. Van Nostrand Reinhold, 1987.

Choi, Hwan-Hee, Jeroen J. G. van Merriënboer, and Fred Paas. “Effects of the Physical Environment on Cognitive Load and Learning: Towards a New Model of Cognitive Load.” Educational Psychology Review 26, no. 2 (June 1, 2014): 225—44. https://doi.org/10.1007/s10648-014-9262-6.

Choudhury, Prithwiraj (Raj). “Our Work-from-Anywhere Future.” Harvard Business Review, November 1, 2020. https://hbr.org/2020/11/our-work-from-anywhere-future.

Clive Wikinson Architects. “Clive Wilkinson Architects | Macquarie Group, One Shelley Street.” Accessed October 8, 2024. https://clivewilkinson.com/portfolio_page/macquarie-group-one-shelley-street/.

Drucker, P.F. “Knowledge-Worker Productivity: The Biggest Challenge.” Engineering Management Review, IEEE 34 (September 28, 2006): 29—29. https://doi.org/10.1109/EMR.2006.1679053.

FastAPI. “FastAPI.” Accessed December 5, 2024. https://fastapi.tiangolo.com/.

Fokkema & Partners. “Deloitte and AKD in the Edge -.” Accessed October 8, 2024. https://fokkema-partners.nl/projects/deloitte-and-akd-in-the-edge/.

Groves, Kursty, and Oliver Marlow. Spaces for Innovation: The Design and Science of Inspiring Environments. Amsterdam: Frame Publishers, 2016.

Gustav. “The Power of Personalized Workspaces.” Gustav Concept, August 20, 2024. https://gustavconcept.com/blogs/news/fostering-individuality-in-desk-sharing-the-power-of-personalized-workspaces.

———. “Travail hybride après le Corona.” Gustav Concept, August 20, 2024. https://gustavconcept.com/fr/blogs/news/hybrid-working-corona.

HAN Shuangyu. “SOHO 3Q Chengdu Office / Superimpose Architecture | ArchDaily.” Accessed October 9, 2024. https://www.archdaily.com/929057/soho-3q-chengdu-superimpose-architecture.

Hansson, David Heinemeier, and Jason Fried. Remote: Office Not Required. Ebury Publishing, 2013.

Heneghan Peng Architects. “AirBnB EMEA Headquarters, The Warehouse | Dublin.” Accessed July 8, 2024. https://www.hparc.com/m/work/airbnb-european-headquarters.

Herman Miller. “How to Bring Focus Back to the Open Office.” Accessed September 30, 2024. https://www.hermanmiller.com/research/categories/white-papers/bringing-focus-back-to-the-open-office/.

Hertzeberger. The Future of the Building “Centraal Beheer,” 2016. https://www.hertzberger.nl/images/nieuws/TheFutureOfTheBuildingCentraalBeheer2016.pdf.
Hill, Alison, and Darren Hill. Work From Anywhere: The Essential Guide to Becoming a World-Class Hybrid Team. John Wiley & Sons, 2021.

Inside. “Action Office 1, Zeeland, Michigan (1964)*.” Accessed October 9, 2024. https://insideinside.org/project/action-office-11964/.

———. “Larkin Administration Building, Buffalo, New York (1906)*.” Accessed October 9, 2024. https://insideinside.org/project/larkin-adminstration-building-1906/.

Instacart. “Introducing Flex First, Instacart’s Future of Work.” instacart.careers. Accessed April 11, 2024. https://instacart.careers/flex-first/.

Kauk, Stacy. “What Does Working Remotely Mean for the Planet? - Shopify Canada.” Shopify. Accessed April 11, 2024. https://www.shopify.com/ca/blog/working-remotely-for-the-planet.

Knight, Craig, and S. Alexander Haslam. “The Relative Merits of Lean, Enriched, and Empowered Offices: An Experimental Examination of the Impact of Workspace Management Strategies on Well-Being and Productivity.” Journal of Experimental Psychology. Applied 16, no. 2 (June 2010): 158—72. https://doi.org/10.1037/a0019292.

———. “Your Place or Mine? Organizational Identification and Comfort as Mediators of Relationships Between the Managerial Control of Workspace and Employees’ Satisfaction and Well-Being.” British Journal of Management 21, no. 3 (2010): 717—35. https://doi.org/10.1111/j.1467-8551.2009.00683.x.

Krajčík, Martin, Dušana Alshatti Schmidt, and Matus Barath. “Hybrid Work Model: An Approach to Work—Life Flexibility in a Changing Environment.” Administrative Sciences 13 (June 6, 2023): 150. https://doi.org/10.3390/admsci13060150.

Krishna, Golden. The Best Interface Is No Interface: The Simple Path to Brilliant Technology. New Riders, 2015.

Krishnamurthy, Nikki. “Our Return to the Office.” Uber Blog, October 4, 2022. https://www.uber.com/en-IN/blog/our-return-to-the-office/.
Lab, MIT Media. “Mediated Atmosphere.” MIT MEDIA LAB (blog), July 18, 2018. https://medium.com/mit-media-lab/mediated-atmosphere-13a4a0b234dc.

Laurence, Gregory A., Yitzhak Fried, and Linda H. Slowik. “‘My Space’: A Moderated Mediation Model of the Effect of Architectural and Experienced Privacy and Workspace Personalization on Emotional Exhaustion at Work.” Journal of Environmental Psychology 36 (December 1, 2013): 144—52. https://doi.org/10.1016/j.jenvp.2013.07.011.

Levy, Natasha. “Space Encounters Uses Planted Partitions to Divide Synchroon’s Utrecht Office.” Dezeen, April 24, 2019. https://www.dezeen.com/2019/04/24/space-encounters-synchroon-utrecht-office/.

Lindberg, Casey M., Diemtrinh T. Tran, and Meredith A. Banasiak. “Individual Differences in the Office: Personality Factors and Work-Space Enclosure.” Journal of Architectural and Planning Research 33, no. 2 (2016): 105—20.

Marsh, Allison. “A Brief History of the Office Cubicle - IEEE Spectrum.” Accessed April 11, 2024. https://spectrum.ieee.org/office-cubicles.
Merrick, Nick. “Gallery of American Enterprise Group National Headquarters Renovation / BNIM - 1.” ArchDaily, n.d. https://www.archdaily.com/783730/american-enterprise-group-national-headquarters-renovation-bnim/56e5ffe0e58eceea1f0000cf-american-enterprise-group-national-headquarters-renovation-bnim-photo.

Mohezar, Suhana, Noor Ismawati Jaafar, and Waqar Akbar. “Open-Space Workplace Design: Balancing Creativity, Teamwork, Privacy, and Social Distance.” In Achieving Quality of Life at Work: Transforming Spaces to Improve Well-Being, edited by Suhana Mohezar, Noor Ismawati Jaafar, and Waqar Akbar, 107—22. Singapore: Springer, 2021. https://doi.org/10.1007/978-981-16-4265-4_7.

Musser, George. “The Origin of Cubicles and the Open-Plan Office.” Scientific American. Accessed May 15, 2024. https://www.scientificamerican.com/article/the-origin-of-cubicles-an/.

Muzaffar, Putri Nadea Adrianna, Norlina Mohamed Noor, and Shahril Anwar Mahmud. “A Comparative Study on the Impacts of Open and Closed Office Layouts Towards Employees’ Perceived Productivity.” 3 (n.d.).
Myerson, Jeremy, and Philip James Nunes Ross. Unworking: The Reinvention of the Modern Office. London: Reaktion books, 2022.

Naish, Tomas. “Open Office vs Closed Office: Which Is Best?,” December 11, 2018. https://tcdconstruction.co.uk/open-office-vs-closed-office-which-is-best/.

Neal, David T., Wendy Wood, Jennifer S. Labrecque, and Phillippa Lally. “How Do Habits Guide Behavior? Perceived and Actual Triggers of Habits in Daily Life.” Journal of Experimental Social Psychology 48, no. 2 (March 1, 2012): 492—98. https://doi.org/10.1016/j.jesp.2011.10.011.

Negroponte, Nicholas, and N. Negroponte. The Architecture Machine: Toward a More Human Environment. 2. print. Cambridge, Mass.: MIT Pr, 1972.

Nikken Space Design. “Nikken Workplace Design Lab.,” n.d. https://www.nikken.jp/en/about/tg1is20000001gdx-att/nikken-workplace-design-lab.

Oxford. “Oxford English Dictionary.” Accessed April 11, 2024. https://www.oed.com/?tl=true.

Pickard, Quentin, ed. The Architects’ Handbook. 1. publ. Oxford: Blackwell Science, 2002.

Qorvo. “Ultra-Wideband - Qorvo.” Accessed October 7, 2024. https://www.qorvo.com/innovation/https//www.qorvo.com/innovation/ultra-wideband.

React. “React.” Accessed December 5, 2024. https://react.dev/.

Robin. “How to Calculate Office Space and Meeting Room Utilization.” Accessed May 15, 2024. https://robinpowered.com/blog/calculate-office-space-meeting-room-utilization.

———. “Human-First Hybrid Work Software | Robin.” Accessed September 30, 2024. https://robinpowered.com/solutions/hybrid-work.
Rolfö, Linda. “Activity-Based Flexible Office Work Environments,” n.d.

Saval, Nikil. “A Brief History of the Dreaded Office Cubicle.” Wall Street Journal, May 10, 2014, sec. Life and Style. http://online.wsj.com/article/SB10001424052702304885404579549800874319342.html.

Searer, Stephen. “Airbnb Offices - Dublin.” Office Snapshots, March 20, 2017. https://officesnapshots.com/2017/03/20/airbnb-offices-dublin/.

Shanahan, Andrew. “The Office Cubicle: From Commercial Flop to Design Classic.” Dezeen, February 1, 2015. https://www.dezeen.com/2015/02/01/office-cubicle-50th-birthday-herman-miller-robert-propst/.

Sheff, Morgan. “MORGAN SHEFF PHOTOGRAPHY.” Accessed October 9, 2024. https://morgansheffphotography.com/architecture-6.
Steelcase. “The New Hybrid Neighborhood.” Steelcase, June 1, 2022. https://www.steelcase.com/research/articles/topics/culture-talent/new-hybrid-neighborhood/.

Superimpose Architecture. “SOHO 3Q.” Superimpose Architecture. Accessed February 28, 2024. https://superimposearchitecture.com/projects/soho-3q/.
Tindle, Richard, and Mitchell G. Longstaff. “Working Memory and Handwriting and Share a Common Resource: An Investigation of Shared Attention.” Current Psychology 42, no. 5 (February 1, 2023): 3945—56. https://doi.org/10.1007/s12144-021-01733-4.

Tom Randall. “The World’s Smartest Office Building in the World.” Bloomberg.Com, September 23, 2015. http://www.bloomberg.com/features/2015-the-edge-the-worlds-greenest-building/.

Tran, Lisa. “The Impact of Hybrid Work on Productivity: Understanding the Future of Work.” KTH Royal Institute of Technology, 2022. https://www.diva-portal.org/smash/get/diva2:1696127/FULLTEXT01.pdf.

University of Exeter. “Designing Your Own Workspace Improves Health, Happiness and Productivity.” ScienceDaily. Accessed June 5, 2024. https://www.sciencedaily.com/releases/2010/09/100907104035.htm.
“Voted ‘Most Admired Architect.’” Accessed October 20, 2024. https://www.

fosterandpartners.com/news/foster-plus-partners-voted-most-admired-architect-ninth-year-in-a-row.

WeWork. “Private Office Space.” WeWork. Accessed August 8, 2024. https://www.wework.com/solutions/private-office-space.
Wright, Frank Lloyd. The Future of Architecture. 1st ed. Plume, 1969.

Wu, Yueyan, Chongyu Lu, Jianhui Yan, Xiao Chu, Meijiao Wu, and Zhi Yang. “Rounded or Angular? How the Physical Work Environment in Makerspaces Influences Makers’ Creativity.” Journal of Environmental Psychology 73 (December 1, 2020): 101546. https://doi.org/10.1016/j.jenvp.2020.101546.