TUM

THE OFFICE | DAS BÜRO

FUTURE *of* WORKPLACES

PROF. THOMAS AUER
STO FOUNDATION VISITING PROFESSOR KASPER GULDEGAR JENSEN

THE OFFICE | DAS BÜRO

FUTURE *of* WORKPLACES

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FOREWORD

by SANDRA PERSIANI & DAVID SELJE

As the majority of the world's population spends a significant portion of their lives in a working environment, the quality of future indoor office spaces becomes crucial to our well-being. The master course "*The Office* | *Das Büro*" investigates experimental working environments aiming to develop conceptual strategies to increase local social comfort and individual wellbeing within office spaces by adopting a human-centric approach. Seven student projects design the spaces in between the furniture and the building scale, within the direct sphere of influence of the users, to activate the environmental parameters associated with comfort, work efficiency and user satisfaction.

(1) Armijos Moya, T.; van den Dobbelsteen, A.; Ottelé, M.; Bluysse, P. M. (2019): A review of green systems within the indoor environment. *Indoor and Built Environment*, 28 (3), 298-309.

(2) United Nations. (2018): 68% of the World Population Projected to Live in Urban Areas by 2050, Says UN. In News; United Nations Department of Economic and Social Affairs: New York, NY, USA, 16 May 2018.

(3) Mangone, G; Capaldi, C.A.; van Allen, Z. M.; Luscuere, P.G. (2017). Bringing nature to work: Preferences and perceptions of constructed indoor and natural outdoor workspaces. *Urban Forestry & Urban Greening* 23, 1-12.

The majority of the world's population lives today in urban areas, with people in industrialized countries spending more than 80% of their lives indoors **[1]**. As the trend is expected to rise, with prospects of the global urban inhabitants to grow up to two thirds in the next 30 years **[2]**, man-made and controlled indoor environments are bound to increasingly impact our well-being and the sustainability of our lifestyles. This is specifically the case of many indoor working environments, as offices are the spaces in the city where we tend to spend a large portion of our active lives **[3].**

THE OFFICE CULTURES

Office environments are strongly shaped by the logics of the economic system, the working culture and the social idea of progress. In the last decades, the western culture has started to shift from a mass-production industrial logic founded on a time-output relationship, to a global culture of interconnectedness where flexibility and real-time communication are the new parameters of success. To achieve competitive advantage by promoting productivity and efficiency of the workers, companies become increasingly employee-centric shaping their business around the needs of the human resources. A renewed interest is discovered in the study of human behavior and its reciprocal relationship to the physical environment. ➤➤

From an architectural point of view, flexibility is introduced in the working culture: Physically through new concepts of hot- and shared-desking, and in time, with home office and an increasingly common nomadic working culture. The interior spaces are transformed into social and environmental micro-environments without questioning the definition of zoning far beyond the spatial arrangement. Office plans shift between hybrids of individual cubicles to collaborative open plan spaces, from formal to informal areas, and from focused to dynamic environments, combining to create multiple working environments for individual working, independent and group learning as well as collaboration. How successful these solutions will be is however still to be seen.

From a human-centric point of view on the other hand, four main aspects affect productivity in a working environment: personal, social, organizational and environmental factors [4]. The office architecture therefore needs to take into account physiological and psychological metrics as well, as physical comfort (air quality, climate, noise), functional comfort (disturbances, interruptions, distance from work, resources) and psychological comfort (privacy, territoriality).

(4) Al Horr, Y.; Arif, M.; Haushik, A.; Mazroei, A.; Katafygiotou, M.; Elsarrag, E. (2016): Occupant productivity and office indoor environment quality: A review of the literature. *Building and Environment*, 105, 369-389.

CLIMATE DESIGN
Environmental comfort has a direct impact on user satisfaction and highly influences productivity [3]. An indoor environment is considered healthy when 80% of its occupants are satisfied with the environmental settings. However, as satisfaction and comfort are subjective assessments that are affected by individual physiological and psychological components in addition to the actual physical environmental conditions, achieving higher satisfaction rates for indoor users is a complex task [4].

Specifically, thermal comfort has often been described as a "state of mind", as it is a subjective state which varies between persons due to a broad range of factors such as age, sex, metabolism rate, time of the year, etc.; and on dynamic factors such as clothing, type of activity and working task, posture, mood. Moreover, the acceptance of a thermal environment is subjective and directly related to the expectation of the occupant [4].

To achieve overall environmental comfort, architecture therefore needs to consider the integration of the social and psychological aspects in the design in combination with specific environmental technological solutions. These considerations lead to the development of new concepts of interior microclimatic zoning combining internal environmental factors as noise mitigation, visual comfort, thermal comfort, ventilation and indoor air quality with the social dimension defining completely different but parallel expectations.

(5) Kostourou, F. (2014): We shape our buildings and then they shape us. In: Angelil, M.; Hehl, R. (Eds). *Minha Casa Nossa Cidade: Innovating Mass Housing for Social Change in Brazil*, Ruby Press, 129-131.

BEHAVIORAL DESIGN

The features of the built environment have a strong impact on our individual behavior and our social structures. Architecture not only materializes space design, but also models attitudes and behaviors by conveying values and conditioning people's perceptions of what is possible and what is appropriate, consciously or unconsciously shaping emerging cultures **[5]**. A primary principle of behaviorology is that we are products of our environment. As Winston Churchill pointed out during the rebuilding of the House of Commons, "We shape our dwellings, and afterwards our dwellings shape us".

The design of the indoor spaces therefore becomes a powerful tool to shape future lifestyles, physically encouraging or discouraging specific types of activities, channeling sought-after responses and overall changing user perception and expectations of their environment.
It becomes in this context, an additional means to improve on user satisfaction and work productivity. ✖

| CULTURAL | SOCIAL | INDIVIDUAL | CLIMATE | ENVIRONMENTAL |
| IDENTITY | STRUCTURE | COMFORT | CONTROL | QUALITY |
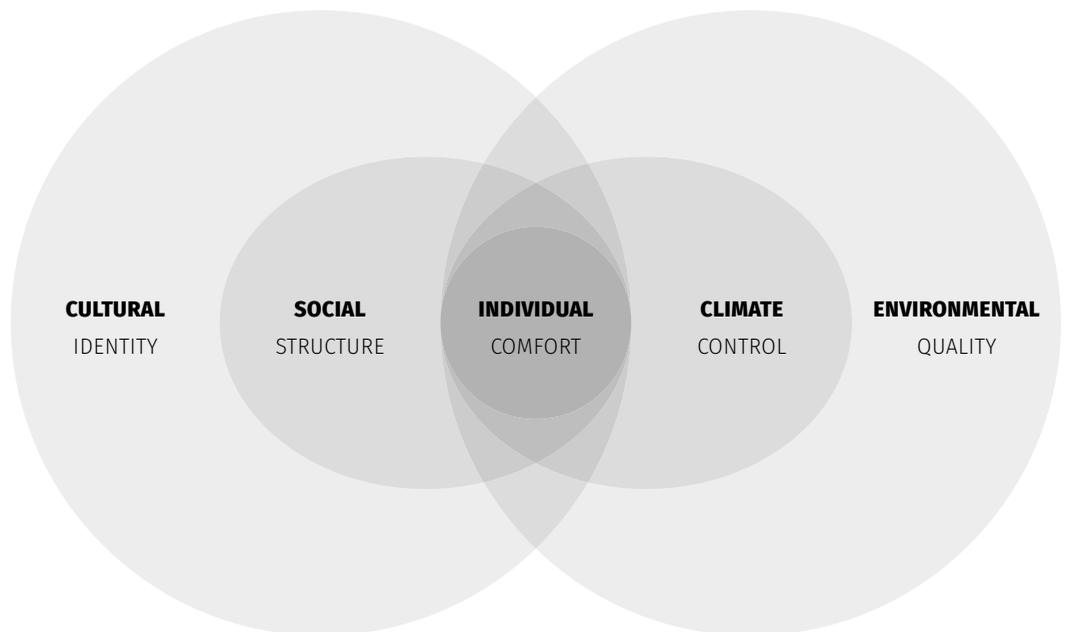
CONSTRUCTS OF INDIVIDUAL COMFORT

The diagram above illustrates the interlacing aspects of individual comfort perception, as it was examined throughout the studio.

THE ACTORS

The Chair for Building Technology and Climate Responsive Design teaches and researches the development of energy-efficient technologies and strategies to achieve maximum environmental quality in the interior and the exterior built environment, while minimizing the use of resources. The holistic design approaches adopted involve an expertise on indoor microclimate regulation, the analysis of user flows and overall energy efficiency of the built system.

THOMAS AUER,
PROFESSOR

Professor Auer studied process engineering at the University of Stuttgart. Since then he has dealt extensively with issues relating to the energy efficiency and user comfort of buildings within the framework of his role at Transsolar Energietechnik GmbH. Between 2001 and 2008 Professor Auer had a teaching assignment at Yale University. Subsequently he held visiting professorship positions at the University of Kassel, the École Spéciale d'Architecture in Paris, the University of Sassari (Università degli Studi di Sassari) in Italy and Ryerson University in Toronto, Canada. He has been a professor at TUM since 2014.

KASPER GULDAGER JENSEN,
GUEST PROFESSOR

Kasper Guldager Jensen is a Senior Partner at Danish architecture company 3XN and the Director of 3XN's innovation company, GXN At GXN, Kasper is passionately engaged in sustainable design, digital processes and new materials. Through his work in the green building space, he has become a spokesperson for the shape of future architecture, focusing on the circular design, digital design and behavioural design. In addition to his industry roles, Kasper regularly teaches on topics such as environmental design and circular economy. In 2018 he taught as a visiting professor at the University of Calgary and Delft University of Technology.

MICHAEL HELD,
GUEST CRITIC

Michael Held is the design director in the learning and innovation center of Steelcase based in Munich. He lived and worked in Asia for over ten years, where he was the director of design management for several well known companies such as Phillips Electronics in Hong Kong and Singapore. Holding a number of international design awards, his focus lies in user-oriented design and experience.

DAVID SELJE, TUTOR

David earned his BSc degree from the University of Stuttgart in 2014 and his MA degree from the Technical University of Munich in 2017. After finishing his studies, he started working as a research associate at TUM, while working in several architectural design offices. He is currently practicing architecture in LBGO Architects in Munich.

SANDRA PERSIANI, TUTOR

Sandra holds a PhD in Environmental Design (2016) and a master in Architecture (2009) from the University Rome La Sapienza. She has been a researcher at NTU in Singapore and is since 2019 a Postdoc in Munich with a TUM Foundation Fellowship. Her research focuses on adaptive and biomimetic solutions in the built environment.
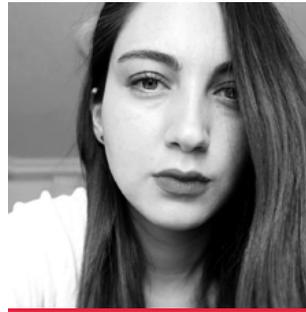
BILGE KOBAS, TUTOR

Bilge has her BSc degree from Istanbul Technical University (ITU, 2008) and her MSc degrees from ITU (2011) and AA School of Architecture (2012) with TUBITAK and British Council&HSBC scholarships, respectively. Since 2019, she is a PhD student at TUM with a DAAD research grant. Her research focus is data-driven design practices in an urban scale.

CHRISTIAN GLANDER, TUTOR

Christian made his diploma at RWTH Aachen in 2008. Since 2009, he works for Behnisch Architekten Munich. In 2015-17 he took part in the postgraduate master program ClimaDesign at Technical University Munich and received his MSc in 2018. Since then he works as a part-time tutor at TUM.

JONATHAN NATANIAN, TUTOR

Jonathan acquired both his architectural degree and practical experience in Israel before earning his master's degree at the AA in London. Since 2018 Jonathan works as a research associate at TUM, where he is currently pursuing his PhD under a DAAD scholarship. In his research Jonathan is developing a digital approach to harmonize energy and environmental quality at the urban scale.

**CHRISTIAN GOLDBACH,
GUEST CRITIC**

Christian Goldbach started his career as a carpenter between 1996-1999 in Germany and Australia. He received his diploma in architecture from University of Stuttgart in 2004. Christian started working in Behnisch Arkitekten in 2004 and was a project leader until 2013. Since 2014, he is managing LBGO Architects and he has been a guest lecturer at TUM.

SUSAN CARRUTH, GUEST CRITIC

Susan is an architect and researcher, with 15 years of experience across practice and academia. She was Head of Research and Sustainable Development for White arkitekter in Denmark, before beginning with GXN in 2018. Her role with GXN includes research, consultancy, teaching and project management, with a particular focus on behavioural design.

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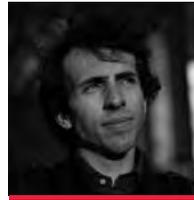
**THIBAULT
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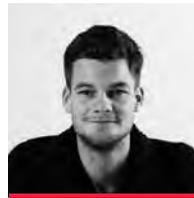
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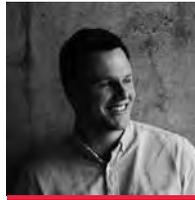
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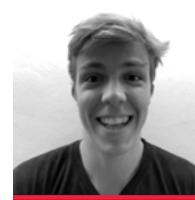
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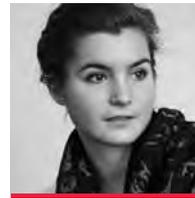
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JESSICA YORK, 21
Victoria University of Wellington, New Zealand

MAX ZORN, 24
TU München, Germany

THE STUDIO

the COURSE AND TEACHING PROCESS

The main goal of *The Office* **|** *Das Büro* **is to investigate experimental working environments and develop conceptual strategies to increase local social comfort and individual well-being within the context of office spaces.**

Seven different student projects address this challenge by adopting a human-centric approach, offering a vision for the next generation of working micro-environments. The solutions deal with a design scale in between the furniture and the building scale, within the direct sphere of influence of the users, to activate the environmental parameters associated with work efficiency, user satisfaction and well-being.

Social interaction, environmental conditions and technological advancements are the main tools used to shape the boundaries of these working micro-environments, from a physical, climatic or purely cognitive perspective of the users, which also ensures the system's evolution to fit the changing tasks and needs.

SymBio is a selection of combinable modules responding to a gaming logic that aims to activate existing office spaces by invading one or more parts of the building, encouraging different levels of informal user interaction and new emerging behaviour.

Workscape is a prefabricated indoor landscape that aims to activate the office users by introducing a third dimension in the indoor distribution, suggesting a wooden structure that can adapt to everything from existing offices to new buildings.

Cur(ve)tain explores the social potential of individuals and groups of people interacting with soft and moldable boundaries. Based on the integration of different proxemic zones, the system encourages the users to actively arrange it according to their changing needs and to selectively modulate the environmental acoustic and visual characters of the space.

Offiziersmesserwände [*Swiss-knife walls*] is a family of multi-purpose movable workstations responding to changing environmental, organizational and functional needs. The name refers to the capacity of the panels to integrate, within one object, a multitude of solutions in answer to arising basic tasks.

Cloud 9 introduces a dynamic ceiling structure composed by foldable tubes in acoustic fabric, connected with the building IoT system, to allow the office users to personalize and tailor the spacial and acoustic proprieties of the indoor space to fit their needs.

Connex is a futuristic projection proposing a mobile office network. The workplaces are physically dislocated from the buildings, which are re-purposed, and integrated on an urban scale within the urban mobility network through the design of autonomous driving work cubicles that can be combined to form temporary meeting spaces.

ICON is a mobile environmental comfort application that challenges the traditional practice of providing office users with individual control on their environmental conditions. It suggests that more comfort expectations can be met by encouraging the users to actively move to selected microclimates existing within the building. The app combines environmental and user data, suggesting *extempore* the specific location that best fits their immediate needs, leading the users through a chosen route.

| Research phase: Developing the research questions | | Concept development: Building the hypothesis | | Testing & experimenting with 1:1 mock-ups: Data driven design | Design iterations and finalising the project: Conclusion |

Semester starts	Excursion to Copenhagen	Testat 1: Research	Design Kick-off	Testat 2: The concept	Data workshop	Testat 3: Experiment	Testat 4: Final
24.04.2019	02-05.05.2019	14.05.2019	15.05.2019	05.06.2019	12.06.2019	03.07.2019	24.07.2019

THE TEACHING PROCESS

For the development of this design studio, a scientific deductive process is adopted as the underlying method to teach the students a working procedure to identify a relevant design idea and support it with strong arguments.

The projects are developed as a team-based research, on interrelated topics researched in parallel, encouraging the sharing and cross-breeding of ideas and information between the research groups throughout the semester.

The design process was subdivided in four different phases of study including a background research, the generation of initial design ideas, an experimental phase and a summary.

TESTAT 1 – THE RESEARCH

The research phase aimed to allow the students to become familiar with the overall topic, learning to review a number of research papers and focusing on a specific aspect, and form their own approach to it.

The students were asked to work in groups of 4 to 5 individuals, for a total of 7 groups in total. Each group was asked to choose one of the seven research topics given, to research the State of Art, and analyse the information from different sources through classification and comparison.

Topic 1. Anthropology

How to empower the human body in the working space? The Vitruvian working human. Study of ergonomic dimensions, proportions, movements, positions and other human dimensions.

Topic 2. Human Perception

How to empower the human mind in the working space? Study of the boundaries of personal and social space, the proxemics, the circadian rhythm. »

Topic 3. Human Behaviour

How do habits influence work satisfaction? Study of user behaviour, social behaviour, potential workday, needs, time-scale, human profiling.

Topic 4. Work Environments

How does the environment impact the work dynamics? Study of private and public space, formal and informal, concentration versus collaboration.

Topic 5. Change of Perspective

How does culture change work dynamics? Study of cultures, work ethics, different generations X/Y/Z, regional differences, habits, routines, rules.

Topic 6. Change through Technology

How can technology evolve modern work life? Study of New materials, connectivity, IoT, etc.

Topic 7. Spacial Requirements

How to distinguish state of the art from obsolete habits? Study of norms, guidelines, standards, constraints, cultural differences.

The students were asked to present the contents of their research by summarizing the State of Art and identifying a research gap to further focus on in the successive tasks. The outcomes were presented to the class in form of a beamer presentation and printed on A2 panels that were posted on the wall of the student's working room to serve as common knowledge database, to be shared by all groups. »

CONCLUDING REMARKS
BY DAVID SELJE
AND THOMAS AUER,
IMAGE FROM TESTAT 2
Photo by Jesse Han.

TESTAT 2 – THE CONCEPT

Design kick-off

As a means to break the ice between the theoretical research phase and putting the ideas into practice, the students were involved in a design kick-off exercise of a couple of hours. To encourage collaboration between the students as well as cross-pollination of ideas, the exercise involved to build on an existing concept, expanding its potential by imagining it within a different context.

The former research groups were split, and the students were reorganized in completely new groups of three persons. Students were given an A3 sheet depicting three different scales of design: the individual scale, the group scale, and the office scale. The students were asked, within each group, to individually sketch a concept for an ideal office space on each scale. After 10 minutes, the students were asked to shift drawing with their neighbour and build on the idea already drawn by implementing it on another scale. This way, each group collaborated on developing three different concepts, testing the limits within the three design scales given.

The resulting 30 early stage concepts developed in 3 scales were commented together with all the students and posted on the wall of the student's working room to be used by all for further inspiration.

Four concepts

To raise the chances of identifying strong and diverse design concepts, the students were challenged to develop many parallel ideas, before selecting one idea to bring further. The students were asked to design four design concepts within each group, based on the learnings in the previous research phase and addressing a specific research gap or problem. The students were encouraged to work with rough models to visualize the solution and develop alternatives and variations.

The four concepts were presented to the class in form of a beamer presentation, supported by the working models used in the design phase. Based on the feedback from the teaching body, the students were asked to select one concept, or to combine their ideas into one main one. »

DESIGN KICK-OFF
30 ideas in 3 scales,
each in 10 minutes.

Topic 1. Anthropology

Arnout Stevens

Ekaterina Vyrodova

Martina Celli

Oscar Waddington
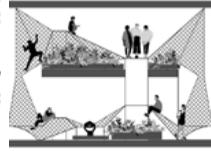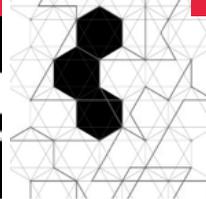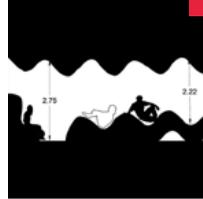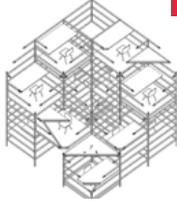
Topic 2. Human Perception

Thibault Brisset

Romain Troubat

Marie-Alice Wätjen

Jessica York
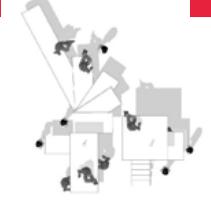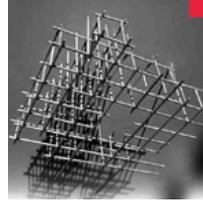
Topic 3. Human Behaviour

Jesse Han

Michelle Lorenz

Enrico Fornasa

Elena Mattiuzzo
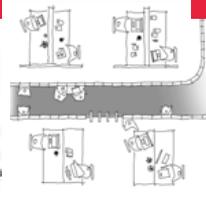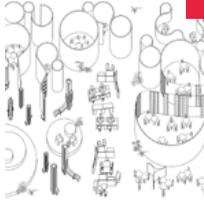
Topic 4. Work Environments

Alexandra Bayborodova

Florian Kraft

Sophie Lorenz

Wolfram Meiner

Mira Simeonova

Topic 5. Change of Perspective

Benedikt Kellner

Mathias Spiessens

Jeong Yeob Kim

Markus Ritter
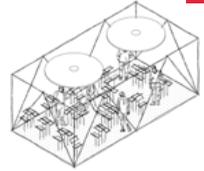
FOUR CONCEPTS

Thumbnails of initial ideas, showing four preliminary concepts developed by each student group

Topic 6. Change through Technology

Nesma Hamouda

Beatrice Brinchi Giusti

Edoardo Daidone

Sören Joosten
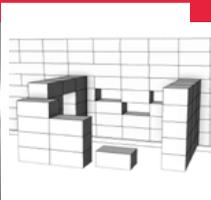
Topic 7. Spacial Requirements

Alex Arndt

Philipp Hölzenbein

Sebastian Koth

Max Zorn

TESTAT 3 – THE EXPERIMENT

The aim with the experiment phase was to introduce the students to the conception and development of a research experiment, and to teach them to use the outcome to further develop and deepen their design concepts.

Each group was brought to formulate a research problem and a working hypothesis for their selected design concept, and to further verify it through a field test. The groups were asked to build a 1:1 scale prototype or micro intervention and to test it within a public space of their choice.

The test results were used, depending on the concept, either to support the hypothesis formulated or as a source of information to further adapt the design to real working conditions. The outcomes of the experiment phase were then summarized and presented through a beamer presentation. »

1:1 MOCK-UP AND REAL USER EXPERIMENTS OF TEAM WORKSCAPES

Photo by Wolfram Meiner

1:1 MOCK-UP AND REAL
USER EXPERIMENTS OF
TEAM CUR(VE)TAIN

Photos by Thibault Brisset

FINAL MODELS

Final presentation models of several projects. Photo taken after 4th Testat.

TESTAT 4 – THE FINAL DESIGN

The final design of each group consisted of a summary of the main relevant aspects achieved in each phase of the design, including a selection of the relevant State of Art, the identification of a specific problem, the formulation of a hypothesis and the consequent development of a design proposal that aims to solve the problem, supported by the outcomes of the experiment.

The following chapter will be showcasing each project in detail. ✖

RESEARCH-

Virtuvian Human, ergonomy, human facts, proportions, movements, positions

HOW TO EMPOWER THE HUMAN BODY IN WORKING SPACE?

ANTHROPOLOGY

BY

Arnout Stevens

Ekaterina Vyrodova

Martina Celli

Oscar Waddington

Proxemics, boundaries of personal and social space, circadian rhythm

HOW TO EMPOWER THE HUMAN MIND IN WORKING SPACE?

HUMAN PERCEPTION

BY

Thibault Brisset

Romain Troubat

Marie-Alice Wätjen

Jessica York

Human profiling, needs, potential workday, social behaviour, timescale, user behaviour

HOW DO HABITS INFLUENCE WORK SATISFACTION?

HUMAN BEHAVIOUR

BY

Jesse Han

Michelle Lorenz

Enrico Fornasa

Elena Mattiuzzo

Private, public, concentration, collaboration, formal, informal

HOW DOES THE ENVIRONMENT IMPACT WORK DYNAMICS?

WORK ENVIRONMENTS

BY

Alexandra Bayborodova

Florian Kraft

Sophie Lorenz

Wolfram Meiner

Mira Simeonova

GROUPS

Cultures, work ethics, generation x/y/z, regional differences, habits, routines, rules

HOW DOES CULTURE CHANGE WORK DYNAMICS?

Materials, connectivity, IoT

HOW CAN TECHNOLOGY EVOLVE MODERN WORK LIFE?

CHANGE OF PERSPECTIVE

BY

Benedikt Kellner

Mathias Spiessens

Jeong Yeob Kim

Markus Ritter

CHANGE THROUGH TECHNOLOGY

BY

Nesma Hamouda

Beatrice Brinchi Giusti

Edoardo Daidone

Sören Joosten

Guidlines, norms, constraints, standards, cultural differences

HOW TO DESTINGUISH STATE OF THE ART FROM OBSOLETE HABITS?

SPACIAL REQUIREMENTS

BY

Alex Arndt

Philipp Hölzenbein

Sebastian Koth

Max Zorn

ANTHROPOLOGY

HOW TO EMPOWER THE HUMAN BODY IN THE WORKING SPACE?

by MARTINA CELLI, ARNOUT STEVENS,
EKATERINA VYRODOVA & OSCAR WADDINGTON

The first aspects addressed in this research were about the physiology and psychology of human beings in the working space.

Regarding physical aspects, the body and its needs, the analysis field was expanded from from general studies on ergonomics to its application in workspaces. Most of the articles analysed focused on ergonomic furniture such as desks or chairs, but it was difficult to find research concerning more uncommon working situations. The standardisation of spacial guidelines and of "the average man" are still in use in the design of work spaces, with a focus on pieces of furniture rather than on a comprehensive system of space and people. A different approach was however taken in the experiment developed by RAAF in Rotterdam. The final goal of this experiment, called "The End of Sitting", was to develop a space where people could work in several non-sitting positions, in order to enhance motion and physical well-being. The idea of working with surfaces instead of traditional furniture was at the core of its design **(2)**.

Psychological needs were then taken into account as the personal well being and positive feelings are important, in order to make the employees more involved in their work and to obtain better performances.

Several research papers, regarding human interaction in the office environment, brought us to the next step of development of the project. The research "Workplace productivity and office type: An evaluation of office occupier differences based on age and gender" shows that perceived workspace productivity is mostly affected by a "variability of physical layouts, more informal office, control over interactions, "downtime" in social areas". It also shows the importance of designing spaces for informal interaction as a part of social areas of the office **(1)**.

FLOW MODEL

Encourage exchange among small groups. It works for "clusters of knowledge" or field of work. It is convenient in terms of time saving, but people gather in the same spot most of the day **(1)**
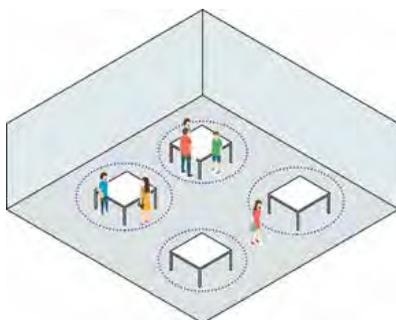
SERENDIPITOUS MODEL

In this office a connection among a greater number of people is achieved. Everyone has to move across office space, because there is no separation between fields of work . More interdisciplinary exchange **(1)**
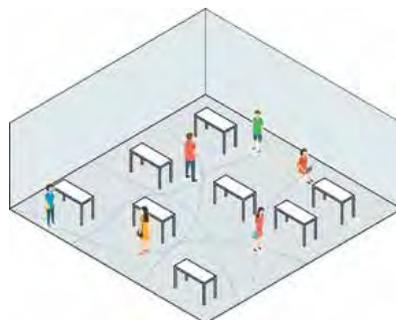
(1) Haynes, B., Suckley, L., Nunnington N. (2017) Workplace productivity and office type: An evaluation of office occupier differences based on age and gender, *Journal of Corporate Real Estate* Vol. 19 No. 2, 2017, pp. 111-138.

(2) Withagen, R., & Caljouw, S. R. (2016). 'The End of Sitting': An Empirical Study on Working in an Office of the Future. *Sports medicine* (Auckland, N.Z.), 46(7), 1019–1027.

WORKPLACE PRODUCTIVITY

According to research **(1)**, the following factors are the most important to enhance the perceived productivity by workers

"Downtime" in social areas   ⬤   Control over interactions   ⬤   More informal office   ⬤   Variability of physical layouts   ⬤

⟶

Another aspect of the research was showing two models of the office space: the "Serendipitous" office and the "Flow Model" office.

The "Serendipitous" office model suggests to deliberately divide people working on the same project around the office in order to force them to move around more and learn from other projects that are developed in the same space. This office model encourages more interdisciplinary exchange and interaction.

The "Flow office" model suggests tethering people, who work on one project, together, in order to get higher results in shortest time. Although, this model does not encourage interaction, it encourages exchange among small groups and more focused work **(1)**.

In this project we focus on the Serendipitous Model as we believe, more interaction in the office brings more interdisciplinary exchange and increases quality of work of the company in future.

Another one important point, proved by research, for the project is that "non-animated objects or "actants" which have central position in the space are effective catalysts for social gathering". The task for the next phase is to design spaces, which could serve as social gathering catalysts and be ones of the important non-animated objects in the office **(1)**.

For the design itself, the concept of "affordance" was crucial to develop unusual surfaces.

This was developed in late 1970's by the American psychologist and writer J. Gibson. Gibson argues that the environment offers several possibilities to humans, and the features of the objects suggest certain ways of use and interaction with them. According to him, humans beings tend to alter and modify their environment so as to change its *affordance* to better suit them and to make it easier to live in. In addition, he argues that learning to perceive an *affordance* is an essential part of socialization **(3)**.

(3) Gibson, J. J. (1979). *The ecological approach to visual perception.* Boston: Houghton Mifflin.

The concept was further developed in 1986 by Donald Norman, who expanded the research about the idea of *affordance* and product design. As he stated in "*The design of everyday things*" the feature of every object suggest to the user how to interact with it. Furthermore, the more the design of the object is intuitive, the more it is likely that it will be used in the right way. For this reason, a key point in the project will be to allow the persons to clearly understand which interactions are possible within their working environment, and encourage specific behaviours within it **(4)**.

(4) Normann, D. A. (1988). *The Psychology of Everyday Things.* Basic Books, New York.

HUMAN PERCEPTION

HOW TO EMPOWER THE HUMAN BODY IN THE WORKING SPACE?

by THIBAULT BRISSET, ROMAIN TROUBAT,
MARIE-ALICE WÄTJEN & JESSTICA YORK

SENSES AND PERCEPTION

We perceive and interpret information from our surrounding environment, stimulated by our senses
and through our mind, we react to it by taking action. The senses enable the ability of familiarization of
environments or scenarios\social situations which therefore allow an individual to adapt to it.

CIRCADIAN RHYTHM

The circadian rhythm is a daily rhythmic activity cycle based on 24-hour intervals, that is found in many
organisms. The body reacts to the variation of light and temperature, as a reference of time. These
reactions make specific tasks more easy at certain hours.

Social interactions and the environment can also impact the perception of time and therefore, the
biological clock. The difference between the biological and social rhythm is called social jet-lag, which can
impact social relationships through stress and anxiety from unadapted physical schedules.

Open space
No physical boundaries

Sociofugal place
Implicit Boundary

Territorial building
Impenetrable boundary

Closed and Personal Offices

Control of disturbance - Control of the environment - Private space, belonging
Procedural memory

Open and Flexible space

Communication - Variation of the environment - Adaptation
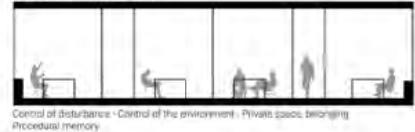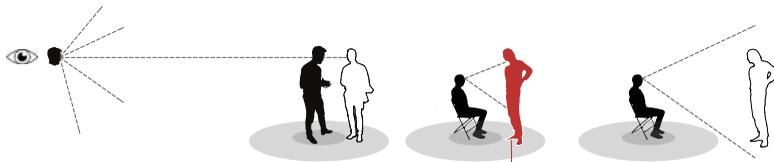
Vertical Positioning

Intimidation
Invasion

Acceptable
Eylevel Difference

Horizontal Positioning

field of view

focus
area 60°

side to side
Distance 0.6 m

face to face
Distance 1.2 m

Acceptable
Eylevel Difference
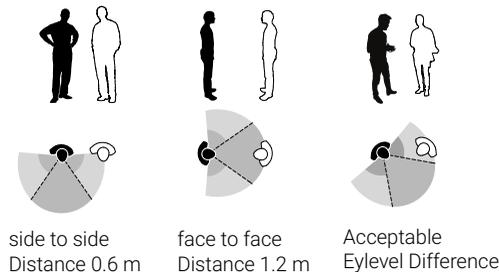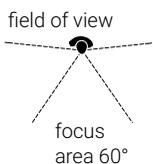
MODES OF BEHAVIOUR

The distance between
the persons -vertical or
horizontal impact the nature
of an interaction

PROXEMICS: INTERPERSONAL DISTANCES

Spatial behaviour is the organization of communication and interaction between people. It is a sub-category of non-verbal communication and body language.

The variation of distance between people changes the way we perceive the others. The American Anthropologist Edward T. Hall called this study of the communication through the use of space „proxemics". The word is a derivative from lat. Proximare = to approach.

The horizontal and vertical alignment of the body and the focus area create different codes for communication. It is a visual code involving eye-contact that can convey a broad range of non-verbal information from intimidation to requests to augment the interpersonal distance.

The most important distance receptors are in the eye. Therefore the personal space is perceived by the individual twice as big in the front as in the back. Proxemic distances resolve from different sensor factors. If the sensory factors of body alignment, field of view and line of sight are considered, the personal space is modified to an elliptical form. Odours and transmitted heat is only recognised in intimate space. The distance providing the capability of touch and interference is enclosed in the personal space.

The Information received and perceived from other individuals varies with distances. The acoustical and vision receptors are the most important, because they can stimulate stress and convey information on larger distances.

BOUNDARIES OF PERSONAL AND SOCIAL SPACE: NOTION OF TERRITORRY

Personal and social space are abstract spheres around somebody, appropriate distances between two people during social interactions, but can also refer to the notion of territory. Your personal space is somewhere only you have access to. It could be a home, a desk, a locker. In order to be precisely defined, this space need boundaries to show a change of status, from social to personal. The boundary that defines a personal space can be obviously a wall or a window, for a closed office. It could also be more subtle, like pieces of furniture.

There is for example a recent trend of offices with no assigned desk, where people work where they want or where they can, regarding the task they have to perform, and the design of the work environment is flexible. This trend creates only social spaces. However, studies show the importance of personal territory. A sense of belonging and appropriation to make people feel more committed to their work place. A control of the access to a specific area makes people feel safe. A role in the decision making of the design of the work environment is a real empowerment for employees and can have important positive consequences in terms of well-being and productivity.

CONCLUSION

The well-being in an office environment can be impacted by many factors. Maybe the two most important are the privacy and the exposure: what can I perceive from others, what others can perceive from me. How do I keep people away from my personal information and how do I protect myself from disturbances created by others or my environment ? That's why an office building needs clearly defined spaces with a specific status. And for this to be clear as a social convention, spaces need boundaries that provide the right environment for a particular task or atmosphere.

Heat transmission
Interference
Odour
Listening
Loudness
Vision
Visibility

Recognition
Mandatory communication

İndividual
Intruder
Not intruding
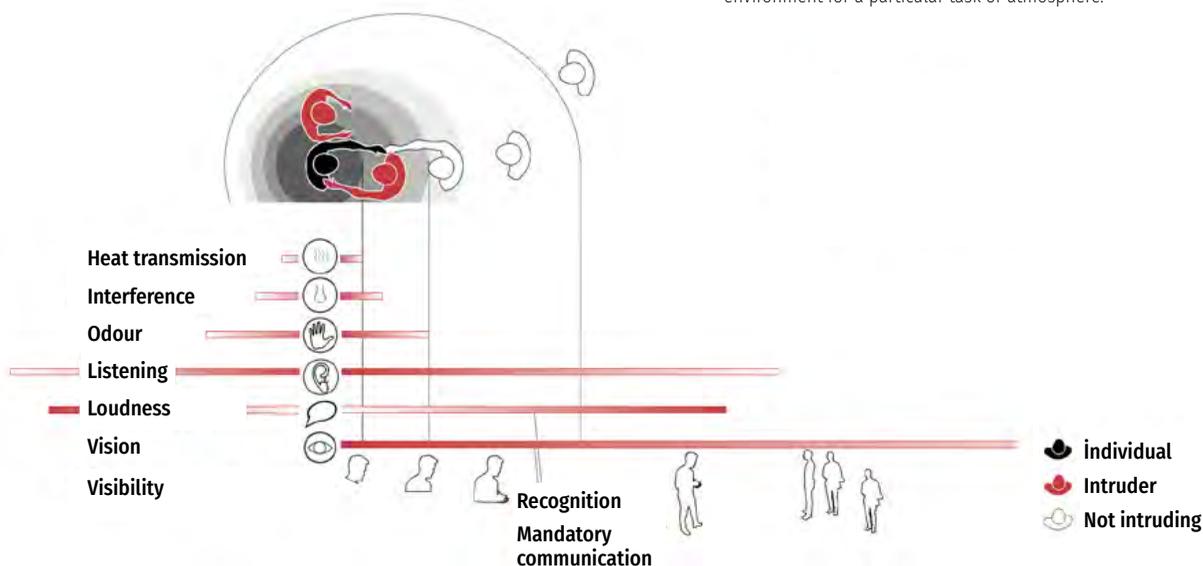
HUMAN BEHAVIOUR

HOW DO HABITS INFLUENCE WORK SATISFACTION?

by JESSE HAN, MICHELLE LORENZ,
ELENA MATTIUZZO & ENRICO FORNASA

Different people need different things from their workplace: different personalities and backgrounds affect the reaction to similar environments.

Our research is three-fold. We begin with the world of human behaviour, understanding that people are complex and multifaceted, each one with his or her own unique personality, preferences, and needs.

First, as we can see from the graphs on the side, the work environment where they are used to work affect their priority of some needs above others.

Secondly, research has proven the ineffectiveness of the open office, due to decreased face-to-face interactions, zero privacy and lack of separations. Boundaries are necessary in the office but they need to be designed better.

Finally, as a result of jobs increasing in flexibility as well as the unpredictability of attendance rates, not all of the office spaces are used throughout the work day. This means unused and wasted space. From these observations, we begin our design. How can a space be easily transformed to fit the user's needs? Can the open office be tailored into a space of autonomy, collaboration, and belonging? Can offices be optimized so that space is not wasted and is instead multi-functional?

INTERNAL AND EXTERNAL STIMULI

On the right page is our analysis of all the different stimuli that affect human behaviour

SATISFACTION GRAPH

Satisfaction for different aspect of people coming from different typologies of offices.

very satisfied: +3
very dissatisfied: -3

HUMAN
BEHAVIOR

IS THE RESPONSE TO

EXTERNAL STIMULI

INTERNAL STIMULI

SIGHT

- **LIGHT**
  Power, Color Temperature, Glare
- **COLOR/TEXTURE**
  Influences mood
  Can be stimulating or distracting
- **VIEWS**
  Nature, Landscape, Amount of Space

SOUND

- **VOICE NOISE LEVEL**
  Private Space vs.
  Collaborative Space
- **ACOUSTICS**
  Reverberation, Open vs. Closed Area
  Material Properties

SMELL

- **ODORS**
  Sufficiency of air exchange
  Separation from
  kitchen/restrooms
- **SCENTS**
  Fragrant vegetation
  Aromatherapy

TOUCH

- **POSTURAL COMFORT**
  Furniture, Body Position (static/active)
- **MATERIALS / FINISHES**
  Comfort
  Stimulation/Distraction
- **THERMAL COMFORT**
  Air Temperature/MRT
  Humidity
  Mechanical/Natural Ventilation
  Air Velocity
  Metabolic Rate/Clothing Level

MIND

HOW PEOPLE INTERACT WITH THEIR SURROUNDINGS

- **EXTROVERT**
  Prefer group activities
  Energized by social interaction
  Easily excited/enthusiastic
  DESIGN IMPLICATIONS
  OPEN SPACE
  FLEXIBLE SEATING
  INTERACTIVE WORK ROOMS

- **INTROVERT**
  Prefer solitary activity
  Sensitive to external stimuli
  Exhausted by social interaction
  DESIGN IMPLICATIONS
  INDIVIDUAL WORKSPACES
  MINIMAL DISTRACTIONS
  PRIVATE BOOTHS

ENERGY

HOW PEOPLE SEE THE WORLD AND PROCESS INFORMATION

- **OBSERVANT**
  Highly practical
  Detail-oriented
  Organized
  DESIGN IMPLICATIONS
  STORAGE SPACE
  PERSONALIZED WORK SPACE

- **INTUITIVE**
  Imaginative and curious
  Big-picture oriented
  Open-minded
  DESIGN IMPLICATIONS
  HOT DESKS
  COLLABORATIVE WORKSPACE
  ADAPTABLE FURNITURE

NATURE

HOW PEOPLE MAKE DECISIONS AND COPE WITH EMOTIONS

- **THINKING**
  Rational
  Objective
  Logic over emotions
  DESIGN IMPLICATIONS
  PRIVATE WORKSPACE
  ORGANIZATION

- **FEELING**
  Emotional
  Social harmony
  Cooperation
  DESIGN IMPLICATIONS
  PERSONALIZATION
  COLLABORATIVE SPACES

TACTICS

HOW PEOPLE WORK, PLAN, AND MAKE DECISIONS

- **PERCEIVING**
  Flexible
  Good at improvising
  Prefer to keep options open
  DESIGN IMPLICATIONS
  COLLABORATIVE ROOMS
  CASUAL SEATING

- **JUDGING**
  Decisive
  Highly organized
  Prefer structure
  DESIGN IMPLICATIONS
  STORAGE SPACE
  PERSONALIZED WORK SPACE
  FIXED ARRANGEMENTS

FLEXIBLE

EXTERNAL STIMULI |SPACE|

STRUCTURED

FREE SPACE

HOT CUBICLES

FIXED OPEN PLAN

FIXED CUBICLES

PUBLIC

INTERNAL STIMULI |PEOPLE|

PRIVATE

WORK ENVIRONMENTS

HOW DOES THE ENVIRONMENT IMPACT WORK DYNAMICS?

by ALEXANDRA BAYBORODOVA, FLORIAN KRAFT,
SOPHIE LORENZ, WOLFRAM MEINER & MIRA SIMEONOVA

Cell Office	Taylorism	Bürolandschaft	Cub

Cell Office

Oldest office layout (since 1726) and privilige of the past, but still the most popular type in Germany [1]

85%
of Germans still work in cell offices [2]

Taylorism

Key objective of every office layout has been the optimization of:

efficiency and productivity [3]

Bürolandschaft

The three most essential factors for office design are:

stimulation coherence control [4]

Cub

Human centric lighting

50

especially for older em
900
for sa [5]

[1] Savills & CCL (2016), [2] Indeed Blog (2017)   [3] Seiferlein et al. (2018), p. 116   [4] Wackernagel (2017)   [5] Seiferlein et al. (2018), p. 73

We analysed the evolution of office layouts throughout history by looking at floor plans and various spatial characteristics. Environmental conditions and how they influence work dynamics were defined for each type of office. Important environmental and spatial requirements were defined as elements.

By analysing the rapidly changing floor plans, we noticed that the sections stayed exactly the same over the course of time.

...bicles

Dynamics

concentrated — collaborative
formal — informal
autonomous — supervised
flexible — permanent
monotone — diverse
unproductive — productive
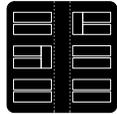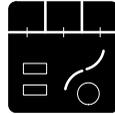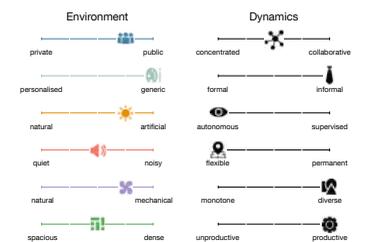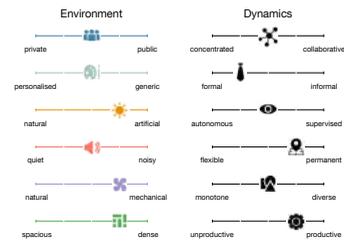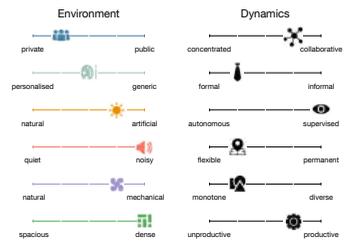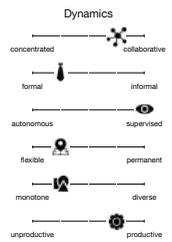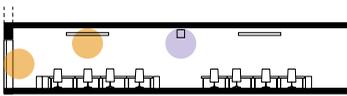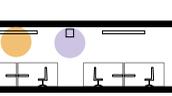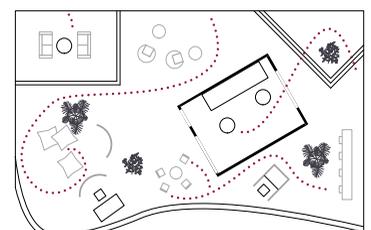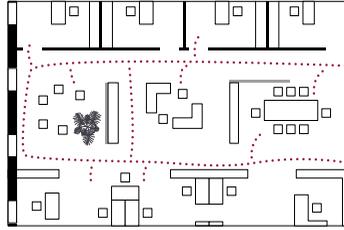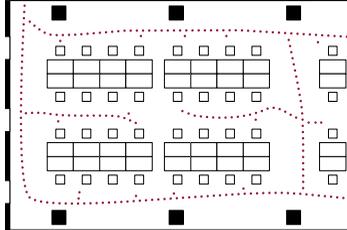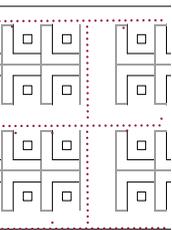
...0 lux not enough,
...ployees that require
...ne level of productivity [5]

Open Plan

Environment

private — public
personalised — generic
natural — artificial
quiet — noisy
natural — mechanical
spacious — dense

Dynamics

concentrated — collaborative
formal — informal
autonomous — supervised
flexible — permanent
monotone — diverse
unproductive — productive

Face-to-face interaction decreases by approximately [6]

70%

Combo Office

Environment

private — public
personalised — generic
natural — artificial
quiet — noisy
natural — mechanical
spacious — dense

Dynamics

concentrated — collaborative
formal — informal
autonomous — supervised
flexible — permanent
monotone — diverse
unproductive — productive

for the best balance:

50% sitting

25% movement [7]

25% standing

Activity Based

Environment

private — public
personalised — generic
natural — artificial
quiet — noisy
natural — mechanical
spacious — dense

Dynamics

concentrated — collaborative
formal — informal
autonomous — supervised
flexible — permanent
monotone — diverse
unproductive — productive

Only **49%**
of people without choice in where to work report a great workplace experience [8]

71%
of people with choice in where to work report a great workplace experience [8]

[6] Bernstein, Turban (2018) Seiferlein et al. (2018), p. 73   [7] Seiferlein et al. (2018), p. 119 ff.   [8] Gensler (2019), p. 14

CHANGE *of* PERSPECTIVE

HOW DOES CULTURE CHANGE WORK DYNAMICS?

by BENEDIKT KELLNER, MATHIAS SPIESSENS,
JOHNNY JEONG YEOB KIM & MARKUS RITTER

Our research focuses on working culture and how culture affects work dynamics. People have tried various explanations and definitions of culture in the past. "Working culture" or "organisational culture" is defined by values and behaviours that contribute to the social and psychological environment of a business. Therefore work culture is a concept which deals in the study of: beliefs, thought processes, attitudes of the employees and ideologies and principles of the organization. It is the work culture which decides the way employees interact with each other and how an organization functions.

The Competing Values Framework is a seminal model of organisational culture developed by Robert E Quinn and John Rohrburgh in the 1980s. They determined that two major dimensions account for the broad range of indicators that make up an organizational culture. The first dimension ranges from internal focus and integration to external focus and differentiation. Some organizations, for example, value managers who are adaptable, while other organizations prefer managers who are consistent. The second dimension ranges from stability and control to flexibility and discretion. Some organizations prioritize harmonious internal relationships and processes, while others focus externally on establishing a market niche. Put simply, this model categorises company culture into four types – collaborate, create, control and compete – all of which are considered equally useful depending on the type of work being carried out. We can distinguish 4 different work cultures: Hierarchy culture, clan culture, market driven culture and adhocacy culture.

WORKING CULTURE MATRIX
4 different working cultures explained through 3 different perspectives.
Positional, Generational and Regional Perspective
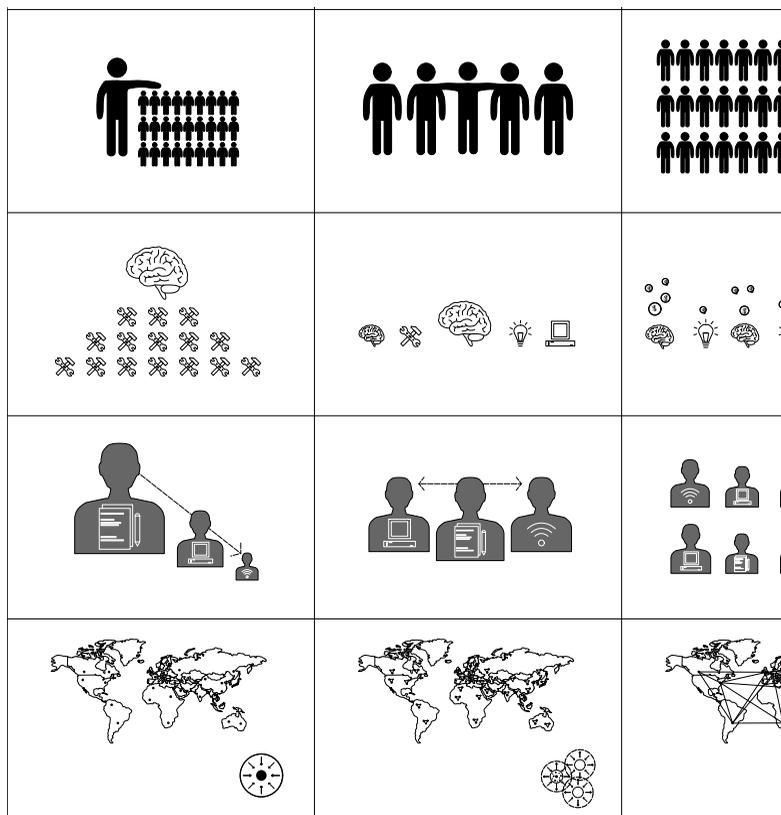
In our research we went through the evolution of work culture to recognise the difference between each culture profile, which always have a dominant culture and may also contain different subcultures. To get a good understanding of the 4 working cultures we examined them according to 3 different perspectives. Positional perspective, Generational perspective and Regional perspective. How does a change in these perspectives influence work dynamics.

The positional perspective defines the position which a person occupies in the office within the framework of a work process. The structure or differentiation between employer and employee plays an important role here. Each of them is part of the process and has different needs, on the one hand for himself but also in communication with the other. The generational perspective is about the different roles, functions and work dynamics of generation X,Y and Z. Through the cooperation of various generations the best possible results can be reached. To achieve this, however, architecture must respond to the diverse norms of all generations. The regional perspective defines the influences of different regional cultures, of effects like globalisation and the influence of location and traditions of a company.

A company that doesn't understand its own culture is like a person without an identity. Understanding the cultural context of an organisation can help the designer offer the right mix of individual, meeting and social spaces and even the atmosphere of those spaces that encourage the desired behaviours. The future of work will be heavily influenced by technological innovation, global economic integration, demographic ageing and institutional changes. All this has to be taken into account to create valuable and worthwhile offices.

WHAT'S NEXT?

Today's work has to a great extent become an invisible brain activity that can happen anytime and anywhere, therefore more and more companies need brainpower. More than 80% of a company's value is immaterial – the value lies in concepts, ideas, innovation, creativity, management and brands. In the future we need managers who are able to tap the potential of every single employee through the recognition and trust that one is able to achieve a goal in many different ways. Management should provide and create room for different rhythm and speeds of work. As the transition towards a more balanced and flexible work culture occurs, management needs to start focusing on managing life as well as work, supporting a change in the perception of work-life balance. Individualized work-life balance for each employee considers professional and personal needs and provides the spaces for individual biological rhythms.

Our current working cultures are in this perspective outdated. It is this knowledge of the need for an innovative work culture that has encouraged us to create a new framework for office environment and work dynamic in the contemporary and future digital age.
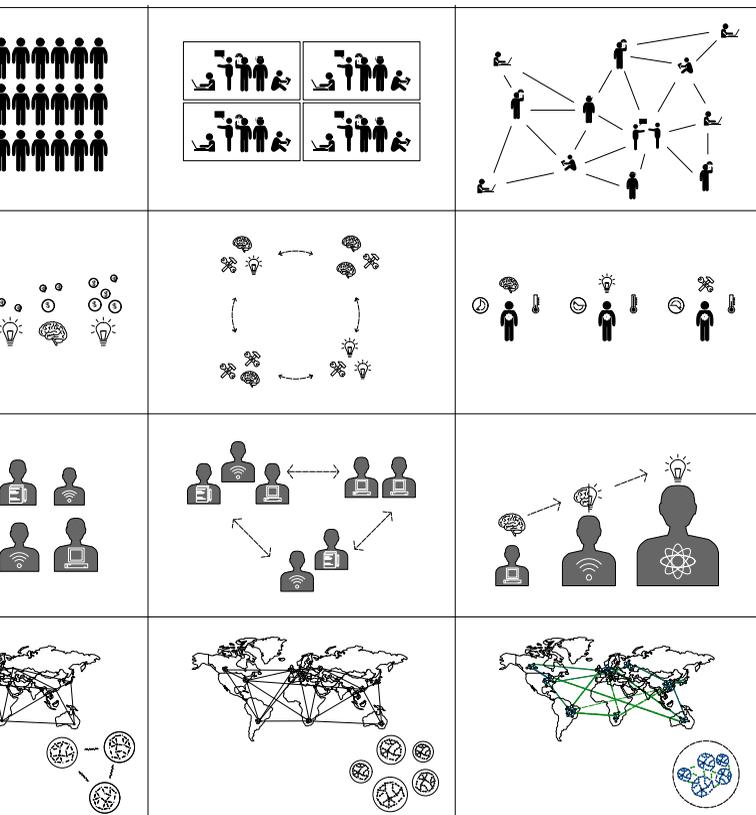
CHANGE *through* TECHNOLOGY

HOW CAN TECHNOLOGY EVOLVE MODERN WORK LIFE?

by NESMA HAMOUDA, BEATRICE BRINCHI GIUSTI,
EDOARDO DAIDONE & SØREN JOOSTEN

The presence of technology in the workplace is not a new topic. Companies all over the globe are continuously implementing technological tools both in and outside of the office. But how does technology impact the spatial conditions of the workplace and work productivity of the person?

This is precisely the question we have addressed as a group and have investigated the impact of Internet of Things (IoT), Information Technology (IT), and Smart Materials on our spatial environment, productivity, and help.

The term IoT refers to the networking of virtual and physical objects, which, thanks to the connection in an Internet-like structure, allows communication and the transfer of data between objects. IoT, for example, enables remote monitoring and control of physical objects, where humans only have to intervene in the system in the rarest of cases.

The much better known and older technology categorization is IT. This includes the entire information technology processing. An everyday example is the telephone, which was already developed on the basis of IT before the Internet existed. IT processing always requires a user, an IT service (platform, operating system, …) and a technical infrastructure (radio network, Internet network, …).

Apart from networking and data transport, more and more so-called smart materials are coming onto the market. These are called smart because their properties can be controlled adapted and generated. Compared to conventional materials, this technical progress leads to a much larger field of application.
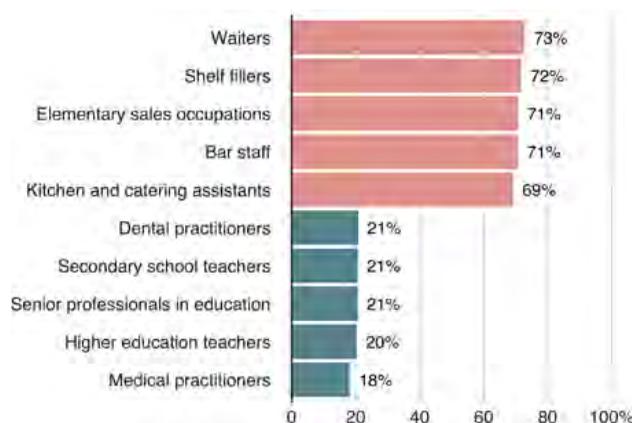
JOBS AT RISK FROM AUTOMATION
Highest and lowest probability, according to *BBC Office for National Statistics*

BALANCE
Schematic diagram to illustrate the weighting of the three main elements and their interfaces such as balance.
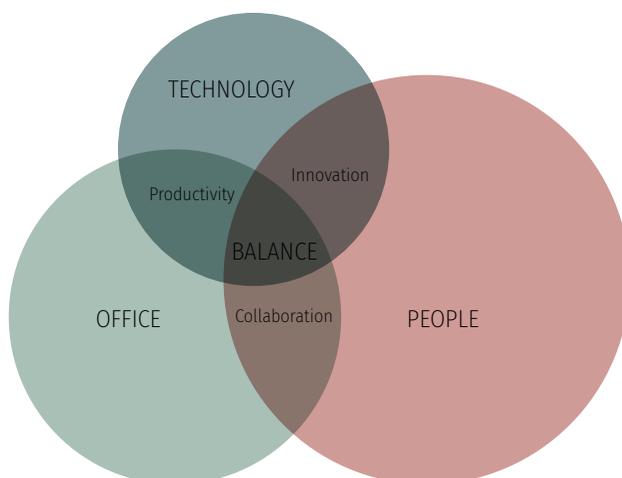
In order to specify the topic of technologies in the workplace, we have researched in detail the influence of the above three categories on spatial conditions and the influence on the employee. Technologies can essentially influence the room atmosphere by three factors: light, room climate and air quality.

IoT works particularly much with sensor technology and is therefore able to automatically control the climate, light and air quality with the help of applications known to us such as a filter system, air conditioning system and lighting system, and to adjust and control condition to the optimum conditions for each individual room.

Another decisive factor regarding the room atmosphere is smart materials. The "smart glass", for example, has an electrochromic coating that allows the transparency of the glass to be changed at the touch of a button. The function has an influence on the light in the room and on the room climate. Furthermore, there are the so-called "Climate Walls", which through a thin film of water on their surface enable the climate and air quality, through the absorption of dust particles, pollen and heat, to positively influence.

One of the most important questions is how technologies can effectively support workers in the present and the future. In the course of our research, we have identified three main aspects. The first aspect is communication and cooperation, which is of interest to employees, as our society is increasingly turning away from heavy industry towards a service society where communication and cooperation are essential.

· IoT has the ability to automate our communication through processes and sensors, by making calls automatically or checking whether conference rooms are occupied or free, these features

facilitate collaboration and enhance productivity. IoT can also be used to automatically control, for example, windows with an electrochromic coating in a conference room, providing ideal privacy and lighting conditions. Applications such as social media apps or video conferencing are already part of everyday life and are made possible by IT.

· The second aspect is ergonomics and usability. In the future, programmable materials are able to create material properties that make it possible to react individually to the individual user. In the future, people with back problems will be able to create an individual office chair with different material hardness or properties. IoT and IT also help in particular with usability, as they provide sensors to automate processes, which simplifies handling. IT supports the user through its simple communication and cloud services that enable data to be retrieved anywhere, independent of hardware.

· The third aspect is security in everyday office life. IoT and IT allow end-to-end encryption through blockchain or intelligent monitoring systems when transferring data or also security with the help of sensors and cameras to protect objects from unauthorized access.

CONCLUSION

To sum up, technologies are justified in their existence because they are extremely useful and helpful, especially for people with physical and mental disabilities, because they can support us in many processes and simplify or even take over many processes independently.

But it is extremely important to always find the balance between people, the world of work and technologies, because at the end of the day technologies should not control us, but instead we should control the technologies and only use them selectively.

SPACIAL REQUIRMENTS

HOW TO DISTINGUISH STATE OF THE ART FROM OBSOLETE HABITS?

by ALEX ARNDT, PHILIPP HÖLZENBEIN, SEBASTIAN KOTH & MAX ZORN

Construction standards such as the German ArbStättV or the DIN provide strict guidelines for the surface design of workplaces. However, these guidelines do not correspond with contemporary working concepts, which have started placing more emphasis on flexibility and interchangeability.

The actual space consumption, however, must be seen in context and dependent on the activity, but individual preferences and the time component also play a determining role.

The series to the right shows how area consumption changes with increasing equipment ($\leq 1{,}21m^2$) compared to working on a laptop ($\emptyset 5m^2$).

This is particularly interesting given that work is increasingly done on the move and that these locations usually only provide a fraction of the required space. While a train passenger usually only has a little more than a third of a square metre of space available, a café offers up to $1.2m^2$. Furthermore, digital workplaces or novel group work stations also have very different area requirements from the ones specified in the norms.

The matrix on the following page contrasts thus norms and workplace concepts, with unconventional settings, offering us the possibility to evaluate the user's actual spatial needs.
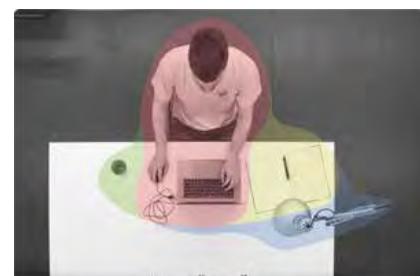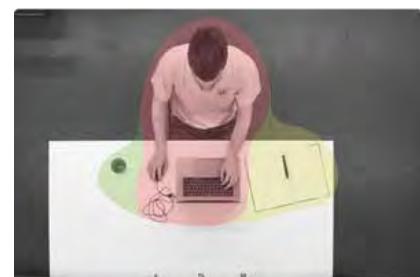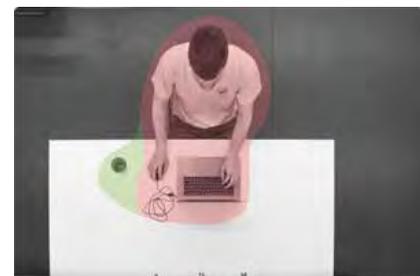
■	0.50 m²
■	+ 0.07 m² = 0.57 m²
■	+ 0.19 m² = 0.76 m²
■	+ 0.15 m² = 0.91 m²
■	+ 0.30 m² = 1.21 m²

SPACE CONSUMPTION EXPERIMENT

Series of space usage of various classical office set-ups.

WORK SPACE MATRIX

Comparison of various classical and
novel work spaces.

2.04m²	1.19m²	0.39m²	2.88m²
STEELCASE COPPICE WORK 01	STARBUCKS CAFE	ICE ECONOMY CLASS	NORM

11.5m²	1.15m²	0.44m²	2.88m²
STEELCASE COLLABO-RATIVE WORKSPACE	OUTSIDE CONTAINER	ICE ECONOMY CLASS GROUP	NORM

8m²	≥2.5m²	2.5m²	1.28m²
SEAGRAM BUILDING	TRANSFORMABLE MEETING SPACE	NORM	NORM

≥6.3m²	1.35m²	≥0.5m²	≤20m²
CDP	COBOT LBR IISY	AR ENVIRONMENT SPATIAL	VR ENVIRONMENT OCULUS

DESIGN-
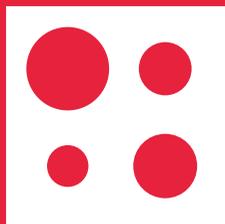
SYMBIO

BY

Arnout Stevens

Ekaterina Vyrodova

Martina Celli

Oscar Waddington

WORKSCAPE

BY

Alexandra Bayborodova

Florian Kraft

Sophie Lorenz

Wolfram Meiner

Mira Simeonova
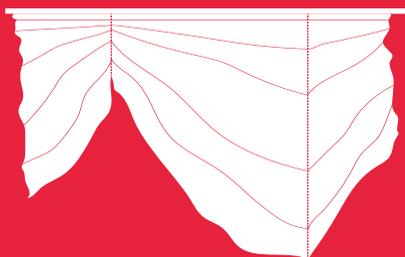
CUR(VE)TAIN

BY

Thibault Brisset

Romain Troubat

Marie-Alice Wätjen

Jessica York
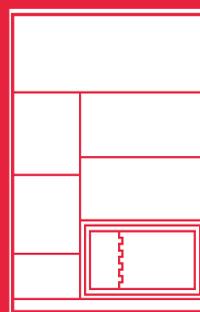
DIE OFFIZIERSMESSERWÄNDE

BY

Jesse Han

Michelle Lorenz

Enrico Fornasa

Elena Mattiuzzo

PROPOSALS
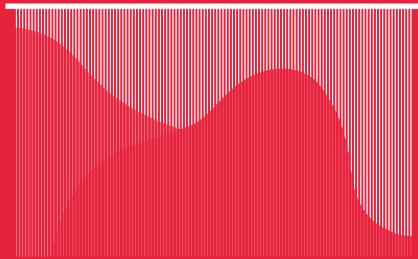
CLOUD⁹

BY

Nesma Hamouda

Beatrice Brinchi Giusti

Edoardo Daidone

Sören Joosten
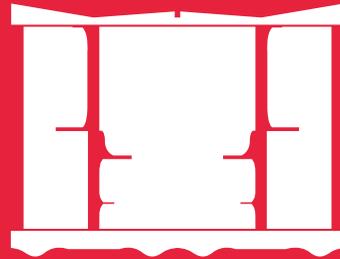
CONNEX

BY

Benedikt Kellner

Mathias Spiessens

Jeong Yeob Kim

Markus Ritter

ICON

BY

Alex Arndt

Philipp Hölzenbein

Sebastian Koth

Max Zorn

SYMBIO

CREATING DIVERSITY IN EXISTING OFFICES

by <u>MARTINA CELLI</u>, <u>ARNOUT STEVENS</u>,
<u>EKATERINA VYRODOVA</u> & <u>OSCAR WADDINGTON</u>

In the process of the research and analysis of existing contemporary projects it became clear that there is a communal problem for all offices nowadays: homogeneous office spaces do not encourage informal interaction, communication and multidisciplinary exchange.

RESEARCH QUESTIONS

The structure of office spaces changed during the time and a lot of different office typologies and layouts were invented, for example: Cell office, Taylorism, Office landscape, Cubicles, Open Plan offices, Activity based offices and a lot of different combinations of the named typologies. However, it is obvious, that people keep sitting while working in any of this layouts. Activity based office, as the most interactive one, still just suggests different places, where office workers can sit down and do their work. There is some interaction and communication which is appearing in the kitchen and when people cross the workspaces of others. More frequent informal communication and communication and multidisciplinary exchange increases quality of work. However, contemporary offices do not provide people with such spaces.

HYPOTHESIS

We believe that a more diversified office layout will shape the behaviour of workers towards the development of a more collaborative working environment.

SYMBIOSIS

SymBio can be integrated in existing office
spaces in order to create diverse environments.

CONCEPT

The concept of the project is based on the biological process of symbiosis.

In biology, symbiosis is an "interaction between two different organisms living in close physical association, typically to the advantage of both". From Greek συμβιόω (verb): living together, coexisting. The name of the Project SYMBIO symbolizes these advantages, which existing offices can get by inserting an additional structure, a kind of a playground in the office space.

We want to bring diversity to homogeneous contemporary offices. Basing the design on the research, we are focusing on diversity of interaction, diversity of outlook, and diversity of postures.

Diversity of interaction means to create spaces for different situations, which can happen during the working day in the office. An important question which we focus on is: "How does moving from formal to informal space affect behaviour at work?"

Diversity of outlook means creating unconventional spaces that encourage creativity and exchange. So the challenge was to move away from furniture, chairs and tables to more playful surfaces. Diversity of postures means a varsity of body positions for different types of work and communication, through non-sitting positions at the desk.

The next step of the project development is a catalogue of the scales of interaction in the office and a catalogue of spaces, that is designed for these interactions. From less active to the most interactive, 10 different kinds of situations were defined. They are a call, sleep, individual work and e-Mails, face to face interaction, small group work, presentation, conference, group discussion, workshop, coffee/lunch space. In the defined situations there are different number of people, which take part in it, and also different number of people which stay active in this situation. This is showed in the catalogue with different colours for different situations: people, which stay active, have black background; people, which are „listeners", have grey background; and people, which can occasionally appear in the defined situation, but do not take part in it, have white background.

Nine spaces were developed for different situations: cabin, hammock, cave, pop up, mountain, coast, nest, swing, lounge. The spaces have no conventional desks and chairs. They are designed to be simple surfaces for creative use of small group of people. Although they can also be combined for a bigger group interaction.

Call	Sleep	Individual Work, E-Mails	Face to Face	Small Group Work	Presentation	Conference	Group Discussion	Workshop	Coffee Place, Lunch
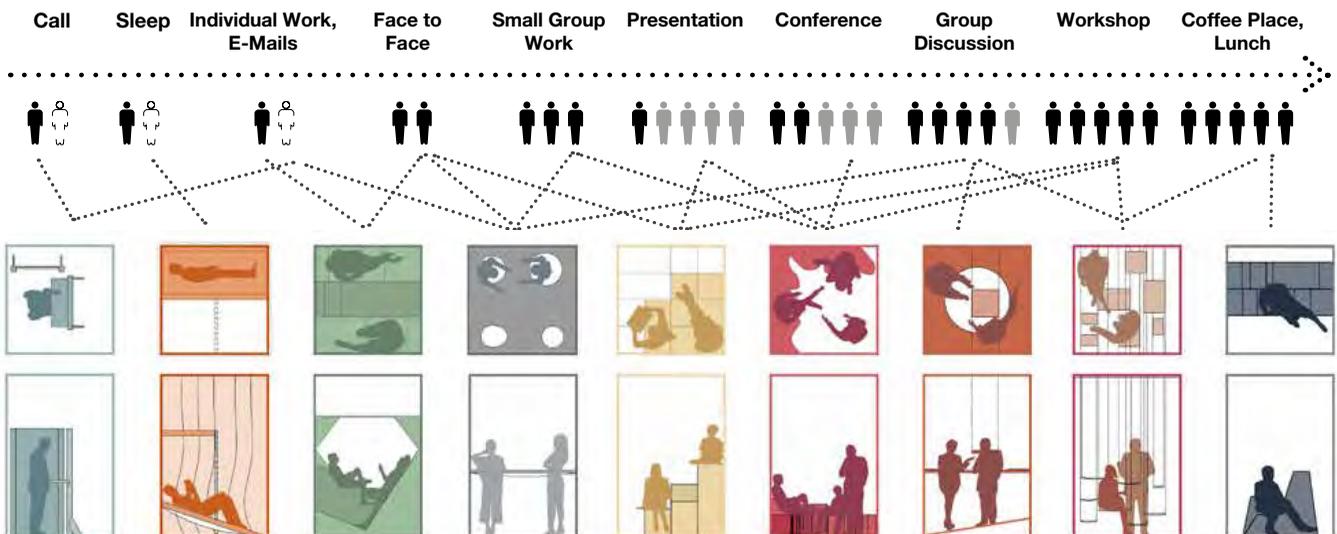
· "The Cabin" serves for calls and individual work. The space has several movable surfaces to organize a private and unconventional working space for short term individual work.

· "The Hammock" has a basic function - rest and sleep and can be used by two people for a short term.

· "The Cave" serves for individual work and face to face interaction. It is closed from two sides and creates more privacy between two people.

· "The Pop Up" serves for personal work, face to face interaction and group discussions. It has a surface which can be used as a table and a support for back.

· "The Mountain" is designed in a way that it can be used as a space for presentation and workshop.

· "The Coast" serves as a space for small group work, a presentation, a conference or a workshop.

· "The Nest" is a space for group discussions and face to face meetings.

· "The Swing" serves as a space for coffee break, lunch, workshop or group discussion.

· "The Lounge" is also a place for coffee break and face to face meetings.

EXPERIMENT

We focused on the most attractive spaces, which provide more different types of communication: cave, pop up, nest, swing and lounge. Two of them, the pop up and the lounge, have some of the basic features from the other modules (the pop up has similarities with the nest, the lounge can be considered as the swing (surfaces on different levels for sitting and climbing) and cave (standing, leaning postures). That is why the decision to build and test the pop up and the lounge in 1:1 was made.

These spaces were first tested separately and then combined in three different layouts.

Fore each of the tested layouts there was a two hour time-lapse of people using the structures. Then the time lapses were analysed. They showed many different ways of use in terms of body positions during interaction. Further analysis showed that "The Lounge" suggests 11 ways of using it, "The Pop Up" suggests 9 ways of use. The first layout provides

5 more ways of use, the second layout 6 more and the third layout two more (each layout added one more element or height difference to the structure).

EXPERIMENTS

There spaces were firstly tested separately and then combined in three different layouts. Many use-cases were found and recorded by time lapse movies.

The feedback of the experiment showed that the spaces have advantages and disadvantages:

· "The Pop Up" was appropriated as an enclosed space for group work with the same eye level. Although it was considered to have too small or too big holes, which were not comfortable for everyone.
· "The Lounge" was generally more appreciated by users. The defined positive sides were comfortable for both standing and sitting, and the space could be used for both individual work and conversation. However two sizes of the surfaces were not satisfying all people.
· "The Pop Up" and "The Nest" provided the same advantages, but "The Nest" overcame the disadvantage of "The Pop Up". According to the results of the experiment, it was decided to add more surfaces to the Lounge and to exclude the Pop Up for the design.

DESIGN

For the design phase we focused on four spaces: "The Cave", "The Nest", "The Swing" and "The Lounge".

While the wire-frame structure is fixed, the surfaces can be arranged on any height by the wish of the customer. The structure is made out of matt black lacked steel. The surfaces are made of plywood for a more neutral and natural design solution. They can however be customized by the user through colour and/or material choice.

"The Lounge" forms a landscape with different heights for sitting, standing, leaning and laying. The surfaces can also be used for climbing up to the next level.

"The Swing" consists of the panels on different heights, which are movable and can serve as tables, chairs, surfaces to climb on. The solution encourages informal spontaneous meetings.

"The Nest" can be used for standing or sitting facing one another. It encourages coherence and collaboration. The net on the bottom serves as an opportunity to get the same height interaction.

SYMBIO: THE MODULES
The Lounge, The Cave, The Swing and The Nest

SYMBIO: THE CAVE

Slanted surfaces offer space for face to face communication. The shape of the surfaces is designed to encourage different non-sitting body positions.

SYMBIO: THE LOUNGE

The Lounge forms a landscape with different heights for sitting, standing, leaning and laying. The surfaces can be also used for climbing up to the next level.

SYMBIO: THE SWING

The panels on different levels are movable and can serve as tables, chairs, surfaces to climb. The solution encourages informal spontaneous meetings.

SYMBIO: THE NEST

Standing or sitting facing one another encourages coherence and collaboration. The net on the bottom serves as an opportunity to get the same height interaction.

COMBINATIONS

The spaces can be combined on different ways. This creates even more different functions with informal atmospheres. The first combination can serve as a Workshop space for four groups. It consists of four "Nests" combined in one level.

The second combination (two variants) serves as meeting space (for more private discussions or for more open discussions). It consists of two different spaces: "The cave "+ "The Lounge", "The Swing" + "The Lounge".

The third combination is a mix of three different spaces ("The Lounge"+ "The Swing"+ "The Cave") and can serve as a coffee place.

The fourth combination serves for presentations. It consists of three different spaces ("The Lounge" and "The Swing" for listeners and the best in the centre for a speaker).

The last combination can serve as an alternative connection between two floors. It is a mix of all spaces in two levels, with meshes and additional beams for climbing.

CONCLUSIONS - SYMBIOSIS

Through two hypothetical scenarios it was analysed how the structure will change contemporary offices. An office without the structure and an office with the playground structure were compared . What could change if office workers are using the playground modules for earlier defined kinds of interaction? The study shows, that the structures are becoming social gathering spots for both spontaneous interaction and planned meeting. Furthermore, the presence diagram shows that the workers are more likely to change placement in the office during the day , while in the previous situation, the employees were less encouraged to do so.

We believe that SYMBIO can change the way people interact, more quality to the office workers life and improve the company results in the future

THE COMBINATIONS

The modules can be combined to gain more possibilities of interaction to implement in the office space. "The Nest" combination can become a space for workshops and big group work .

THE COMBINATIONS

"The Lounge" and "The Cave", designed for more individual work, when combined with "The Swing", will become a space for informal work and spontaneous meeting.

CONTEMPORARY OFFICE: TRACKS DIAGRAM

The analysis of the daily tracks of 5 hypothetical workers outlined that their paths are mostly independent to each other. This graphic is a sum of all the tracks at the end of work day.
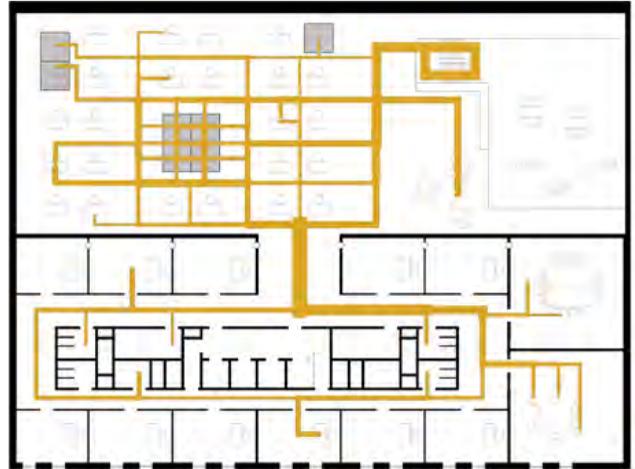
SYMBIO **OFFICE: TRACKS DIAGRAM**

With a structure in the core of the office, the paths of employees are crossing one another. The interaction between people is enhanced in both formal and informal meeting.
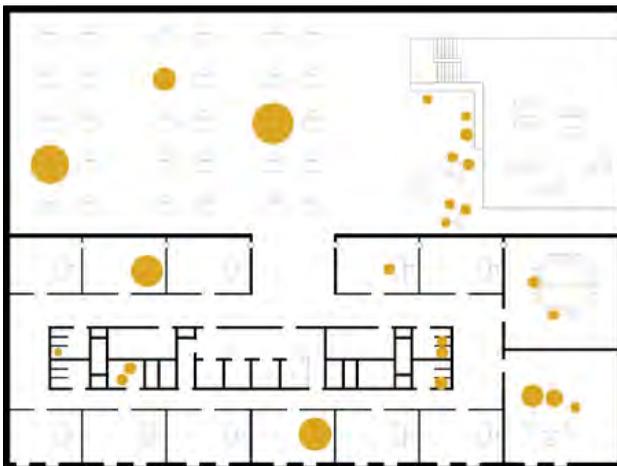
CONTEMPORARY OFFICE: PRESENCE DIAGRAM

In this situation, the hypothetical workers spend most of their work day in the same place, mainly their desk or meeting rooms.
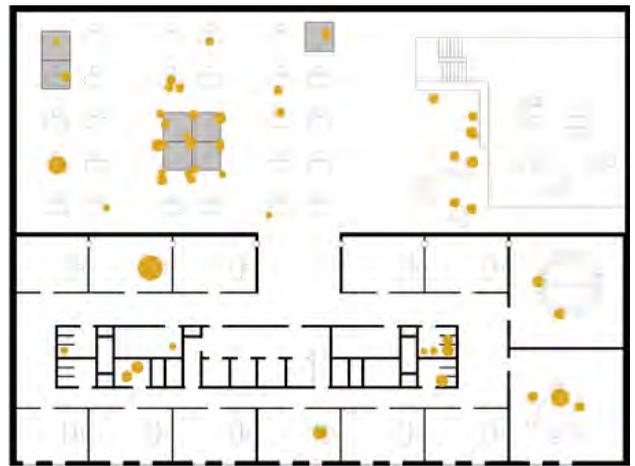
SYMBIO **OFFICE: PRESENCE DIAGRAM**

With the structure in the office, more workers are encouraged to move form their fixed places. In this way, the exchange of knowledge is encouraged.
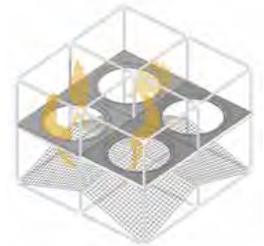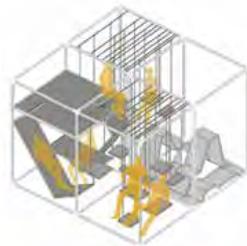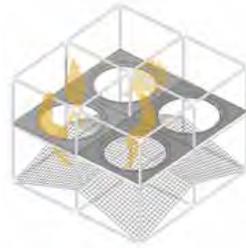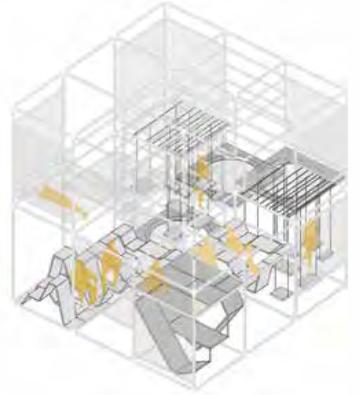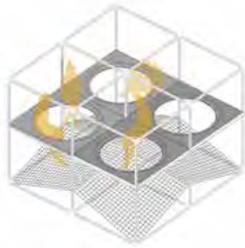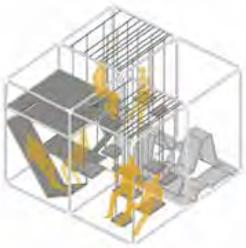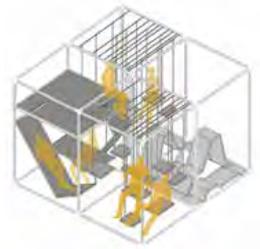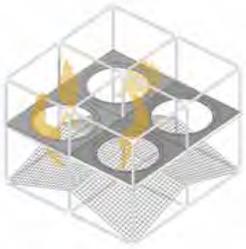
WORKSCAPE

INTEGRATING THE THIRD DIMENSION

BY ALEXANDRA BAYBORODOVA, FLORIAN KRAFT, SOPHIE LORENZ, WOLFRAM MEINER & MIRA SIMEONOVA

Throughout the years, office layouts have have differed in all but from one aspect: the section. By bringing a dynamic section into the workplace, Workscape is attempting to create diverse spatial experiences through a dynamic landscape.

RESEARCH QUESTIONS

The evolution of office layouts throughout history did not change much in the third dimension as much as it did as floor plans. Environmental conditions and how they influence work dynamics were defined for each type of office. Important environmental and spatial requirements were defined as elements.

By analysing the rapidly changing floor plans, we noticed that the sections stayed exactly the same over the course of time. Therefore the main research question was whether we could improve the office environments through working with the third dimension.

HYPOTHESIS

The initial hypothesis was that adding a third dimension to the office environment will benefit work efficiency and create a vibrant and uplifting atmosphere.

Cell Office — 18th century
Taylorism — 1900
Bürolandschaft — 1960s
Cubicles — 1980s
Open Space — 1990s
Combo Office — 1990s
Activity Based Working — 2000s
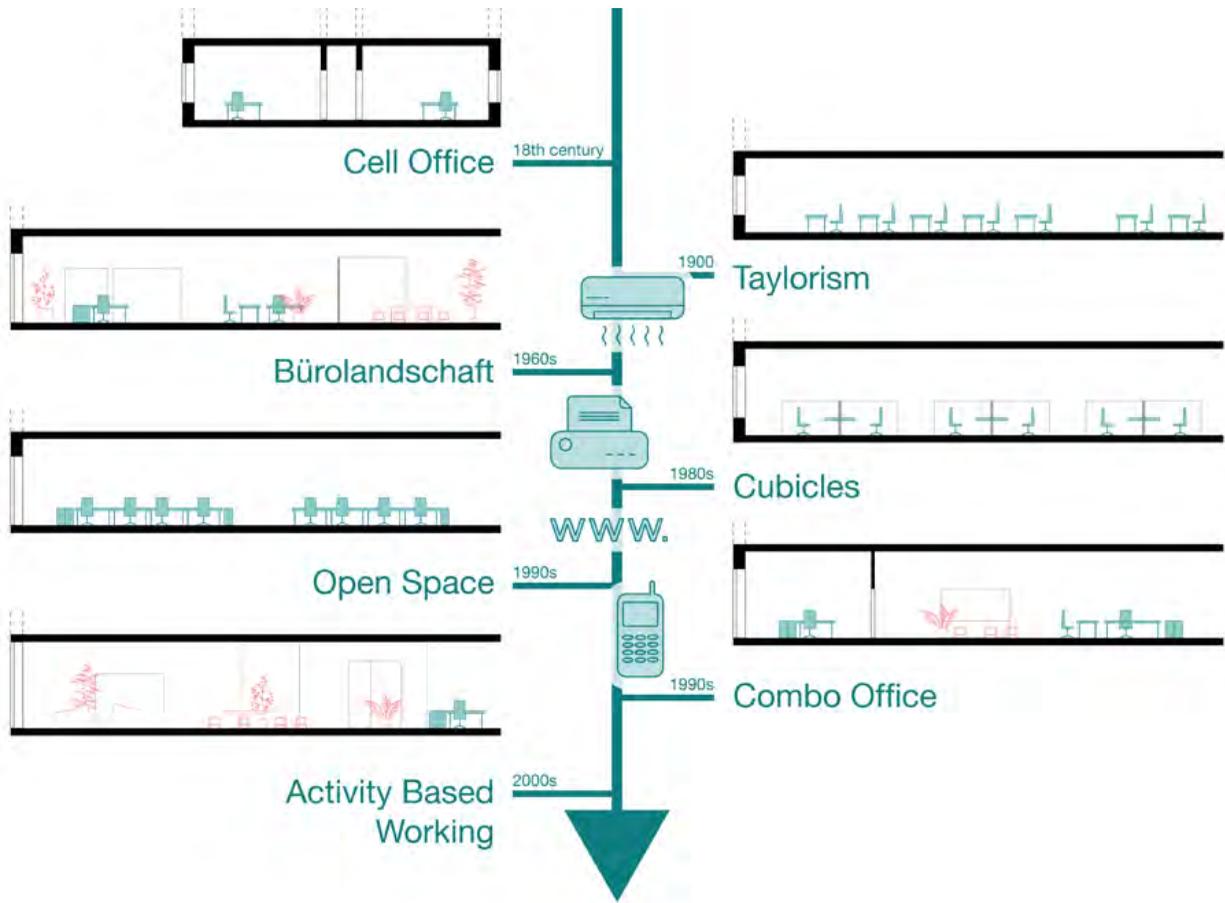
CONCEPT

Research shows that while the workplace layouts have changed throughout the years, the change was limited to the plan level and did not affect the sections.

The idea is to create an office landscape in 3 dimensions, which increases the environmental diversity and work efficiency.

The landscape is built of units that are designed for different uses: relaxing, meeting, informal communication, presentation and concentration.

The result of the combination of different work units, wedges and the users inside the office creates entirely new possibilities for the work space how is possible to have a new perspective of the workspace.

WEDGES

According to personal and ergonomic preferences the wedges can be fixed in various positions in the wood construction.

The rotating mechanism on the back of the wedges locks the wedge in between the slats. A lock in the hinge provides the option to put it in place both vertically and over head. These two positions, horizontal and vertical (related to the slats), are possible in the structure.

There are two types of cushioning according to climatic preferences available. One is realised with a insulating material to warm the user. The other is a mesh fabric spanned on a frame to provide ventilation and cooling.
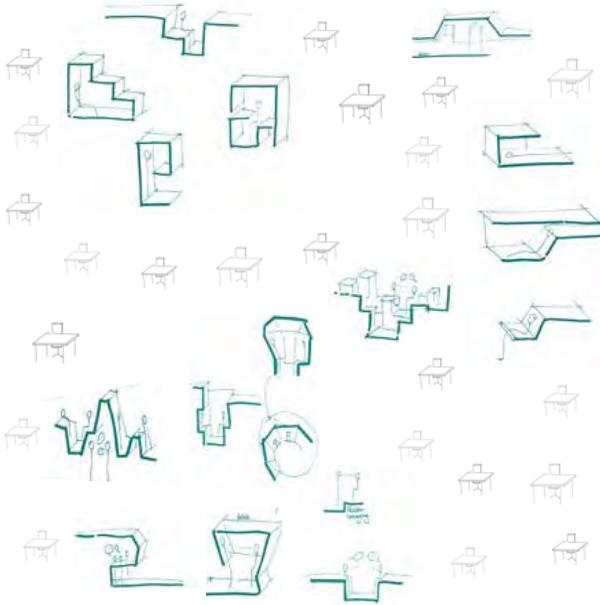
UNITS

Different units for presentation, meeting, relaxing, concentration and informal meetings.
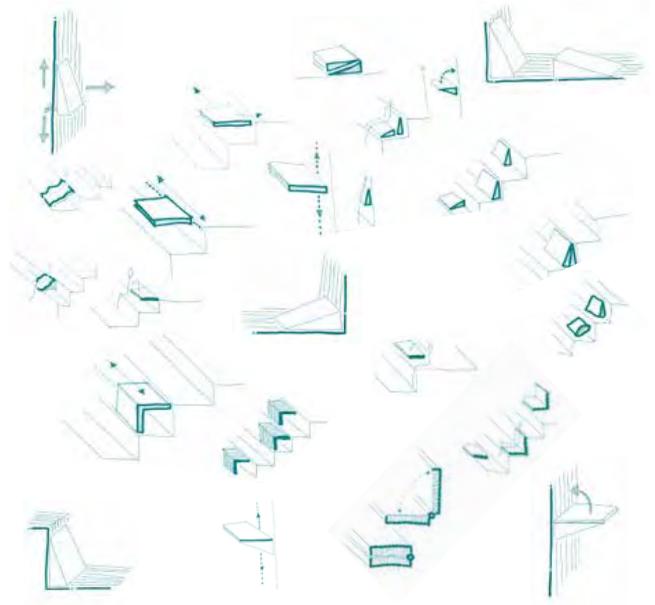
WEDGES

The Workscape is designed to be used with wedges- that can support different body positions and serve as a table. The complementary wedges offer two different surfaces: padded textiles are used for sitting and leaning. A wooden panel on some of the wedges provides a stable surface for working.

COMBINATION

The combination of different units and wedges in different positions offer a variety of body positions.

Enhance the existing office environment

SCENARIOS

The Workscape system can be placed in different types of buildings. Based on the conditions, there are 3 defined scenarios: enhance the existing, voids and split levels.
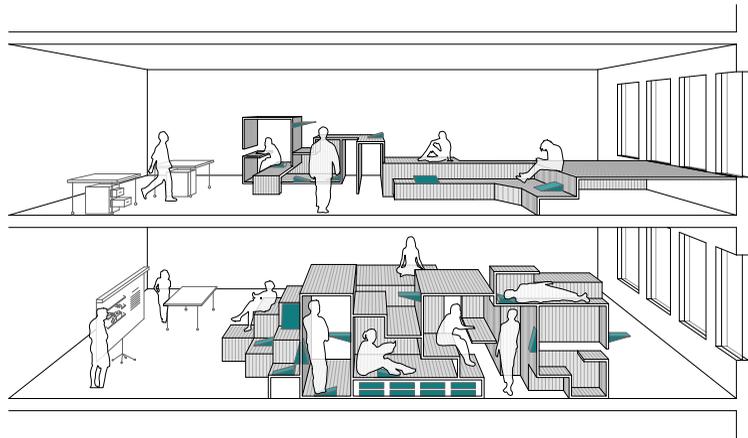
Scenario 1: Enhance the existing

Within the existing environment of the open office, the structure provides additional space qualities by utilising the whole height of the room without altering the building structure.

Scenario 2: Voids

To enhance the work dynamics and performance, voids are cut in the existing slabs. They provide a higher sense of connectivity and facilitate inter-floor activities.

Scenario 3: Split levels

In this scenario the entire building adapts to the concept of alternating slabs and room heights. Therefore it requires a new style of office building.
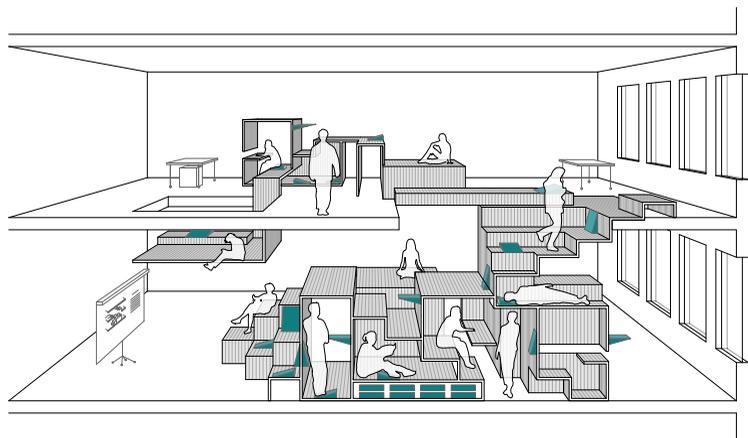
SCENARIO 2

Voids are cut in existing floor slabs
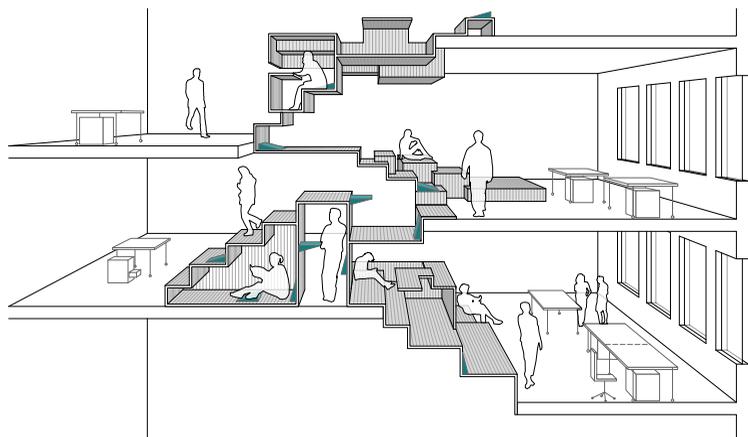
SCENARIO 3

Split levels for alternating room heights room heights

BUILDING THE SYSTEM

The design process of Workscape is based on 4 steps: analysing specific conditions, defining a spacial program, creating program-based units and the construction of the entire structure.

First step - defining environmental conditions: dimensions, circulation, direction of natural light, quiet and noisy zones.
Second step - defining a program for Workscape based on the conditions.
Third step - selecting the program-based units for different uses.
Fourth step - placing the units defined by the program and construction of the Workscape.

ANALYSING THE SPACE

Different steps

FIRST STEP

SECOND STEP

THIRD STEP

FOURTH STEP
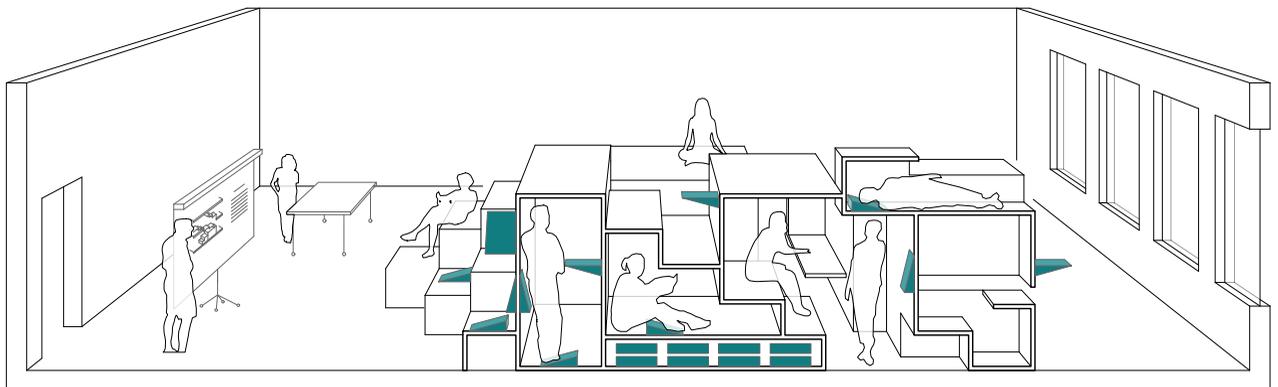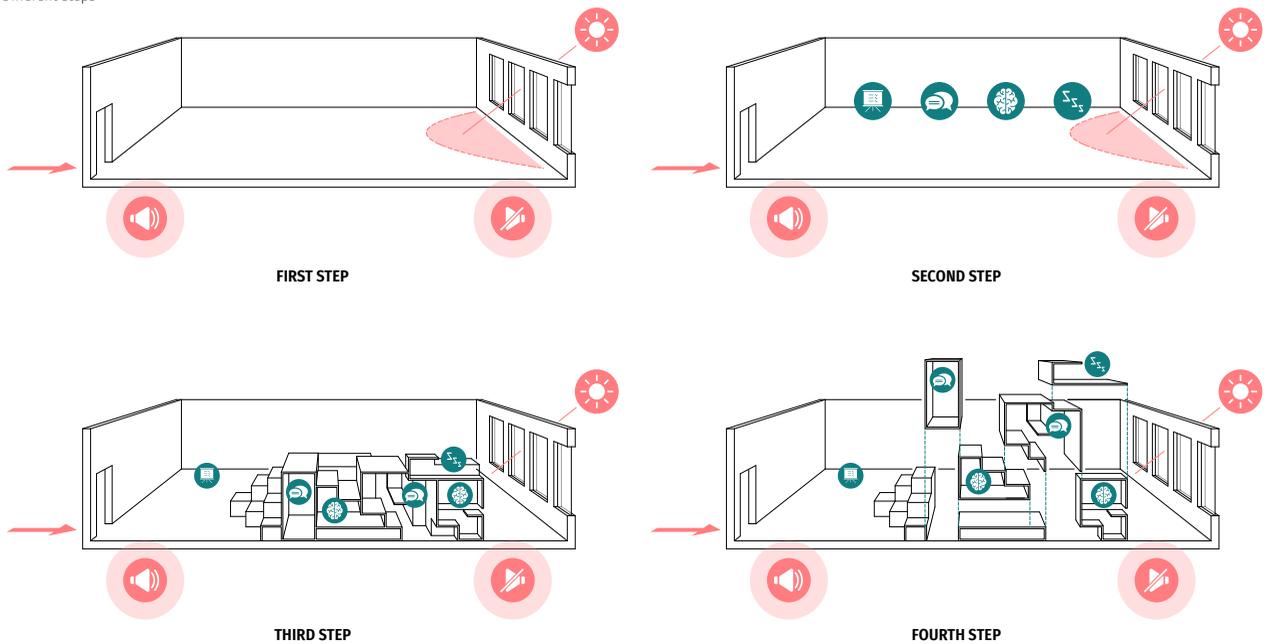
THE OFFICE

Example of a *Workscape*.

PROTOTYPE

By testing different positions and space requirements the most relevant units were selected for the mock-up. A combination of open and closed units was chosen, allowing for different body postures: standing, resting, sitting below and above.

Most popular positions in %

n = 109

Satisfaction level in %

n = 55

12% Re-clined

34% Standing/ Leaning

54% Sitting

Most popular positions by type in %

n = 109

3% 41-50

3% 51-60

20% 18 - 21

74% 22-30

Student (47)

Other (8)

Age groups in % and occupation

n = 55
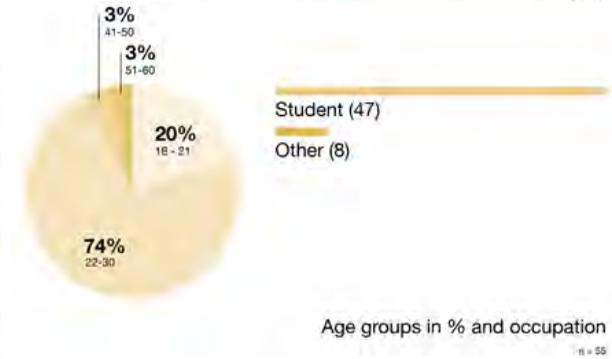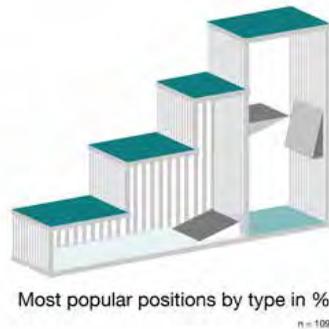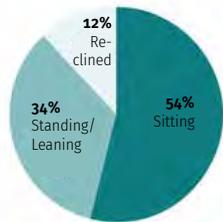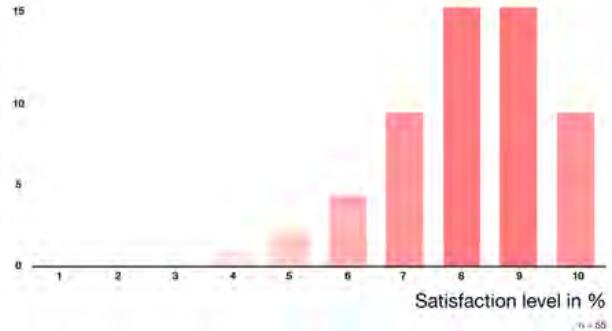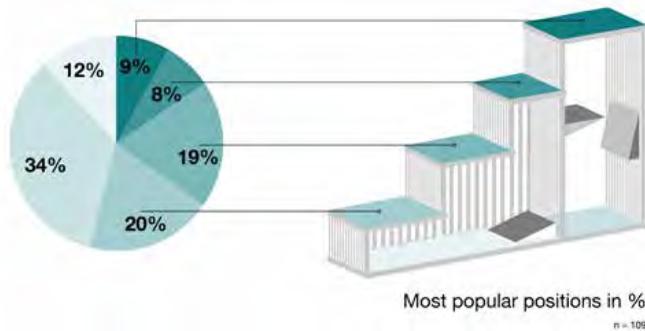
TEST

The test circle based on 5 steps:

1. Prototype

Building a 1 : 1 mock-up.

2. Testing random test subjects to work under defined conditions and surveillance.

3. Observe and document

Collecting data from the field test with:

- video/photo recording

- questionnaire

4. Analyse

Analysing how people interact with the mock-up. Determining issues and advantages of the design.

5. Improve

Improve the prototype based on the analysed data.

DOCUMENT & OBSERVE

To get more objective results, people who tested the mock-up were given different tasks to accomplish: passing concentration tests, solving puzzles etc. A total of 62 people were asked to fill the questionnaire about their experience. During the test, a time-laps video was made from 2 cameras.

ANALYSE

After the test, the collected data was analysed and the most important aspects for improving the design were selected.

First, the average satisfaction level was determined. Afterwards some tendencies were recognised depending on different conditions.

An average grade was given for the different positions and for the number of people using the model at the same time.

Then next step was to analyse the feedback what was given and to define advantages and disadvantages for the improvement of the design.

IMPROVE

PROTOTYPE

ANALYSE

TEST

OBSERVE & DOCUMENT
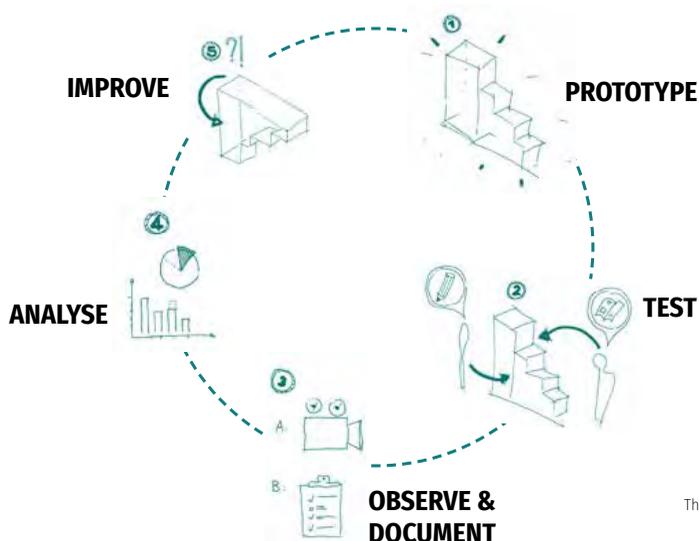
MOCK UP & TEST

The iteration circle based on 5 steps
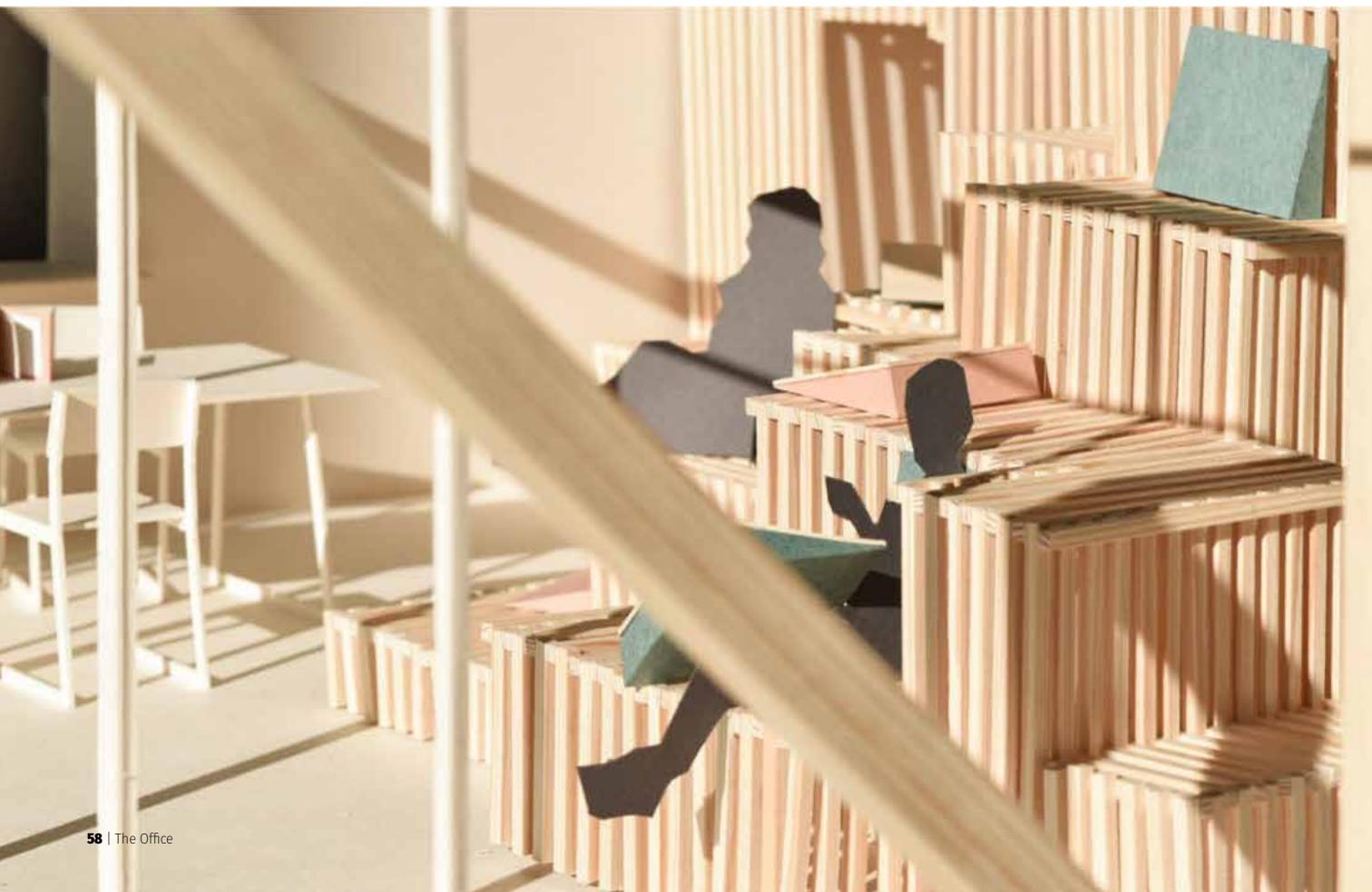
DESIGN APPLICATION

In order to design a complete Workscape structure for the built office environment, a quiet corner in the 3XN/GXN office in Copenhagen was selected. The size of the plot allows for a high about of flexibility in the given space to realize many of the proposed units close to each other.

DESIGN PROPOSAL

Workscape design proposed for the allocated space in 3XN/GXN office.
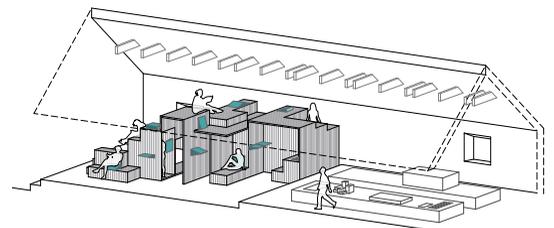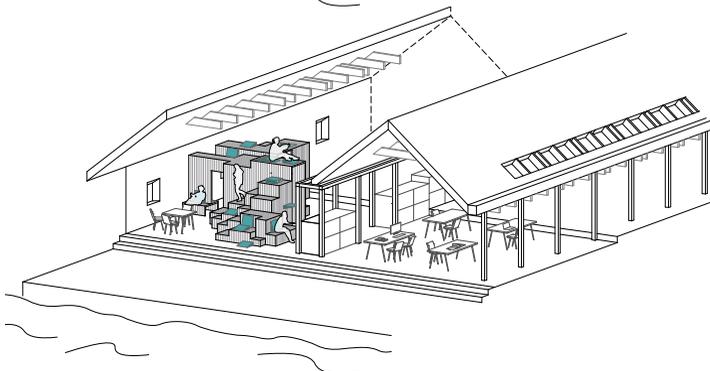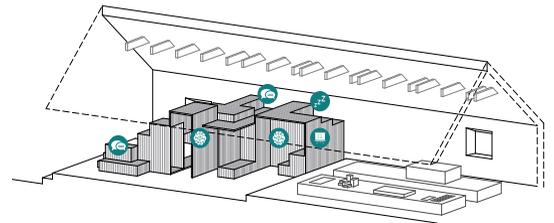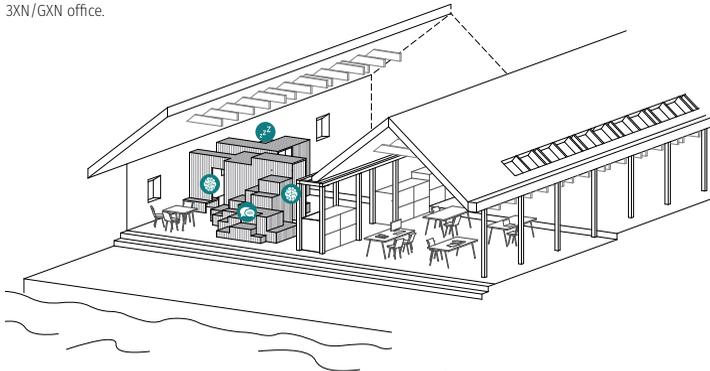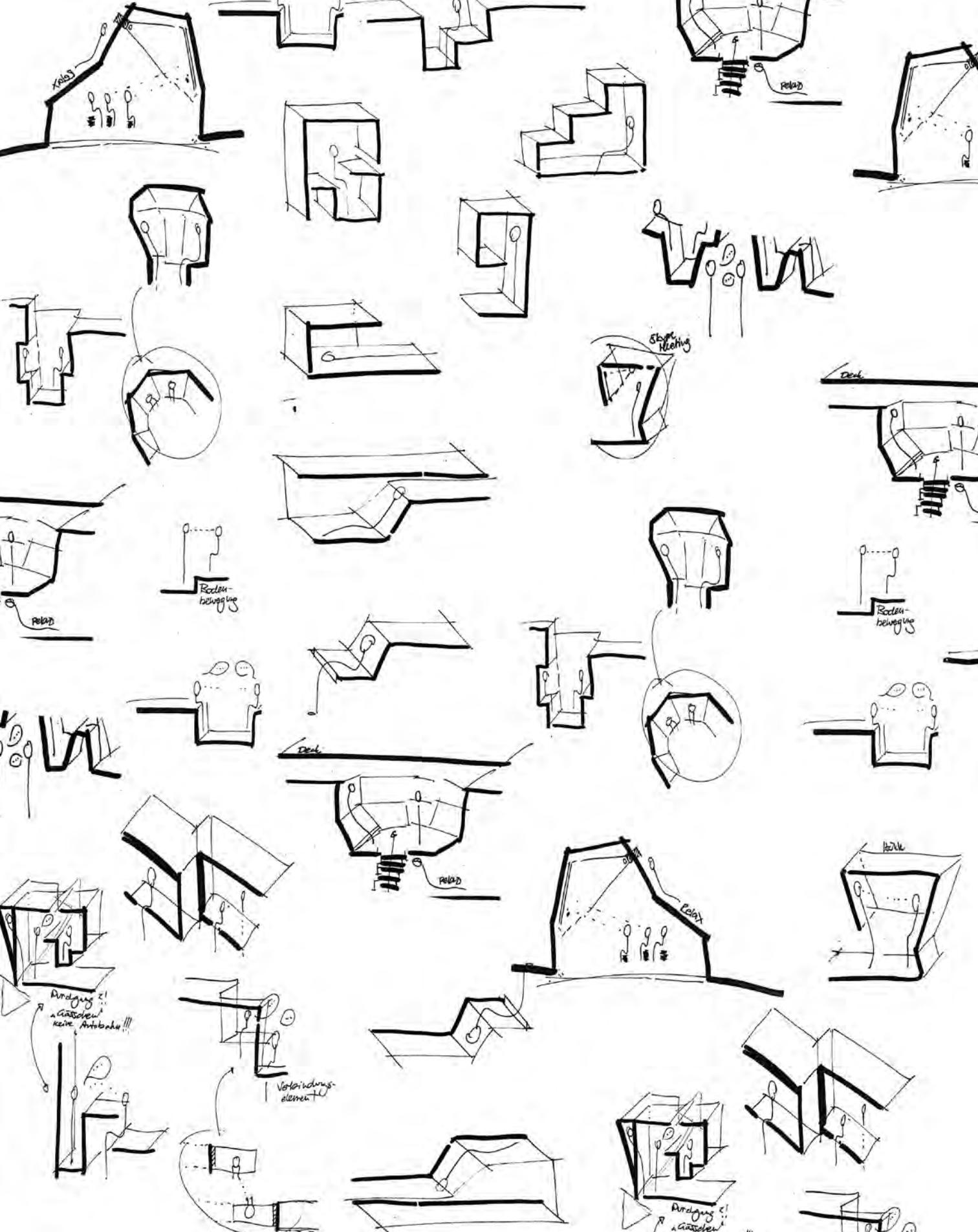
Relax

Boden-
bewegung

Deck

Skyer
Meeting

Rundgang
"Gässchen"
keine Autobahn!!!

Verbindungs-
element

Relax
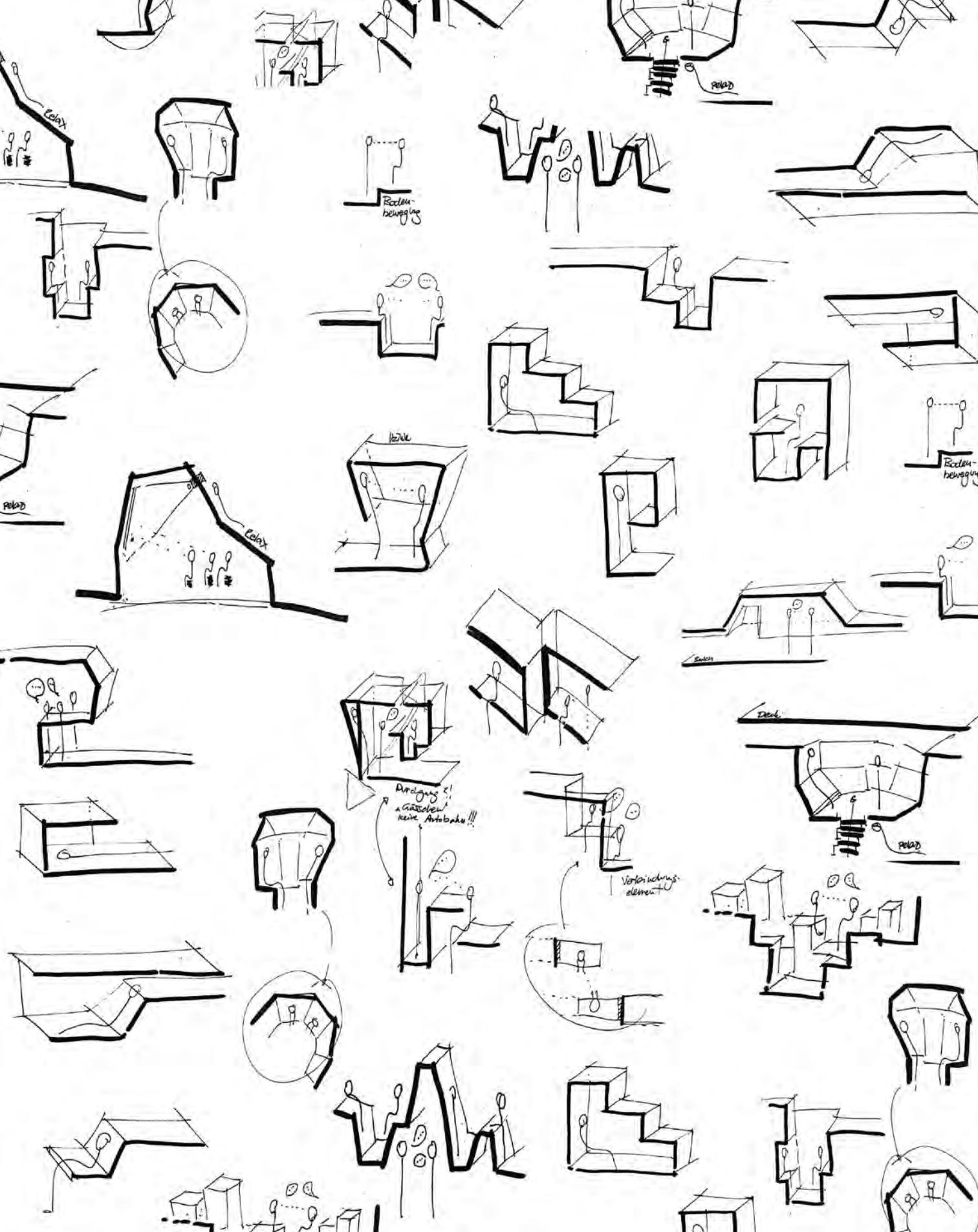
Relax

Boden-
bewegung

Pelod

Relax

Pelod

Boden-
bewegung

Deck

Pelod

Durchgang !
= Gässchen
keine Autobahn !!!

Verbindungs-
element

Pelod

CUR(VE)TAINS

BOUNDARIES ENHANCING SOCIAL INTERACTION

by THIBAULT BRISSET, ROMAIN TROUBAT, MARIE-ALICE WÄTJEN & JESSICA YORK

The CUR(VE)TAINS design proposal changes the way we move, think and feel in a space. Right from the human senses, proxemics and perception productivity of office workers will change forever as these new boundaries are introduced into the office of tomorrow.

RESEARCH QUESTION

The office has become an integral part of Human Society and a place where workers spend at least 25% of their lives. The office space has constantly been developed and redesigned but has yet to reach its optimum.

Today any work requires cohabitation and communication. How can we create boundaries which can enhance social interaction?

HYPOTHESIS

Social interaction is becoming a major part in office and work environments. Traditional office layouts with walls and partitions create divides. From research on our topic, physical boundaries will be able to enhance and/or increase social interaction in an office space.

CUR(VE)TAINS

The two main principles are the organic and
light aspect of the boundary.

EXPERIMENT AND TESTING

With physical modelling right from the early stages of design. We experimented with many different materials and textiles, looking at something soft and more organic for an office space as opposed to something rigid and hard like wood or concrete etc. We also looked at different folding patterns identifying their range of motion and flexibility which we found to be of big importance in our design allowing to design adjustable spaces.

CONCEPT

During our research on Human Perception, we identified necessary aspects in today's office spaces: a decrease in stress, adjustability for comfort levels to increase productivity. Decreasing stress is achieved by reducing visual and auditive distractions. Adjustable comfort is the ability of a person to change or adapt a space to suit their needs whether that's thermal comfort, how warm or cold they want to feel, or visual comfort, whether they want more focused private work or to be in a more social environment. In our design we wanted it to be mouldable and adjustable for the human, something organic. Something which flows effortlessly through a space that a person can change or adapt whenever they want or need. We want to give people the chance to determine what kind of boundaries they have in their office, when they want them, and how they want them to be, to give people the option so that their comfort levels are optimum and then they can be more productive.

We began with a urved curtain that would flow through the space and raised from the floor to sit on, or become a desk, or to be lowered down from the ceiling to form visual and acoustic boundaries using a soft curtain or type of textile. And there would be different levels of opacity depending on the work space type requirement. After our 1:1 scale model we realised that having one design that can do everything doesn't always necessarily work out, and there's not always a need for one thing to be a seat, a shelf, a table. We then thought about how we could evolve the design to keep the qualities we have but make a more sensible design, without forming too much of a contrast. This brought us through to having 3 separate designs, which holistically go together and merge into one. Each three have different qualities and aspects which give them their own unique characters to suit the different work environment needs.

MODEL 1:1
We experimented with a 1:1 model to observe how fabric could at the same time be adaptable, easily movable and sustain the weight of several persons.

TYPE Ø1 : THE FLOAT

The first design relates to the initial concept that has been kept throughout the design process. The idea of this is a soft material that is able to be adjusted so either pulled and stretched out or compressed and compacted together. It extends down from the ceiling, as seen in the image to the left. It was a continuous thought during the design process whether any part of the design would be fixed or loose. For structural purposes and for basic office functionality, the curtain was designed with certain points that are fixed, while the body of the curtain creates the dynamic movement and ever-changing adjustable shapes and forms.

We are placing a mechanically powered string that is able to be expanded and contracted through the press of a button. When released, the material of the curtain will be lowered and stretched out to floor length. There is enough material so that if the occupied space needs full privacy or enclosure, there is the ability to do so. When the material is fully extended there is still a curve and natural flow to the material, which gives an aesthetic feature as well as providing another element to dimension making it a 3D boundary not just 2D. The curtain's folds also play a role in the see-through proprieties of the fabric, as the more the folds, the more opaque the boundary. The fixed strings, even though are at set points can all be lowered or raised individually. This offers the ability of different levels of boundaries in the space but also provides and organic shape that flows through the space.

FLOAT

The first curtain is hanging. It's an adjustable boundary in terms of height and vertical length. It provides only the enclosure needed.
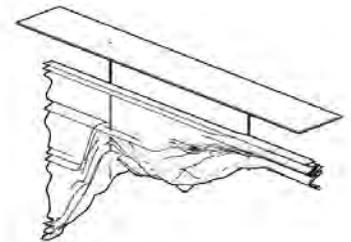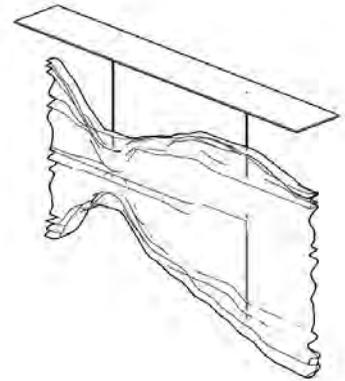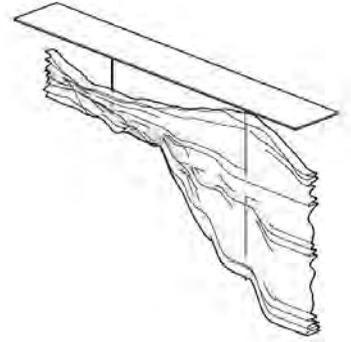
TYPE 02 : THE FIX

The second part of our design is The Fix.

The organic shape, inspired from the first concept creates a connection and continuation from type ones design. As the vertical curtain boundary comes to an end, the seated area/lowest height of the this design begins. It's starts off at around 40cm a regulatory seated height and gradually inclines creating a space at which people could lean back on to lie down. It is then raised at a height where by as you sit down, your arm could rest of it, and as well as this, someone who is standing could half sit/half stand, a simple rest or stop by position. Again there is a gradual increase to a more standing table height where at least two people could work on or lean against.

From this, one side of the shape continues on curving upwards until it gets to a final and tallest height of 2,40 m. On the other side the table height section flows down back to a seated height creating more of a cove as the long seat now has a back rest. The length of the seat could hold four people or could be a space for someone to lie down on. The lower bit of the design is flexible, so it is able to curve around to make a more enclosed area for people to sit around and talk to each other.

TYPE 03 : THE FLEXI

The third and final part of the Cur(ve)tains is an extension of Type 02: The Fix. At the further end of the The Fix design, the extendable, flexible and movable design is attached. This Flexi curtain is made of a similar material to The Fix with a fairly opaque fabric that encases an expandable and contractable moving structure. Each partition width for both the base and the top is 30 cm with steel rods of 2,40 m connecting the two.

The benefit of this structure allows the motion of the design to be stretched out completely at a given length of, or stacked up. When stretched out fully it can work as a partition wall curve around to create an enclosed space in type two. The design can curve or straighten in any direction giving endless options for spaces to be created and used. So if people are wanting the space to be left open, it's can be folded in and will stay in place where it's left.

THE FIX

At some specific places in an office, the floorplan needs to have a clear spatial organisation. This curtain provide some visual reference in an highly adaptable environment.

1000mm
400mm
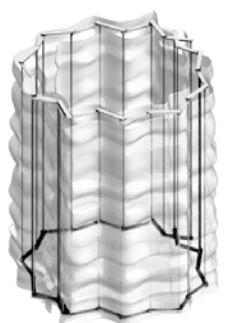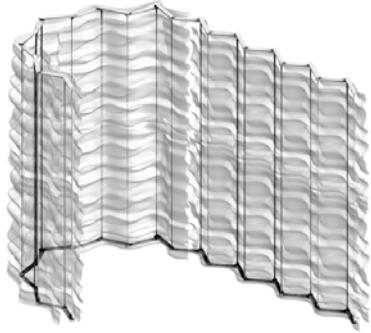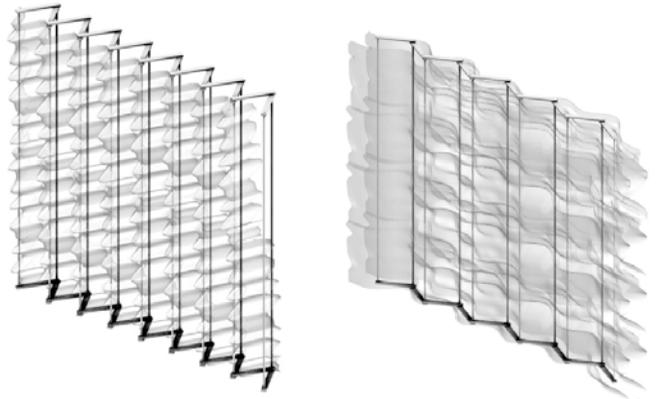
THE FLEXI

Attached to the Fix, this last curtain is possibility to create a
room with complete or partial enclosure to organize a meeting
or adjusting the privacy of a spot. The space can then be given
back for an informal use.

2700mm

2400mm

400mm
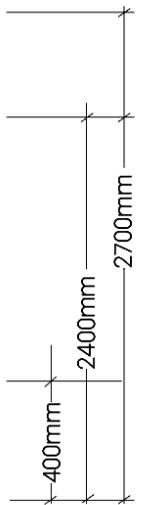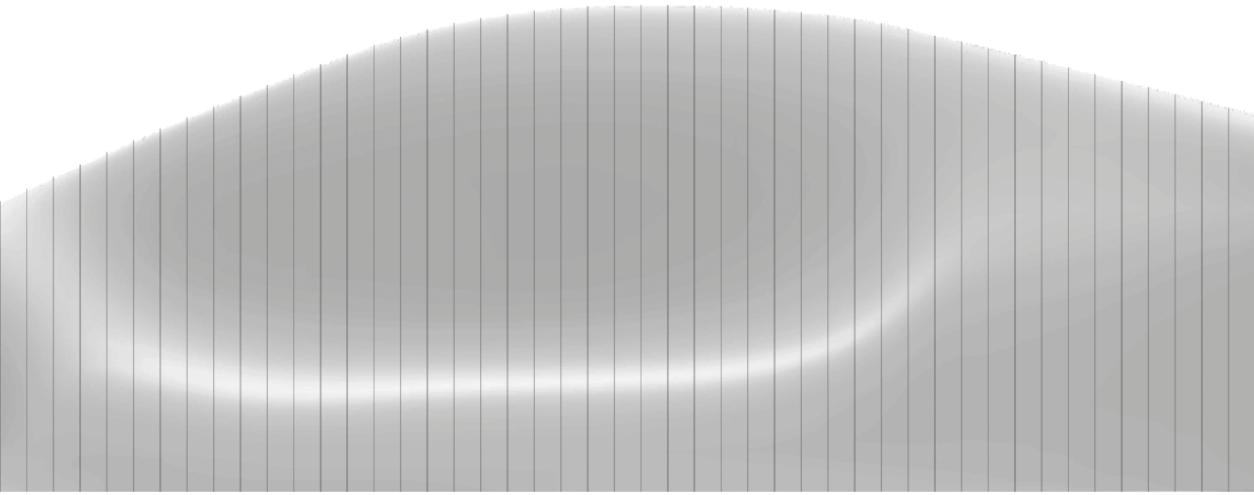
This design is attached to The Fix but can potentially be removed so that if a space somewhere else in the office requires the need to be closed off for private meetings or individual work it can be taken and folded into place.

This design is both aesthetic and functional. If it were to be in an office the maintenance would be easy in regards to cleaning as well as if there was a breakage in part of the structure. The modular segments can be replaced/fixed individually without having to replace the entire thing. With two layers of fabric this gives customers the option to choose their fabric or colour or opacity of the material to suit the work environment. Also allowing for unique and personalised qualities for individuals to enjoy.

CONCLUSION
The evolution of our project began with the initial research question of how to empower the human mind in an office space with the research topic of HUMAN PERCEPTION. We looked at the proxemics of humans, social and physical boundaries and the circadian rhythm. We began with the very basics of human senses and learnt how these effect so much of what we do. We needed to find a way for people to be productive at different times of the day in the office. To achieve this we needed to increase comfort levels and decrease stress for individuals. We know however that everybody

FINAL MODEL

Final 1:20 model showing multiple positions at the same time.

DESIGN PROCESS

These pictures were produces during our research, analysing what shape could provided the condition needed and could host the necessary interactions

is different so to please everyone at the same time is near impossible. A comfortable environment for one person is not necessarily the same for another.

So our design focused on making a space adaptable and ever changing to help suit the needs for different people.

The CUR(VE)TAINS are a developed idea that is changing the office of today. The 3 parts show great potential for any type of work spaces which are commonly required in offices today. Our design adheres to many different work types: private and individual more focused work of either 1-3 people, or up to 8 people. Collaborative work requiring more social needs with groups catering for 4-7 people. Group meetings and

larger work spaces, 8+ people if required. Informal spaces where the other side of the design can be used - size will change dependant on each scenario or situation.

These adjustable boundaries that we have created not only suit an open plan space aesthetically but also prove to be functional and ergonomic. As people are able to adjust these whenever they need, it helps to make spaces private if they need to be or open as well. Depending on group work sizes and types or the scenarios CUR(VE)TAINS can be adjusted to suit them all. The ever changing design demonstrates that social interaction can truly be enhanced, offering a better and healthier work environment for different types of individuals in either formal or informal situations.

DIE OFFIZIERMESSERWÄNDE

DESIGNING THE INTERMEDIATE

by JESSE HAN, MICHELLE LORENZ,
ELENA MATTIUZZO & ENRICO FORNASA

Offices are constantly changing and so are people's preferences. Why not design something that can be adapted to both? Die Offiziermesserwände is a project which questions the one-size-fits-all approach of open offices and designs with people's needs in mind. Three panels, infinite combinations.

HYPOTHESIS

We believe that boundaries are necessary in an office in order to create a division of space. However, they must be designed intentionally so that rather than being a wall dividing people, it becomes a dynamic intermediate space which can be arranged in a multitude of ways. Walls are too static for a collaborative office. However, flexible and interactive boundaries increase satisfaction and productivity of employees because they give autonomy to their users and can be arranged based on the office's and people's needs.

EXPERIMENT

In order to test our theory, we built a one-to-one mock-up of a preliminary design: a double-sided, modular panel with a variety of desks, standing desks, and operable "windows" which allows interaction through the panel. Could this panel encourage collaboration while providing individual space simultaneously and do it better than a traditional desk and chair? We began the test by asking testers to explore the object and play around with the different panels which flipped out in different arrangements. Although the mock-up made of cardboard, duct tape, and wood was not fully functional, we asked testers to play
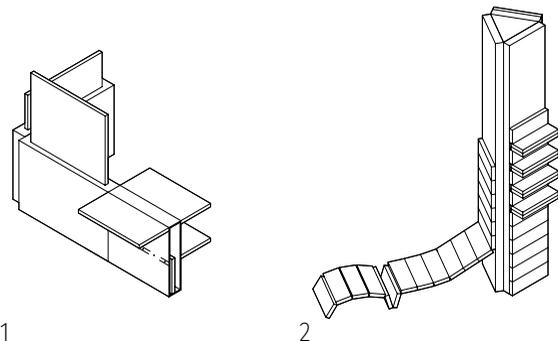
1

2

VISUALIZATIONS AND EVOLUTION

On the top there are some visualizations of the final panels. On the bottom it's explained the evolution of our project starting from the previous designs: 1 War Room; 2 Rollerwand; 3 Skinny Boy; 4 Connect|Divide; 5 The Wheel; 6 Offiziermesserwand.

3
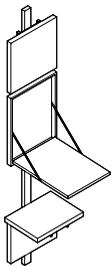
4
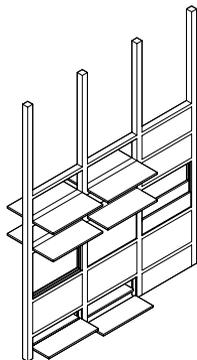
5
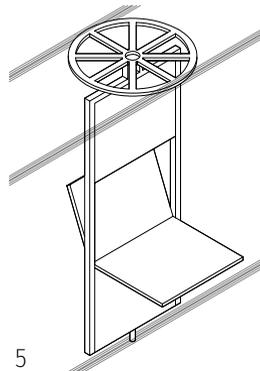
6
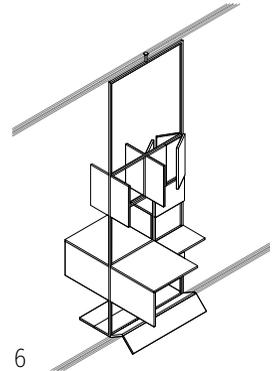
out scenarios: working alone, working with the person across from them, and doing group work on one side. After scenario testing, the users filled out surveys. The background information section asked about their experiences with offices and which layouts they had worked in before. We then asked them to compare our mock-up to typical workspaces, which they would prefer to use, and what activities they would perform with our mock-up. From this test, we realized the potential of our project. People said they would use our panel for anything from working alone, working with a partner, taking a phone call, and eating lunch. Users said they would prefer our project over traditional desks, cubicles, and private rooms. From this test, we realized that there is a need for this: something flexible, adaptable, and playful.

CONCEPT

Die Offiziermesserwände, meaning "the Swiss-Army knife walls," is just that. It is more than a wall; it is a family of double-sided panel systems which allow collaboration or separation and can be arranged as needed, giving workers autonomy over their environment. Panels open out of the frame to become standing desks, sitting desks, chairs, shading, shelves, and magnetic white boards. We believe this concept can change the way that offices operate. Given our aforementioned hypothesis and research, this concept was optimally and strategically designed to provide a workspace adaptable to any user and any office's needs. The desks can be adjusted height wise to fit everyone's unique proportions. When the panels are closed, they can be efficiently stored away or become surfaces where one can write ideas or hang notes. The panels can be used alone or be assembled in infinite arrangements. The corner of the desks can fold away and with the new trapezoid-shaped desk, two panels can align to create a cove. And with the many possible combinations, we can look at space in the office differently. Die Offiziermesserwände can be the only furniture in the office where every worker chooses his or her own panel and arrangement each day. Or it can be used in addition to traditional office layout. Die Offiziermesserwände can be strategically placed in an open office to create a variety of spaces. Rather than an office being completely open, which we know is what causes feelings of lack of privacy and decreased face to face interaction, different areas of the office can be made into semi-private working and meeting spaces with these panels.

The family is made up of three panels: The Wolf, The Coyote, and The Pup. Each panel has its own strengths and when used together, create a dynamic and playful space.

THE WOLF: STRONG ALONE, BEST IN PACK

The wolf is made up of an adjustable stand-
ing desk and an adjustable sitting desk.

At the top and bottom are gadget panels
where one can attach a foldable chair or
infrared heating panel at the bottom, or a
light, fan, and or plants at the top.
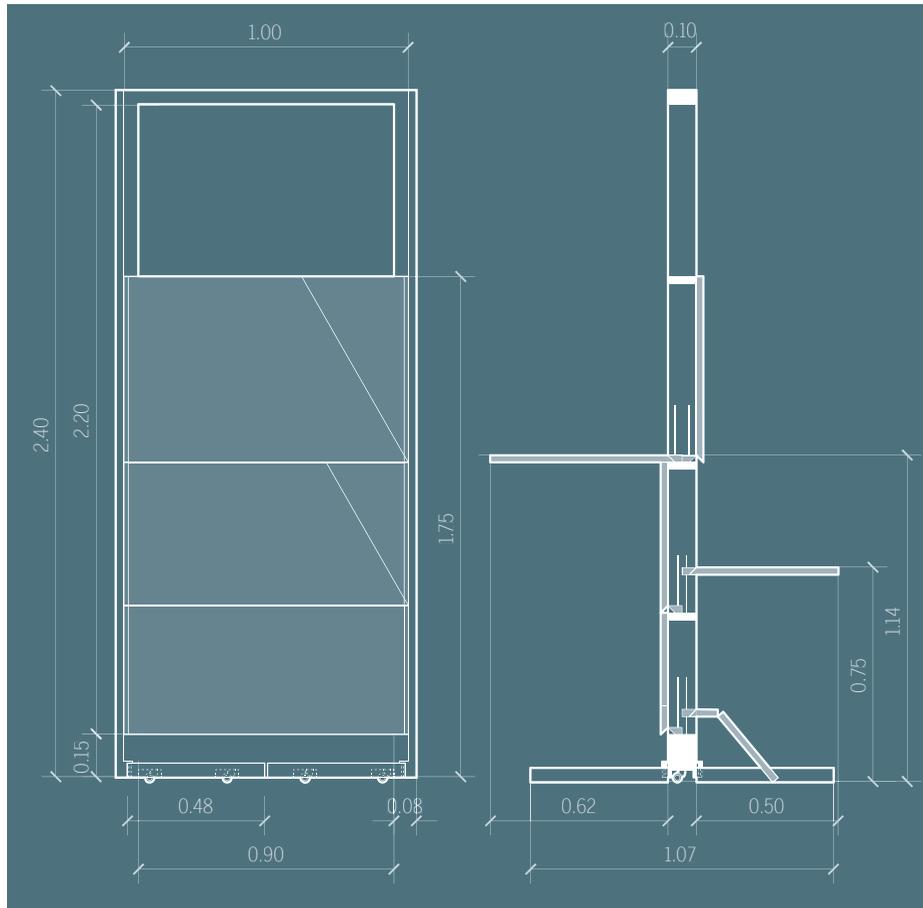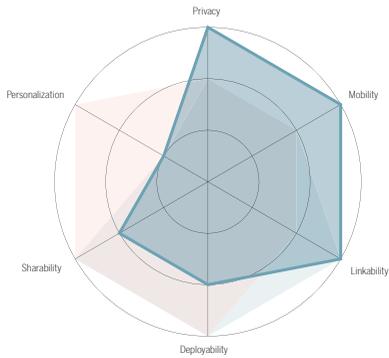
PERFORMANCE COMPARISON

The graph below shows the performance level of the Wolf
panel on various parameters in comparison to the panels of
the family.

Panel Frame
Powder-Coated Aluminum
Black

Adjustable Standing Desk
#6CA0B2

Adjustable Sitting Desk
#B4D0D4

Magnetic White Board
a3 CeramicSteel
Arctic White 2 CS Gloss

Flip-Out Stands
Powder-Coated Aluminum
Black
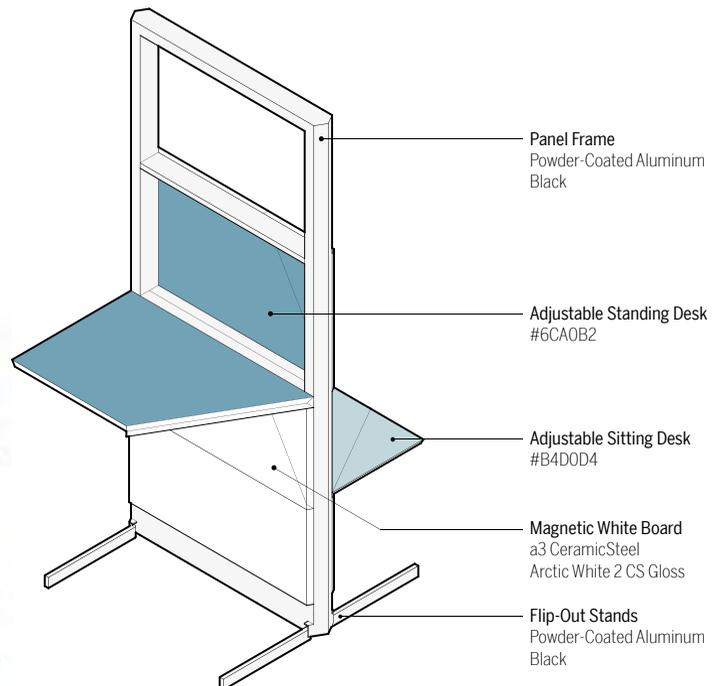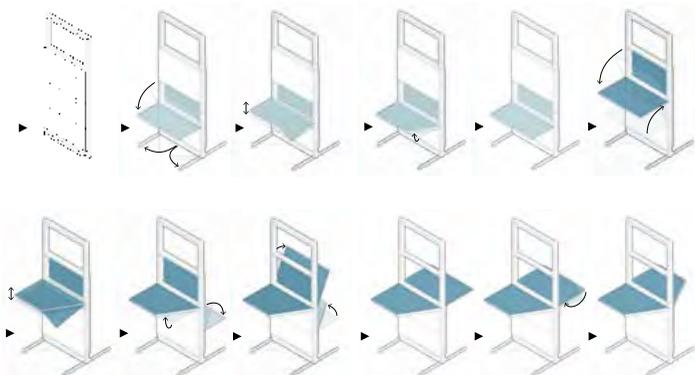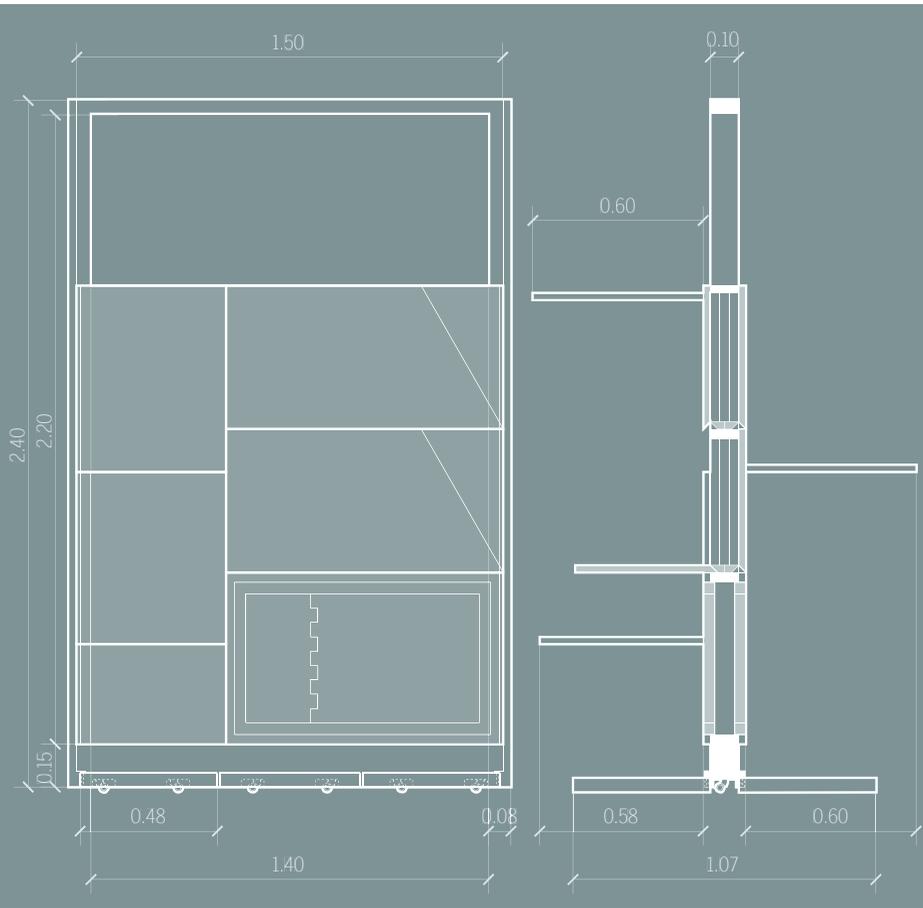
THE COYOTE: PLAYFULLY DECEIVING

The Coyote is the widest panel since it in-
cludes a fold out seat, an adjustable sitting
desk, and an adjustable standing desk.

It also includes mid-range panels which can
be adjusted to open the panel for commu-
nication across both sides or pulled down
for privacy.
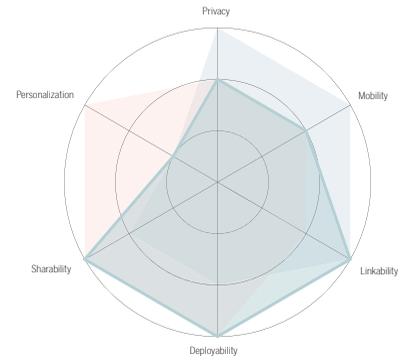
PERFORMANCE COMPARISON

The graph below shows the performance level of the Wolf
panel on various parameters in comparison to the panels of
the family.

Panel Frame
Powder-Coated Aluminum
Black

Adjustable Standing Desk
#6CA0B2

Magnetic White Board
a3 CeramicSteel
Arctic White 2 CS Gloss

Adjustable Sitting Desk
#B4D0D4

Fold-Out Seating
#F2A9A5

Flip-Out Stands
Powder-Coated Aluminum
Black
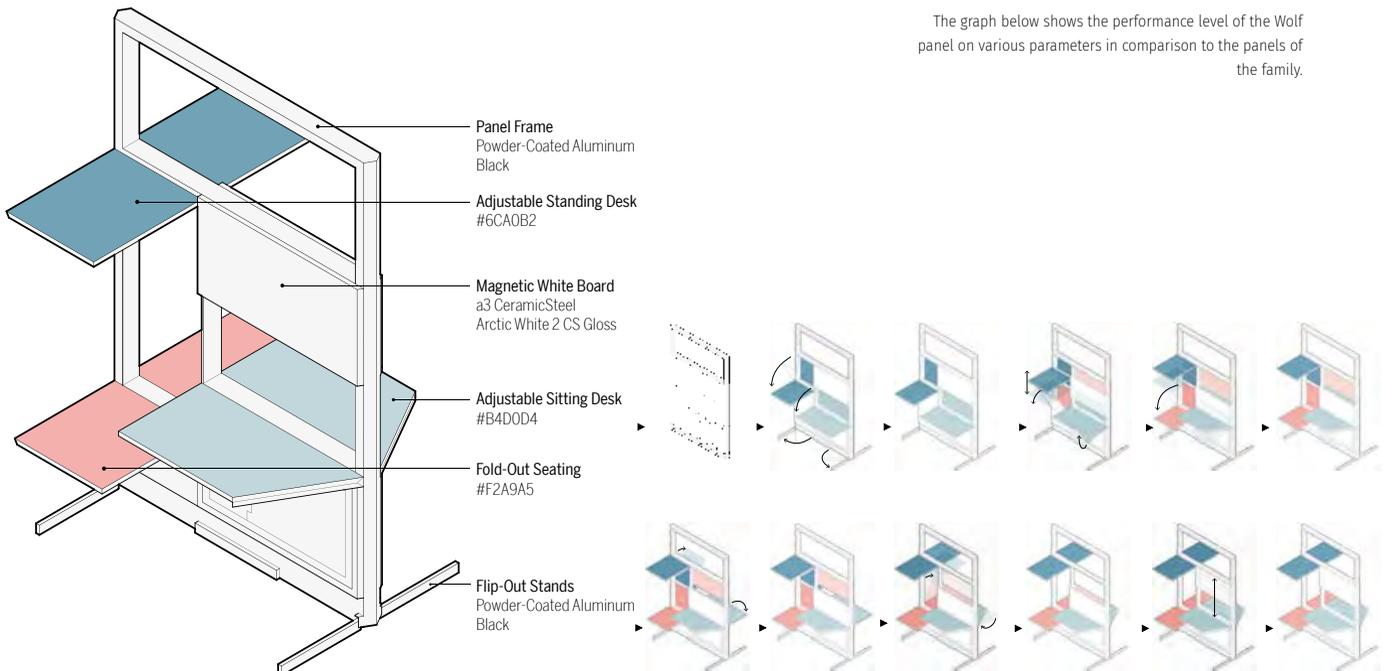
THE PUP: CUTE AND RELIABLE, SUPPORTIVE

The Pup is the support panel which includes shelves and an angled white board.

The drawings represent that there are infinite possible combinations with these panels.
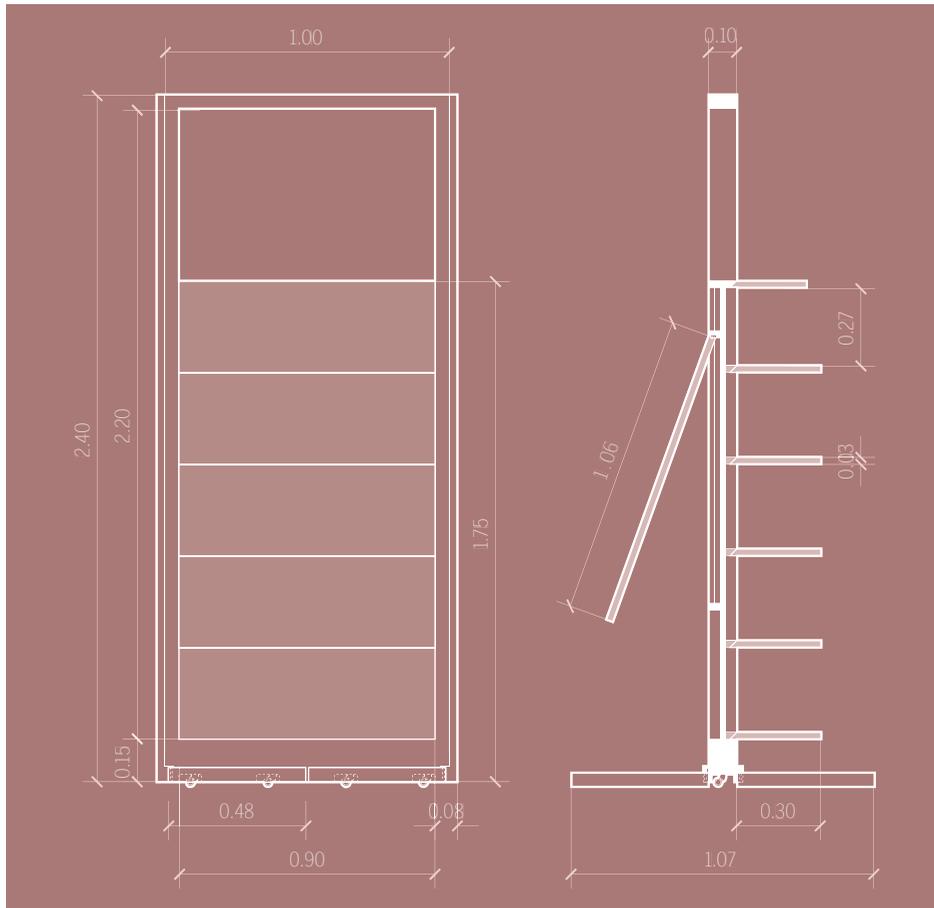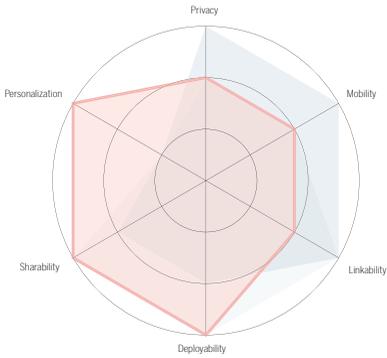
PERFORMANCE COMPARISON

The graph below shows the performance level of the Wolf panel on various parameters in comparison to the panels of the family.

Panel Frame
Powder-Coated Aluminum
Black

Shelving System
#DCE2E2

Interior Frame
#FCD3CC

Magnetic White Board
a3 CeramicSteel
Arctic White 2 CS Gloss

Flip-Out Stands
Powder-Coated Aluminum
Black
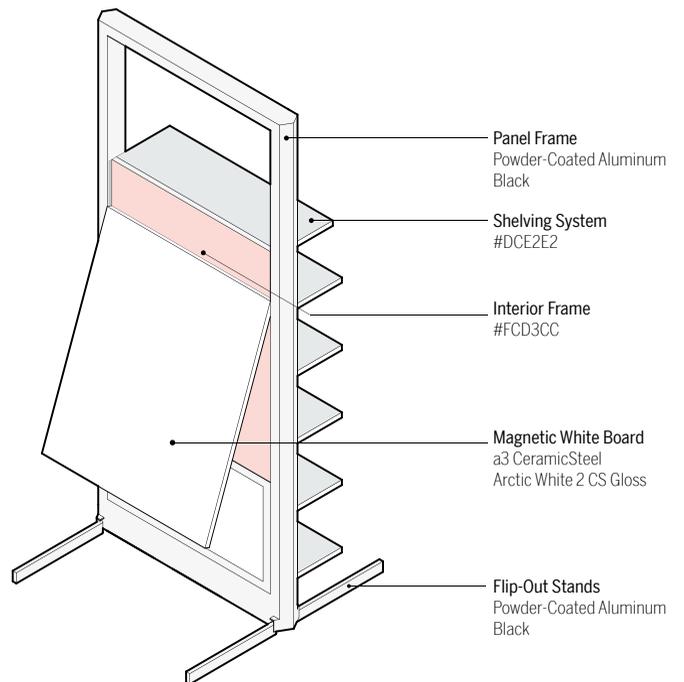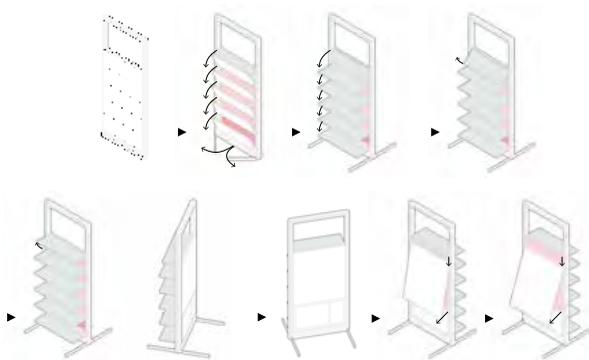
The panels begin with a metal frame. At the base are deployable wheels for quick mobility along with a stand which flips out if needed for support.

Within the frame are a series of horizontal beams which support the panels which flip out to become a standing desk, sitting desk, chair, etc.

Thanks to this frame, it is possible to connect some gadgets to the panel. In the upper part of the panels there are a fan, a lamp, and some vegetation. In the lower part there are an infrared heating panel and a folding chair.

DETAIL 1

POSITION OF THE GADJETS
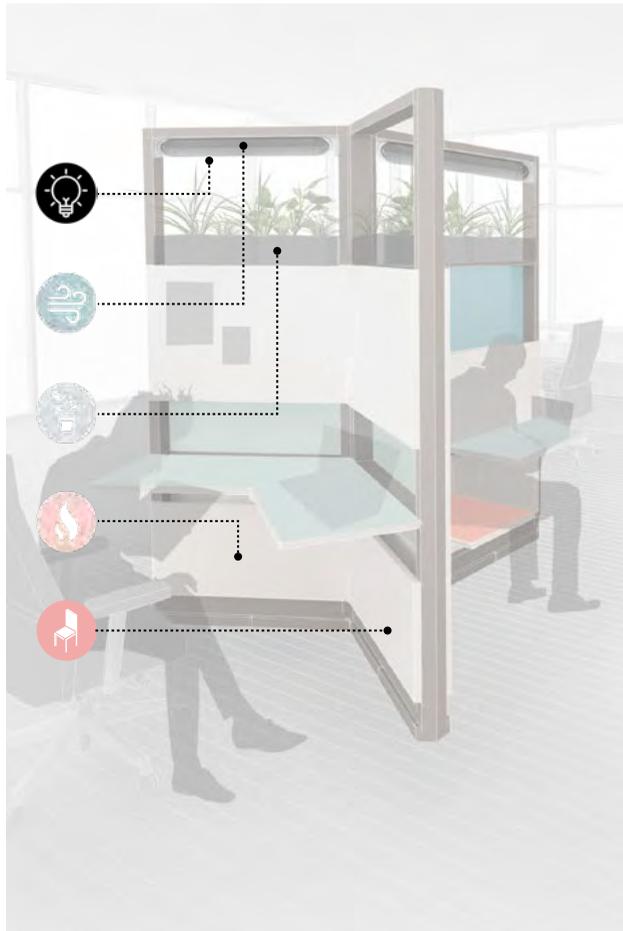
Section of the top part of a generic panel that shows the position of the cooling system, the lighting system and of the vegetation.

Position of the gadjets in a visualisation.

Interlocking Panel

Battery/Powered Fan

Battery Pack
Lamp Frame
Adjustable Light Panel

Low-maintenance
Indoor Plant

Soil

Water Drainage/
Retainment Layer

WaterAbsorbing Felt

Recycled Plastic Planter
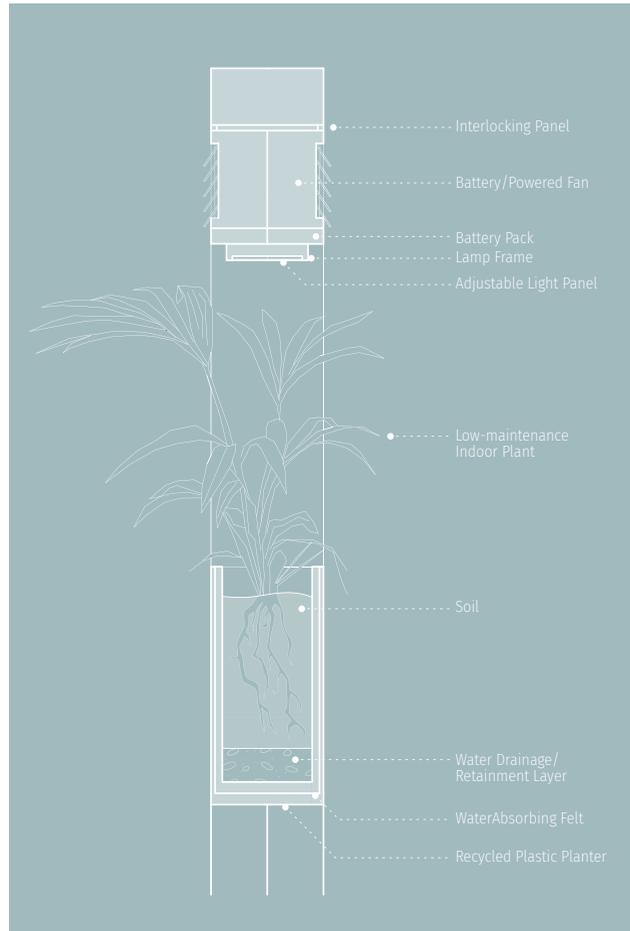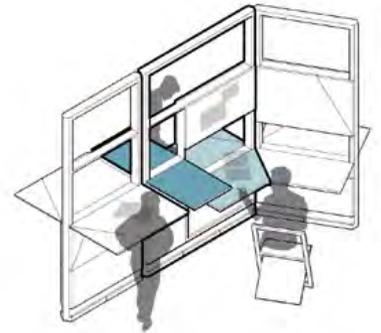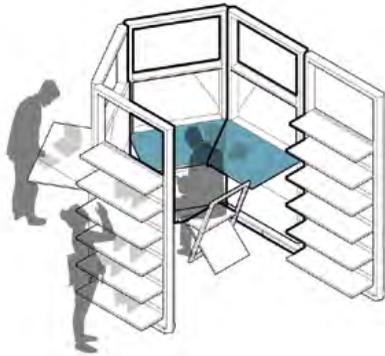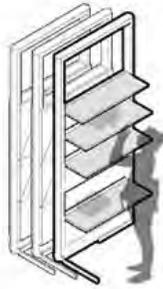
POSSIBLE COMBINATIONS

Axonometric views of
possible combinations of our
panels.

DETAIL 2

Axonometric view of an
explosion that shows how
shelves can be opened and
how they can slide on tracks.
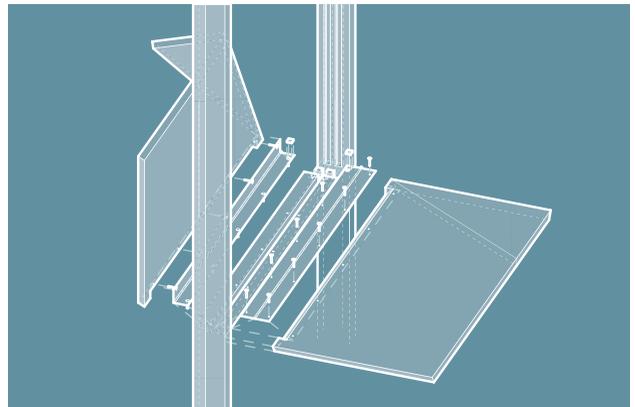
DETAIL 3

Axonometric view of an
explosion that shows the
wheel system under the
panel.
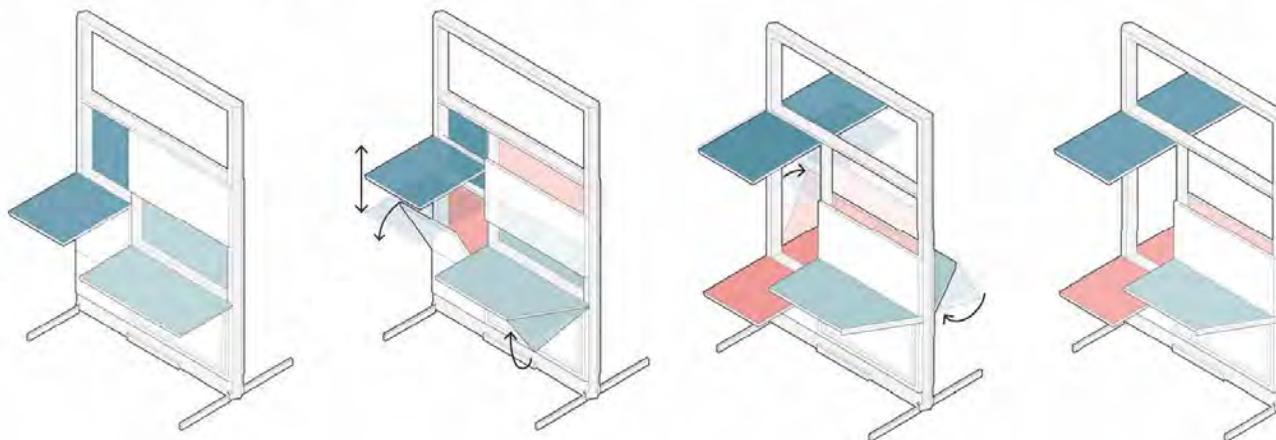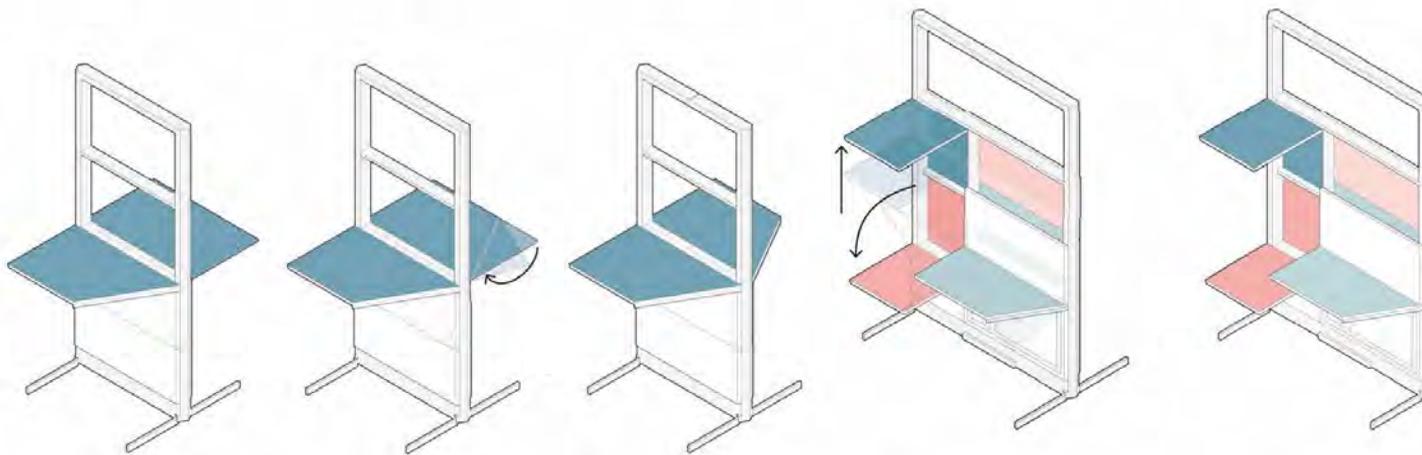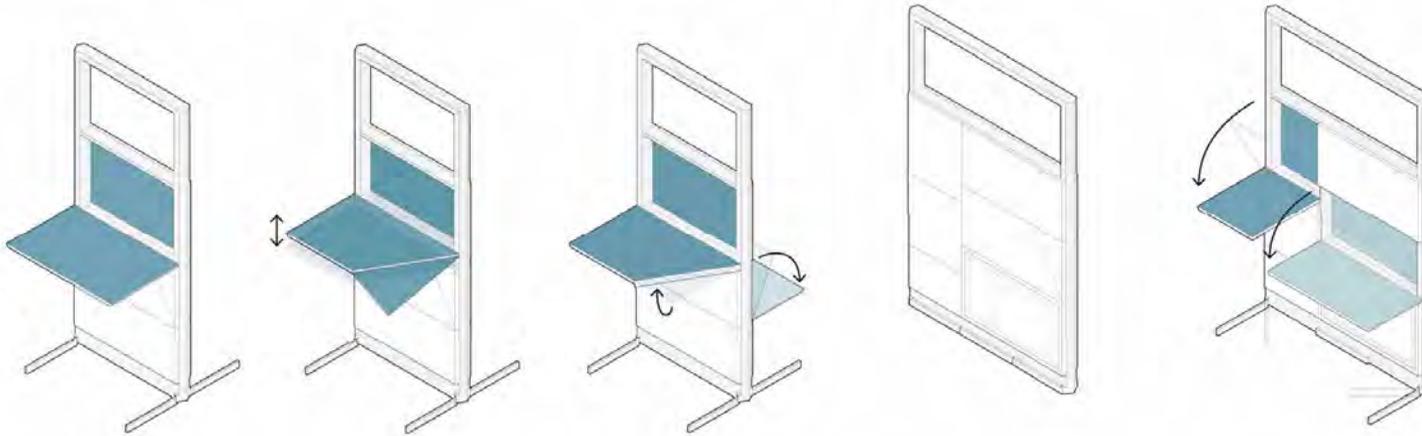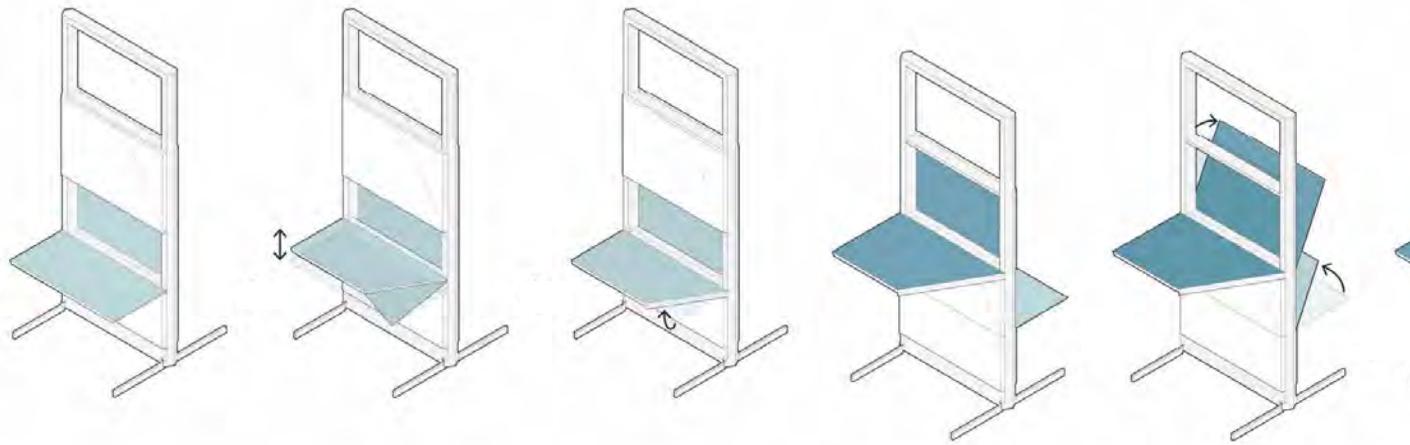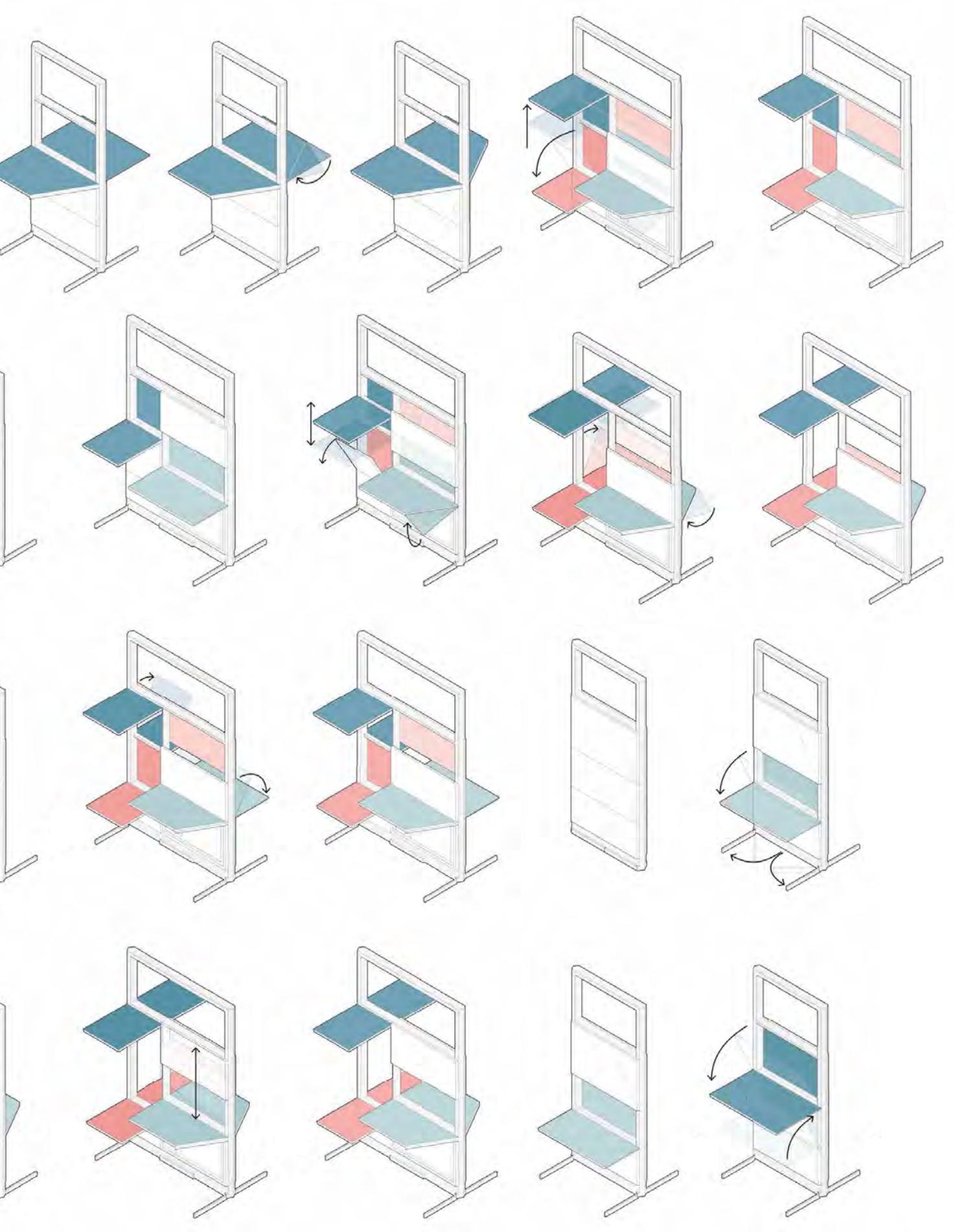
CLOUD[9]

A DYNAMIC CEILING STRUCTURE SYSTEM

by BEATRICE BRINCHI GIUSTI, EDOARDO DAIDONE,
NESMA HAMOUDA & SØREN JOOSTEN

In order to solve the problems of the existing office layout, a combination of fixed and movable fabric pipes helps to take the office as we knew to a new era. While the fixed pipes provides illumination, sound personalization and spatial differentiation through shaping it and using sound dampening material, the movable system is utilized at specific locations to fix and deal with a given deficiency of the present layout.

RESEARCH QUESTIONS
From the research done in varying topic areas related to human, space, climate, and technology within the office, several conclusions have been made:

- Lack of movement by people inside the majority of offices due to too much time spent in sitting positions causes health problems.
- Existing offices lack of flexibility in functions and space results in bad optimization of the space.
- Increasing casual interaction between people in the office improve productivity.
- Temperature variability in the office causes alliesthesia, resulting in a need for greater adaptability to temperature changes.
- Natural light inside the office cannot be replaced.
- Different lux intensity and temperature in the office affect human health in different manners.

The most interesting conversations revolved around the user and their workspace. Which is the relation between office space and time spent in the office? How well are people able to collaborate within the workspace? How connected are employees within existing office layouts? By using an existing office as a case study, we were able to explore these motivating questions and crossing it with the research founding we came up with the optimal solution.

CASE STUDY

We started considering an existing office where one of us have worked in, choosing it because it has qualities that can be found in many recognizable open floor plan offices of today. The first issue we discovered was with the idea of fixed employee workstations. Some teams were located far apart from each other in the office leading to increased difficulty and frustration when needing to collaborate. Additionally, we also recognize an inefficient use of space within the office. In fact, about one out of every 6 employees were out of the office for long periods of time and often for consecutive days. This left many fixed workstations unoccupied therefore creating dead space within the office. Some executive employees are disconnected from the main workforce of the office due to their office being enclosed and private. From these observations we have concluded that people are used to solid walls and fixed spaces that create stationary, well defined work stations, however, these spaces are not always fully occupied, resulting in wasted space within the office.

HYPOTHESIS

People are used to solid walls and fixed spaces that create stationary, well defined workstations, however, these spaces are not always fully occupied, resulting in wasted space within the office. Furthermore, classic walls partitions are limiting the interaction through peoples, often leading in too isolate people in the office. A solution for this issue lies in a dynamic ceiling structure that can meet the varying needs of changing work tasks.

CASE STUDY

Through the analysis of an existing office it has been possible to highlight the main problems within an office environment

Disconnect within the office

Inefficient use of space
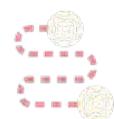
Fixed employee work stations

CONCEPT

Inside an existing office we saw that we need to: achieve flexibility needed to optimize the usage of space during a given time, maintain boundaries but transform them through a flexible and versatile structure- something that is not possible for classic brick partition walls for example, to not only be flexible but also allow for people to interact with each other, and if necessary bring the right amount of isolation to be able to work in silence and disconnect from the rest of the office, maintain the characteristics of the classical office solution with open space or a more closed cubicle but at the same time have the capability to change it.

To accomplish all both a permeable and versatile barrier is needed.

DESIGN

Starting from the problems analysed in the case study, we have developed a design capable of revolutionizing the structure of the entire office, based on the abandonment of traditional barriers and the filling of space through a dense offset grid of white mesh pipes. These pipes are suspended from the ceiling, and which are able to compose a dynamic workspace within the office.

These are divided into different areas, some composed of fixed tubes and others of flexible tubes. The fixed tubes cover the entire ceiling with different lengths to create the varied topography that can diversify the spaces below, improve acoustics through the sound absorbing fabric and benefit the aesthetics of the entire office.

Flexible areas are placed in unresolved or badly used areas of the office and are composed of tubes that can modify their length by creating different formations of space. These areas are based on the idea of creating a subtractive architecture. While normally architecture is a process where you are building things: walls, floors, ceiling, and create spaces out of that, this process began with infilling the entire space almost solid and then creating a volume excavated out of that.

Light permeability

Levels of transparency

Colour indicator

Ability to disappear
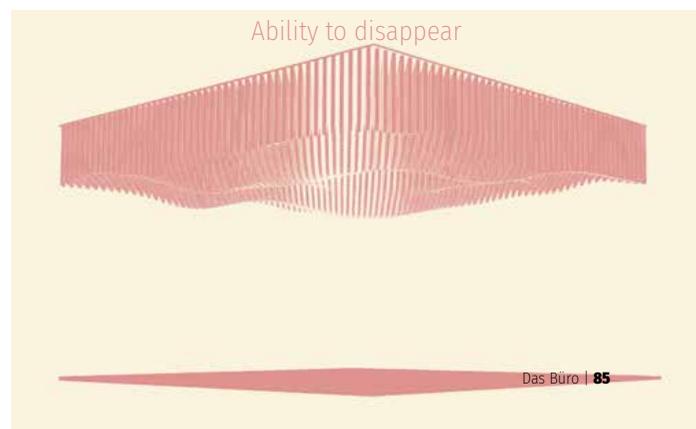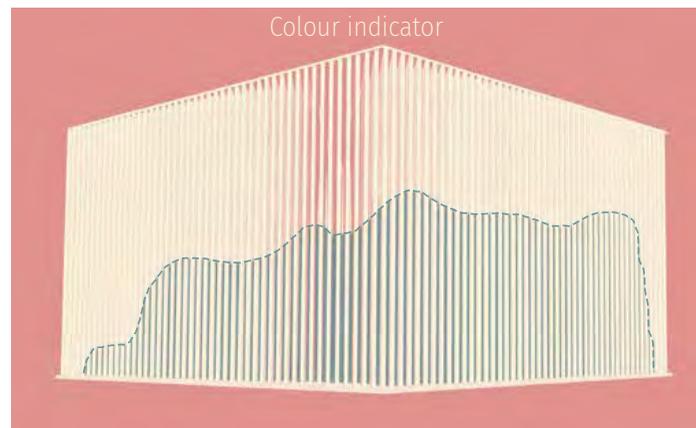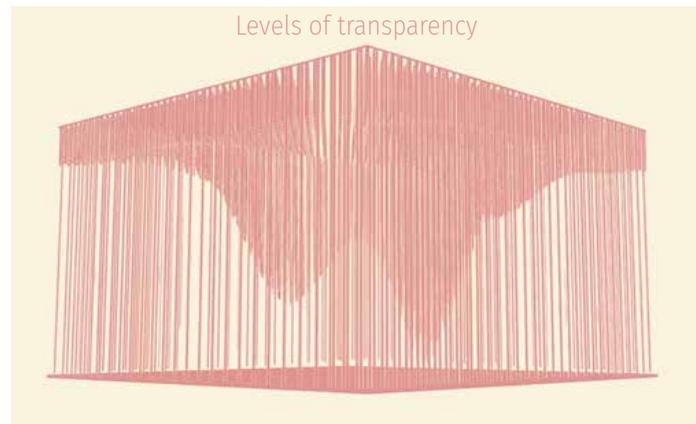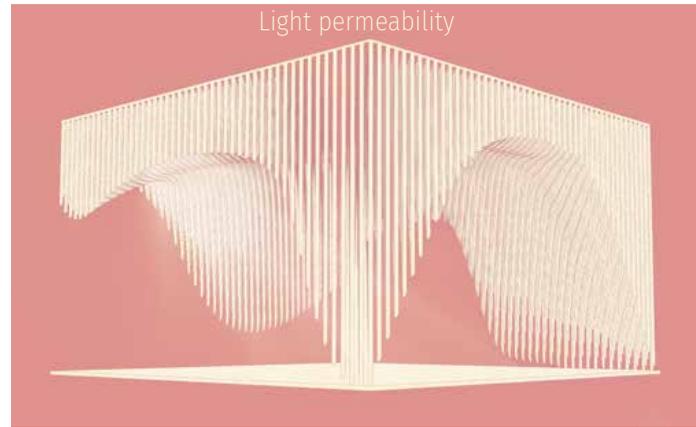
Through this system, the space can be shaped indefinitely, in order to provide the ideal shape for a given situation and people, moreover its formation can be changed almost instantaneously to benefit the needs of the changing uses.

Considering the shifting translucency and the shifting views as one of the main points of interest of the project, the tubes are composed of a fabric chosen for both its acoustic and translucent qualities. The system can provide a barrier with different layers, and so different levels of transparency. With these permeable boundaries, there is a potential for both private and open, interactive spaces to exist in the same exact place.

The nature of the material also allows more daylight to penetrate through the barriers, and thus improving the working conditions of employees, an advantage that is lost when a solid wall is present. Both natural and artificial light are very important within the project. An artificial lighting system is in fact placed above the fixed pipes system

to shine down through the gaps in the tubes, solving a functional aspect but also contributing to create a special atmosphere below the ceiling. The flexible tubes are instead equipped with an artificial light indicator, through which users can communicate how the space is being used to those existing on the outside using different colours of light. For example, if a private meeting is going on, a blue light may be used to indicate this activity. Other colours may also be used to express spaces where communication and interaction can be encouraged.

As the system is variable, it has the ability to disappear when not in use, providing a non permanent solution to the office, but at the same time the acoustic properties of the material make it a useful addition to the office even when not in use.

EXPERIMENT
The experiment was made to test the effectiveness of the permeable pipes barrier. For doing so we used four different layouts with the choice to go through the pipes or avoid them by going around the experiment.

SECTIONS
While the fixed ceiling defines the space below depending on its topography, the flexible spaces can vary and ensure different uses of space.
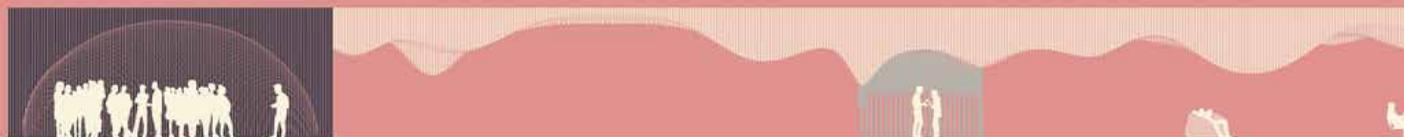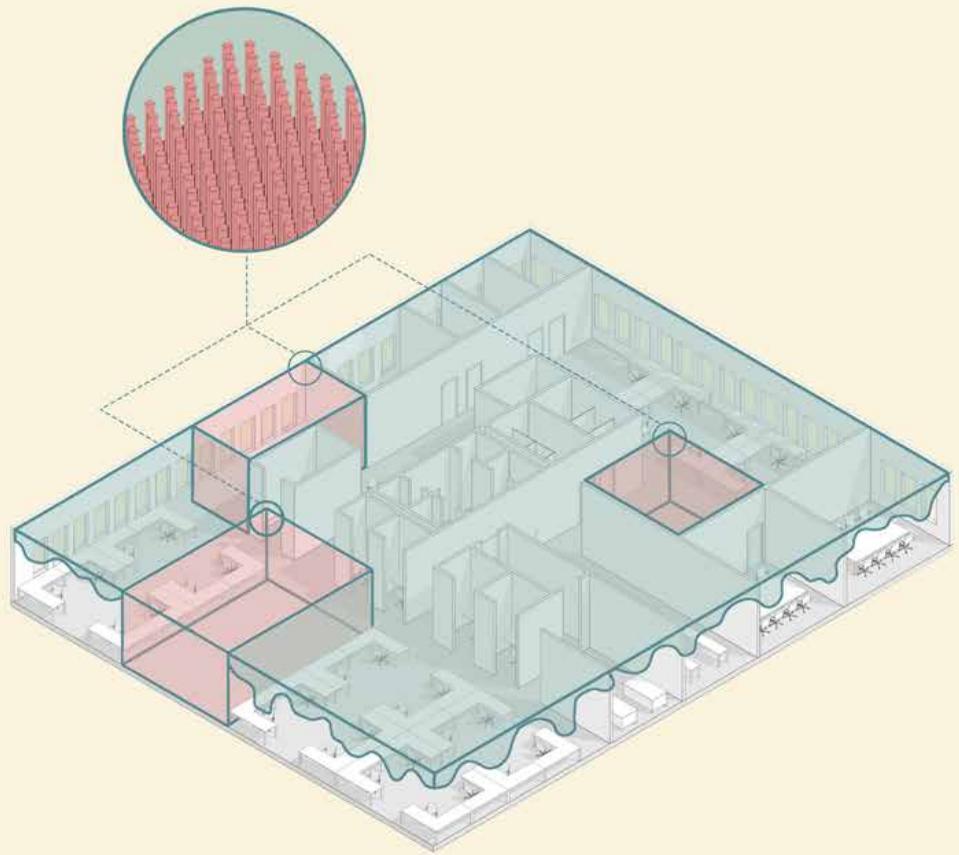
SPATIAL ARRANGEMENT

The office has been renovated through the mesh pipes system,
with both fixed and flexible areas.

THE MECHANISM

Each tube is driven by a mechanism that can raise and lower
it. The entire system is operable through control points at its
perimeter.

Stepper motor

LED light

String

Fabric loops

5 cm

2.5 cm

Metal rings

Fabric

10 cm
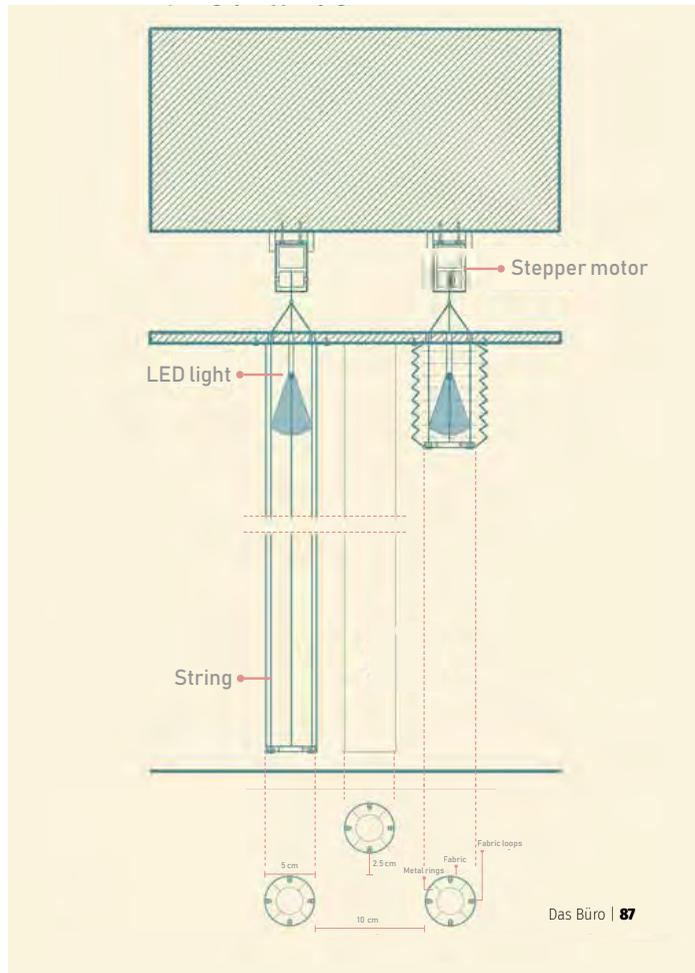
The first and second layout were designed to have the same path on the inside and only differed in density of pipes. From these two layouts we saw one substantiable difference: with more density almost all of the people went through the designed path, with less density they were more prone to go through the pipes because the path was less defined. The third layout was divided in half, one side more dense with pipes and the other half more rare with pipes. This gave people the opportunity to choose the path to take. As result, most people passed through the middle where the two densities changed. Only a few people, but almost the same amount for both, chose left or right side. In the fourth layout the two outer perimeter layers were full of pipes and the interior was almost empty. While in the other three layouts, around 60% of people went through the experiment and the remaining around it, in the last one the result was inverted, only 40% of people went through the experiment even though there were sign indications to go through it. So we actually can substitute traditional boundaries using pipes. Another side experiment we tested was to see how people interacted with the space. We observed people sitting with a pouff and talking inside, but it was also interesting to see many post on Instagram showing the project and people experiencing the ambiance of the project during sunset.

CONCLUSIONS

Going to analyze how this system intervenes on the whole office, we can conclude that this is solving the problems related to a fixed layout, and therefore to the lack of flexibility, to the unused spaces, and to the limited interaction, optimizing the space and being able to adapt to all uses and functions, provided by both the fix and movable part. It's also boosting the interaction within the office, through its permeable designed boundaries, that allow more interactions than the traditional walls, maintaining the possibility to achieve the same isolation comfort. This is also useful when it comes to reducing the noise level in the office, as the sound proof material allows sound comfort and the sound personalization provided by ceiling shape and amount of layer used for the movable part. Light plays another key role in the project, it can solve the issue of glare, the light inside the pipes, in fact, limits the glare but the chosen transparent material spread light through the entire space, both natural and artificial. Communicating the intentions inside the movable part is also clearer and more immediate, through the appropriate colour indicators. Last but not least, there is the experience given by this system and the total immersion that can be experienced, both at a tactile, visual and properly sentimental transport level.

THE RESULTS OF THE EXPERIMENT

Data analysed on a sample of 423 people
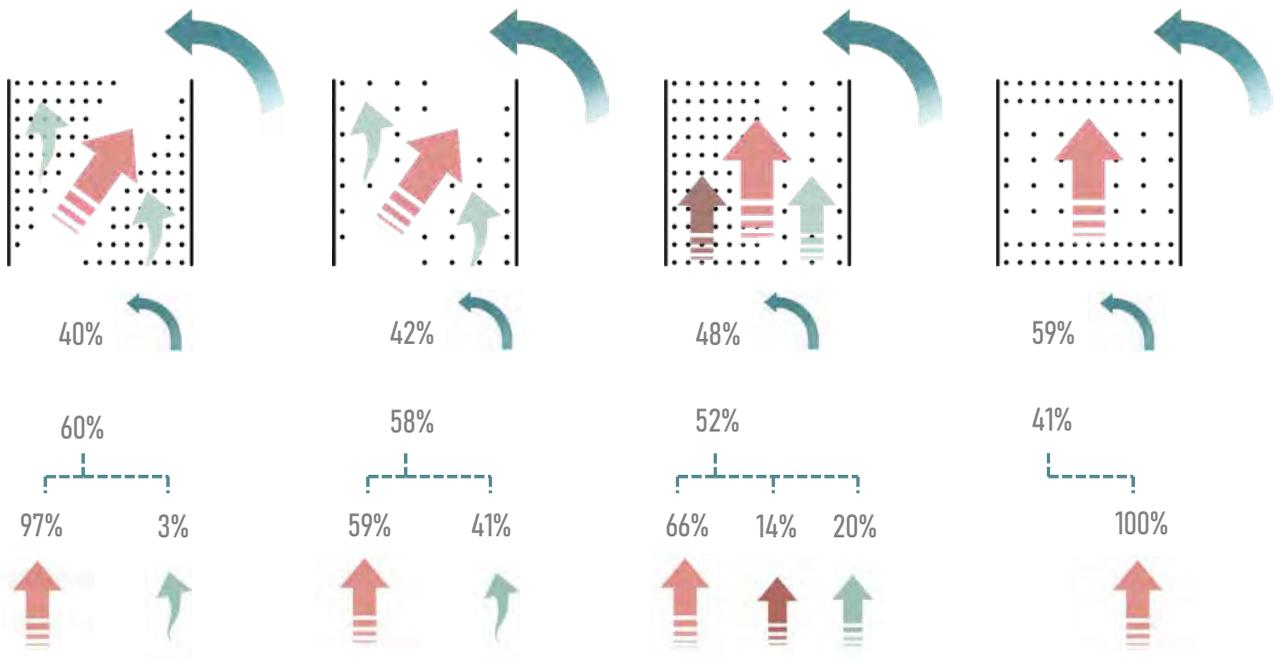
THE 1:1 MODEL

Through the construction of a full-scale mock up it has been possible to analyse the reactions of the people involved in it.

LIGHTS AND SHADOWS

One of the most fascinating things is the play of light that is created through the tubes.

THE TOPOGRAPHY

Very characteristic is the enveloping sensation that you feel under the structure
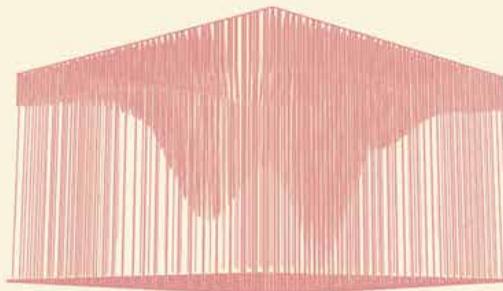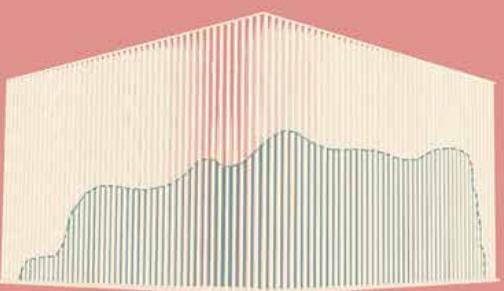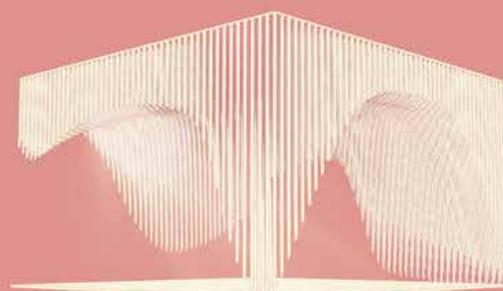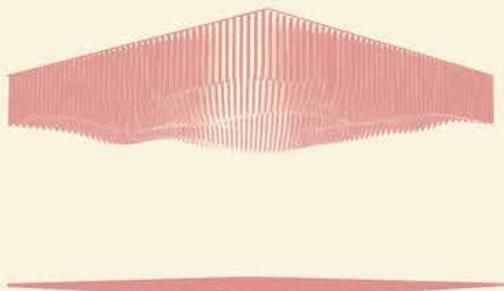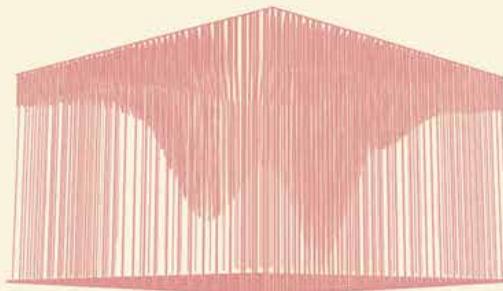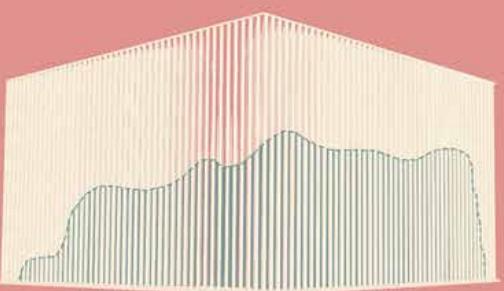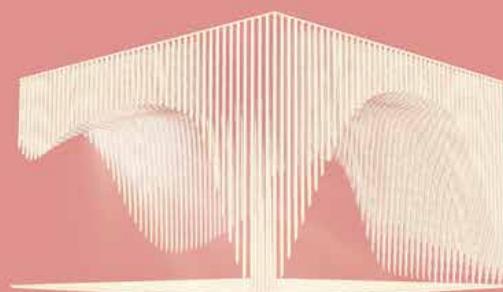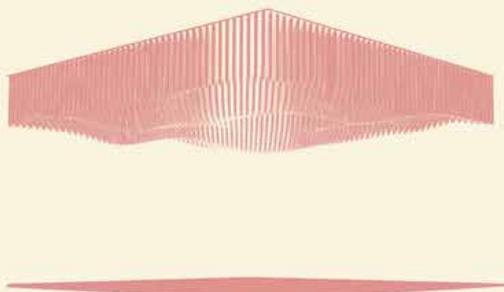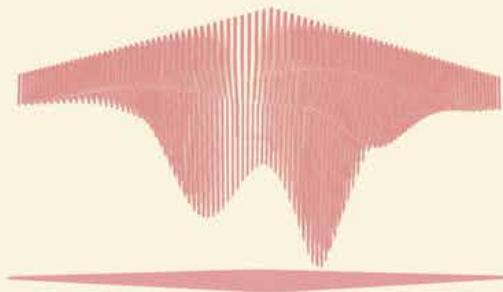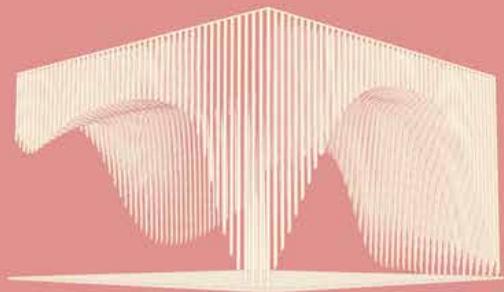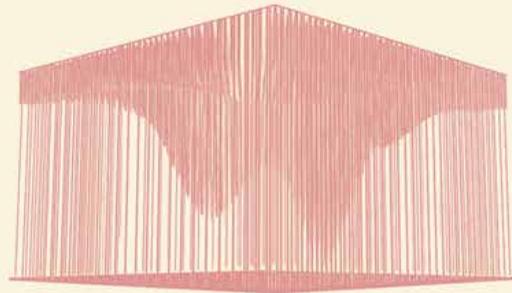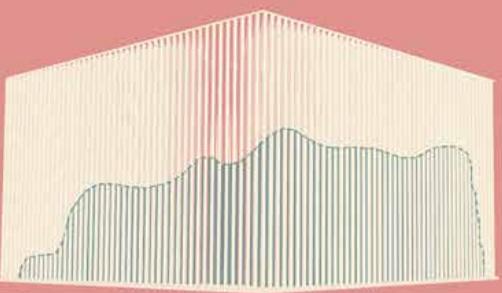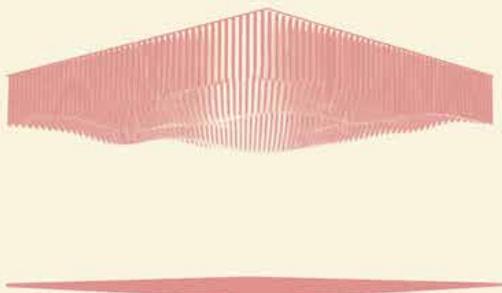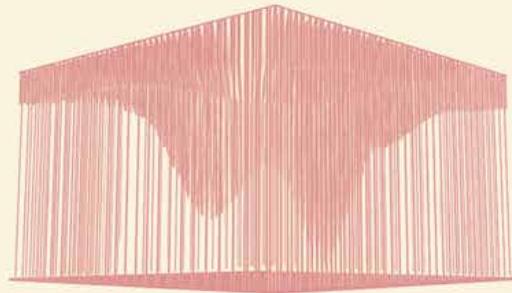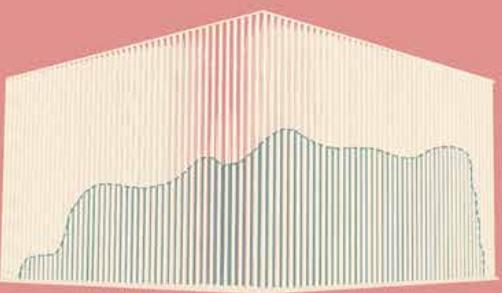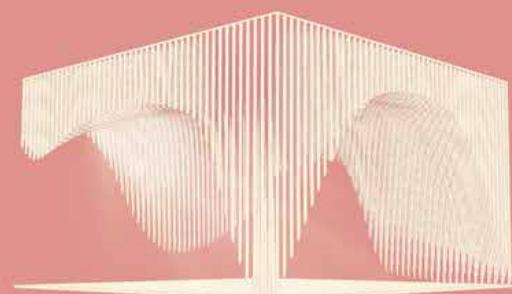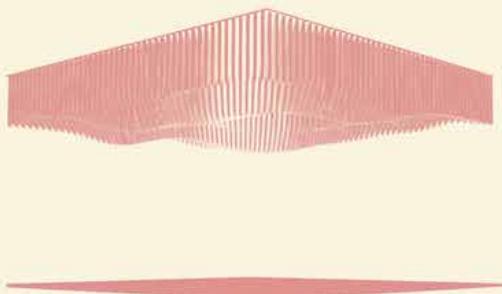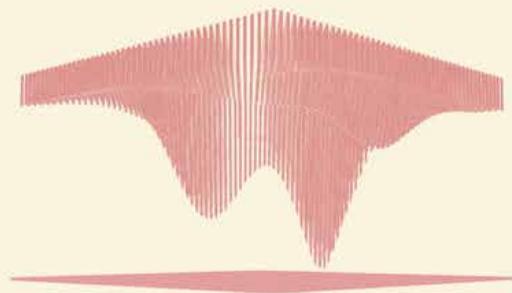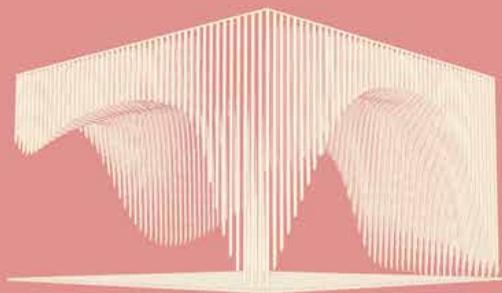
CONNEX 2041

A FRAMEWORK FOR PHYSICAL CONNECTIVITY

by BENEDIKT KELLNER, JOHNNY JEONG YEOB KIM,
MARKUS RITTER & MATHIAS SPIESSENS

Through the combination of an individual workspace, a building block for a meeting space and a transport system, Connex becomes the catalyst for a more efficient way of work in space and time. Connex shifts the meeting space, the most valuable space of the future working culture, to the urban fabric. Welcome to a new kind of working culture. The age of Connex.

RESEARCH QUESTIONS

The past organisational cultures are mainly based on the so called industrial work culture, however in the evolution of work culture they haven't evolved far from its origin. Today work has to a great extent become an invisible brain activity that can happen anytime and anywhere, therefore more and more companies need brainpower. In the upcoming work culture, work is no longer limited to the office from 9-5. Work will create much more valuable output when employees have the flexibility and trust to manage their own time and efforts and the right environment for the different types of work they are doing. Even though the majority of companies believe that a flexible work culture already exists, employees are not taking full advantage of these offers.

How can we provide frameworks for this new fastly growing working culture? How can we encourage communication, relationship building and networking in this digital age? And how can our infrastructure react to the rapid evolution of technology and the way we work?

08:36, 14.03.2041. LMU, LUDWIGSTR. 28, 80539 MÜNCHEN.

Connex is a physical network that connects you to other users.

HYPOTHESIS

Building upon long-standing trends in employment we can expect a highly diverse employment regime with a strong emphasis on high-skilled, knowledge-intensive jobs. This makes the supply of appropriate skilled labour and the development of flexible work organization models that can reconcile productivity and innovation with individual and family needs a crucial factor of success in developed economies. This individualized work life design model will consider professional and personal needs at the same time and provide the spaces for the different individual biological rhythms. The ability to work where ever and whenever you want will greatly increase not only productivity and efficiency of work but also the recognition of one's potential and trust that one is able to achieve. In order to fully meet these needs a mentality change is needed. From, I can see you - therefore you work. To, even if I don't see you - I still know that you work. What Connex does is exactly that, initiating the mentality change that is needed.
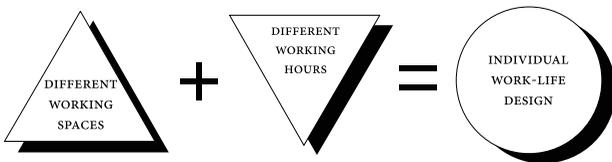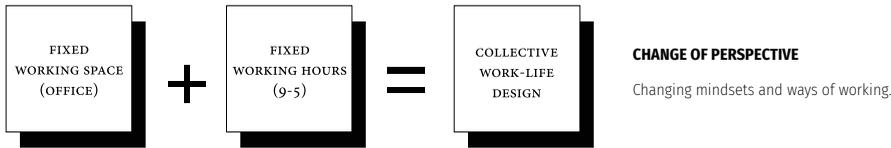
FIXED WORKING SPACE (OFFICE) + FIXED WORKING HOURS (9-5) = COLLECTIVE WORK-LIFE DESIGN

CHANGE OF PERSPECTIVE

Changing mindsets and ways of working.

DIFFERENT WORKING SPACES + DIFFERENT WORKING HOURS = INDIVIDUAL WORK-LIFE DESIGN

DISTRIBUTED WORK-LIFE DESIGN

How connectivity changes urban fabric.

Centralized   Decentralized   Distributed

Office space disolving

Reuse for more living space

Displacement of workspace
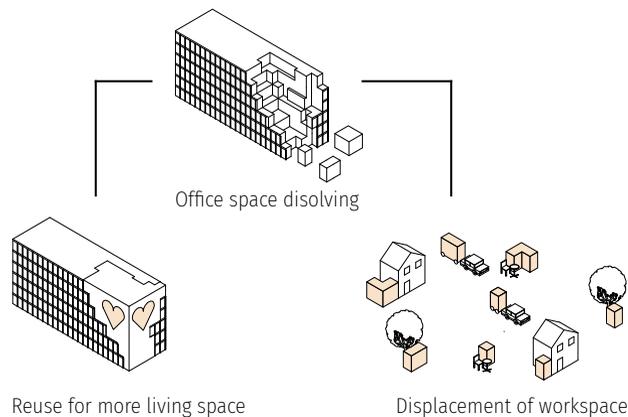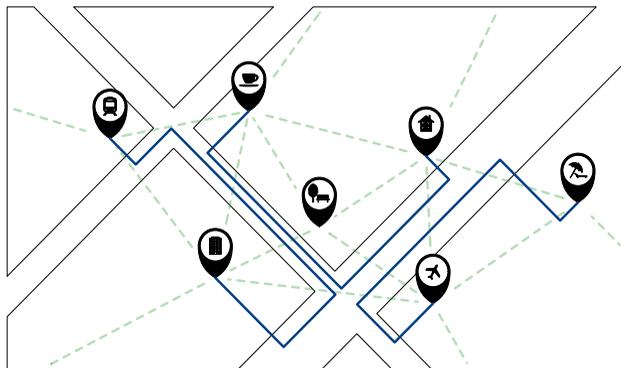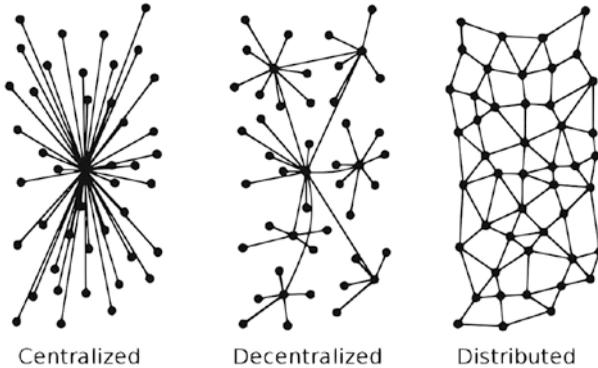
CONCEPT
Work where ever you want, whenever you want.

The virtual network, or the (almost) perfect network (internet, virtual world) where time and space are eliminated and information exchange is instant is probably the biggest evolutionary step that defines and will define our society for a long time. The network culminates in instant and complete accessibility. It questions our own physical presence and sets the static approach of architecture before a big task. On the other hand we still have the physical network or the 'incomplete' network (train, buses, cars, etc.) where time and space are still present. This network fights against waiting, stands against feeling time and distance.

Whilst the pure information exchange is possible through the virtual network, we will still need a substantial physical space that can connect people for business meetings not only internal but also between companies, because we can't simply replace human interaction by any kinds of technology.

So we are creating a physical space that gives people the opportunity to be connected in real life, yet it should fit into the context of the distributed work culture in the digital age of the 21st century.

Connex is the Idea of providing a flexible (individual) work space, which, at the same time, can be transformed into a collective meeting space, where human interaction can take place. It activates the idea of being able to decide individually where and when to work depending on the type of job that needs to be done. But primary connex ensures meetings, the most valuable workspace in future working culture. It ensures a physical connectivity on an urban scale. Instead of fighting time and space in the physical network, we should make greater use of that given time and space.

We can ask ourselves now how this connectivity changes urban fabric. Workspaces get distributed from the static office to connex and different publicly accessible spaces.

This together with Connex as a transport system gains a great amount space which can be used not only for public spaces but also for housing. To explain this we will give a little overview of the situation today and the possible situation in 2041 if Connex is implemented.

Streets are used by private cars and public transport with peak times during the day. Streets sit mostly empty, in the early afternoon, late evening, and at night. This is today's reality—the baseline for any future scenario. What if the infrastructure is more elastic? Streets should be able to adapt more throughout the day, transitioning from entirely vehicular to almost entirely pedestrian, and every iteration in between, depending on demand of traffic. Autonomous driving and pedestrian can be on the same "flat" infrastructure, so roads can become public squares. This is not a wild thought, but a real possibility to be the next revolution in urban space.

When fully autonomous and cars communicate with each other, they could keep 3 times less distance. This results in a possible tripling of the amount of vehicles. Taking the induced demand effect in mind the right approach for this space gain should be the reduction of road infrastructure and creating more public spaces and greenery instead of allowing more cars to drive on existing infrastructure. We need to optimize the demand instead of raising the supply. If you expand people's ability to travel, they will do it more, living further away from where they work and therefore being forced to drive into town.

Optimizing demand refers to changing how passengers use the transit system, by decreasing the demand for transit, moving trips away from peak times, or moving trips onto shared transport modes. In contemporary society this is not an easy task, because the problem lies in the human behaviour. Connex reduces the need to travel to the office everyday causing traffic jams. People can work from anywhere at any time. People have meetings at different times. This spreads the travel behaviour of people through space and time which greatly increases the efficiency of the infrastructure and leaves more space for public life and greenery.

Floors above the plinth of the city are nowadays used as offices, homes and very occasionally as a public function. Public life happens most of the time 2 dimensional. There is a rather big separation in type of building, one exclusively used for working and the other one for housing. Via Connex and corresponding future working culture, floors above the plinth of the city are used as a mix between housing, office space and public space with a greater emphasis on housing and public functions. Public life extends now more 3 dimensional. Buildings become hybrids for different functions

2019

City infratrustructure layout. Road and pedestrian infrastructure take up a large amount of space
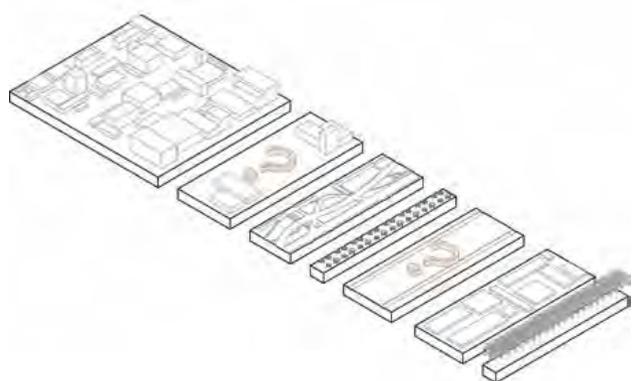
2041

Through Connex as meeting space and as autonomous transport we gain space on two fronts that can be used for housing and public greenery.

The city of Munich grew exponentially the last decades. Even though an extensive suburbanization took place, the city centre, its districts and the rings around couldn't unburden themselves from the large amount of incoming travel. By taking of the pressure of the static office and distribute it to different publicly accessible spaces and connex we gain space not only for these public spaces but also for housing. Buildings in the city get regenerated with homes interwoven in a mixture of public functions and offices. Urban life is more distributed and reduces the travel to hotspots in the city. Connex could be the next innovation that really liberates our strung out suburbs and dysfunctional inner cities. Spaces in dense urban context can be reorganised more effectively.

When we do the study of how much space a person takes up for work and transport at a given moment, we see that moving to a shared system, a better distributed system of workspaces and a more elastic way of taking up space, gives us a reduction of more than 8 times the contemporary space intake. Instead of owning a private car, a private office and a part in a meeting room, which most of the time is not full, we shift towards shared public transport, home, public space and Connex.

2019   18.5m²
in total

TRANSPORT
1.5 - 5.5m²

MEETING SPACE
2m²

OFFICE SPACE
2 - 10m²

1.5m²
PUBLIC
TRANSPORT

2.25m²
INDIVISUAL
CONNEX

1,44m²
CONNECTED
CONNEX

2.25m²
INDIVISUAL
CONNEX

2m²
PUBLIC
SPACE

2041   2.18m²
in average
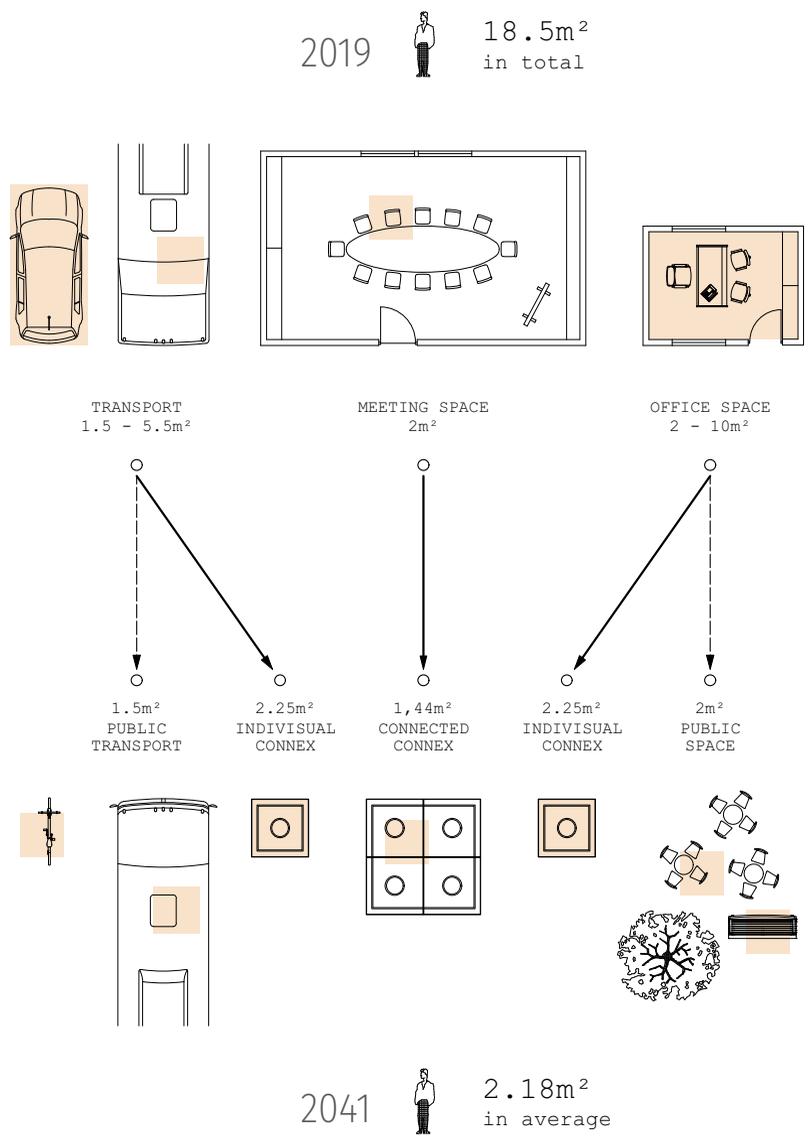
SIZE COMPARISON

up to 8 time reduction of the amount of space a person takes
up for work and transport at a given time.

MEETING, 14:36, 23.01.2041,BAVARIAN ALPS.

Group work and meetings can be hold in places other than
conventional offices.

MATRIX STRUCTURE - TYPE OF OPENINGS

A crucial part of the design process was analyzing and
choosing the right combination of structure and skin for both
individual work as for meetings.
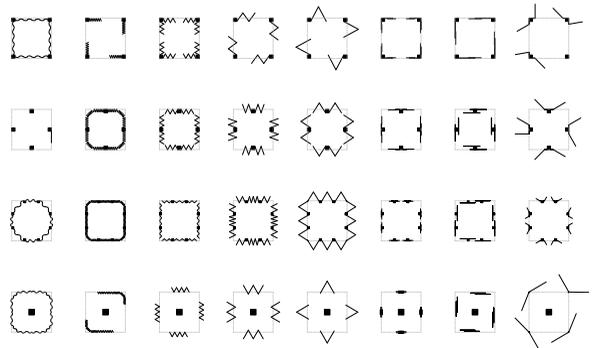
MODEL CORE - SKIN

The structure in the middle was chosen in combination with
the furniture. the facade can move freely and 3 sides can be
cleared without corner obstructions.
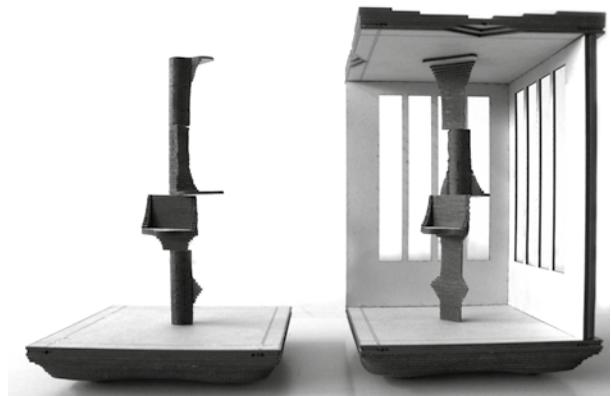
EXPERIMENT: 1:1 Model

The youngest generation and it's corresponding individual working culture seeks for a working space that is minimal in attributes, flexible in use and encouraging to work in different locations.

Connex enhances this minimalistic and nomadic way of working while still offering valuable advantages in comparison to the different working environments found in the city landscape (bars, coffee-shops, parks). By building an adaptable 1:1 model of Connex we were able to test a variety of proportions which suit the best for different working positions and different ways of working. We saw that having a height of 2.18m was ideal for sitting as for standing. For the width there were a bit more variables. The amount of people working in it, what kind of work, how long the work lasts etc. Because the connex is primarily designed as an individual space, by connecting extendible to a collective space, we found that the width could be relatively small. This also ensures that every side is reachable for a person who sits or stands in the middle, which is advantageous for having a (touch)screen as the inside of the facade. Our optimal proportion in the end was 1.20m x 1.20m x 2.18m. we took this measure as the basis for further experiments. Mathias worked in it for 2 hours, about 30 strangers worked in it for 3-10 minutes and different materials for the facade were tested.

How Connex brings back human interaction? The idea of what constitutes a meeting room has also vastly changed in a very short space of time. Well designed, dedicated meeting focused spaces are essential, but the more specialised the spaces and technology, the more specialist the user will need to be support these spaces. We believe therefore that the space itself needs to be as neutral as possible to enable productivity, long attention spans etc. Less is more.

A growing number of participants are requesting events and spaces that are "stripped down to the essentials". The focus is on personal interaction and the shared experience. Today we create meeting spaces that inspire people and encourage communication, providing the time for relationship building and networking. The increased focus on participant engagement and personal development demands an inspiring and dynamic setting in which to thrive.

A boardroom, ballroom or auditorium, however many technical bells and whistles they have, can't create that personalized and unique experience that we now demand. Participants want to play a more active role and help to shape the meeting. Interaction becomes the vital element as the groups are smaller per location.

SIZE EXPERIMENT
120 x 120 x 218 cm showed the best performance.

The interior design is conceived as a modular glass box, where windows will be screens and one centre object will guarantee all possibilities of sitting, standing, working, watching etc. The facade of connex is conceived on the one hand as a protective skin for individual work and on the other hand as the connecting element between multiple connex'. The skin of a connex enables a large adaptation and personalisation. Every side is divided in 4 equal panels and 2 corner panels. Each panel spins around it's middle axis, moves through a railing system and inter-locks with other panels. The skin is built up as a double system which facilitates the possibility of using sun shading, collecting solar energy and still make use of the interactive technology on the inside. The varia-tion of visibility in connex enhances productivity and comfort.

When a meeting occurs the facade slides open and the individual pan-els are used as vertical interactive displays to present information and work around. The static character of a conventional table limits a shared experience due to the orientation of the human body.

In order to have full flexibility in the facade, the structure is moved to the centre of the connex. In this way we treat every facade in the same way and empowers the directionless character of the connex. Connex's can be connected in every possible direction, giving full flexibility to the user to shape their meeting.

The structure is designed as a multifunctional core, not only serving structural requirements but also different positions people work and meet the best in. The barstool-height seat, the standing-height table, the personal light and footrest provides the needed adaptability for personal work and the needed neutral environment for meetings where standing and sitting happens on the same height. The user interacts with this sculptural core in a more direct and inspiring way than a con-ventional chair and table.

MEETING FOR 4

The interaction between worker and core and skin and worker changes when a meeting is happening.
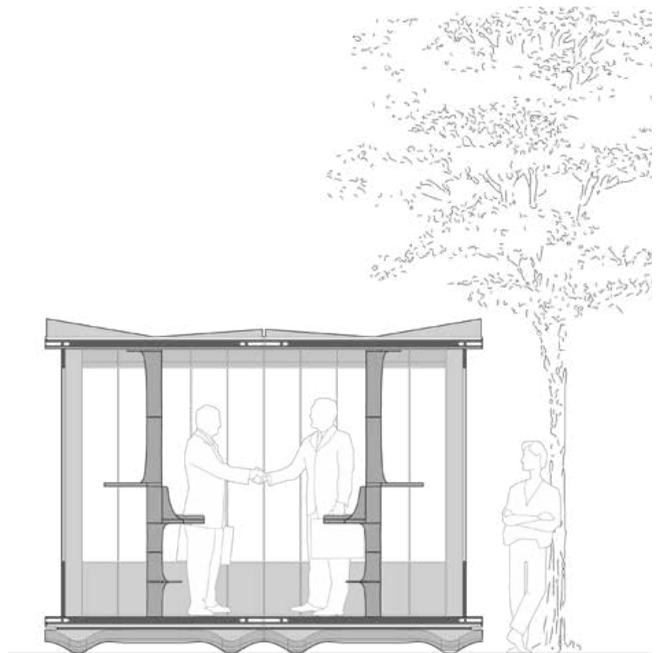
MEETING FOR 2

The core is conceived as the neutral and reliable backbone element for a worker during a meeting

IN ORDER TO ENCOURAGE COMMUNICATION AND NETWORKING, HUMAN INTERACTION NEEDS TO BE STRIPPED DOWN TO THE ESSENTIALS.

Our multifunctional sculpture is designed for a stripped down human to human contact during a meeting.

CHANGING WORKING POSITIONS PROMOTES BRAIN ACTIVITIES FOR A LONGER TIMESPAN.

Our multifunctional sculpture is designed for different variations of working scenarios during travelling.

Interactive display

Touchpad

Workbench

Bar stool height seat cushion with fabric covering
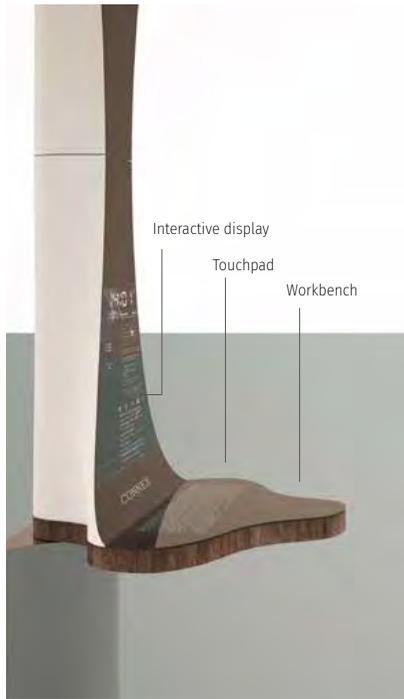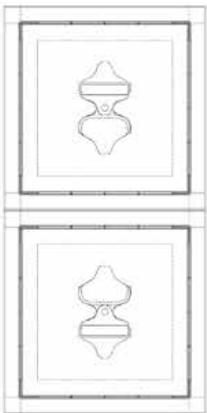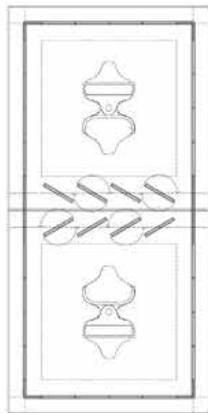
Connecting	Turning	Sliding	Stacking	Meeting
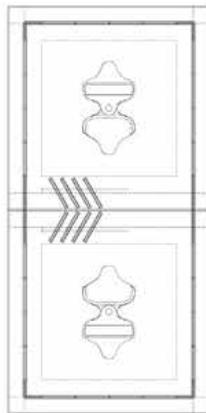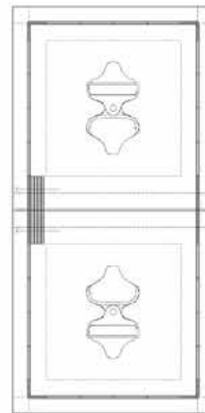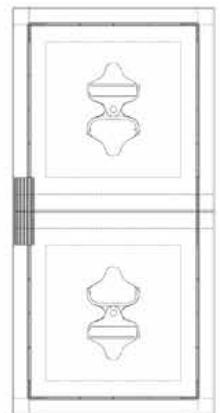
CONNECTING

The facade of Connex is conceived as the connecting and the shared interactive element between multiple Connex's.
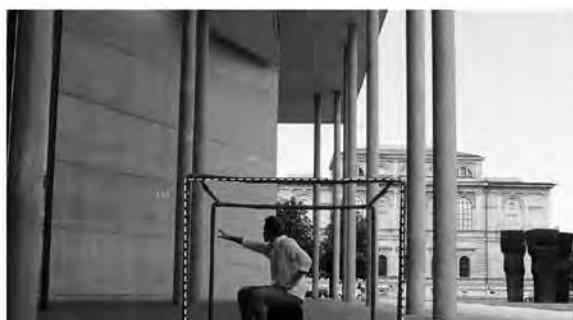
ICON

INTELLIGENT COMFORT OFFICE NAVIGATION

by <u>ALEX ARNDT</u>, <u>PHILIPP HÖLZENBEIN</u>,
<u>SEBASTIAN KOTH</u> & <u>MAX ZORN</u>

Office buildings never meet the comfort preferences of all their occupants. But, can the number of satisfied people within an office building be raised by guiding users to spaces that meet their individual comfort needs better?

PROBLEM STATEMENT

Office buildings never meet the comfort preferences of all their occupants. Contemporary buildings are planned with 10% PPD (predicted percentage dissatisfied). Consequently, a tenth of the staff feels uncomfortable at any given time - in its best case scenario. This is a direct result of uniform indoor climates which are proposed by code and standards. The human comfort range on the other hand, is quite diverse and changes over the course of the day. Smart building concepts do not yet introduce a paradigmatic change, they merely try to optimize what already exists. However, users often act contrary to the assumed behaviour. This divergence creates the performance gap, which in turn leads to a remaining inefficiency even in highly engineered buildings.

HYPOTHESIS

Passively operated buildings provide a wide range of indoor climates, depending on internal and external heat gains or losses. A passive building that caters different climates, would therefore offer the opportunity to have a suitable environment for each and every user in the building. We propose guiding office workers to spaces that fit their activity and individual comfort best. This will be made possible by an AI-based app: ICON.

ICON STRUCTURE
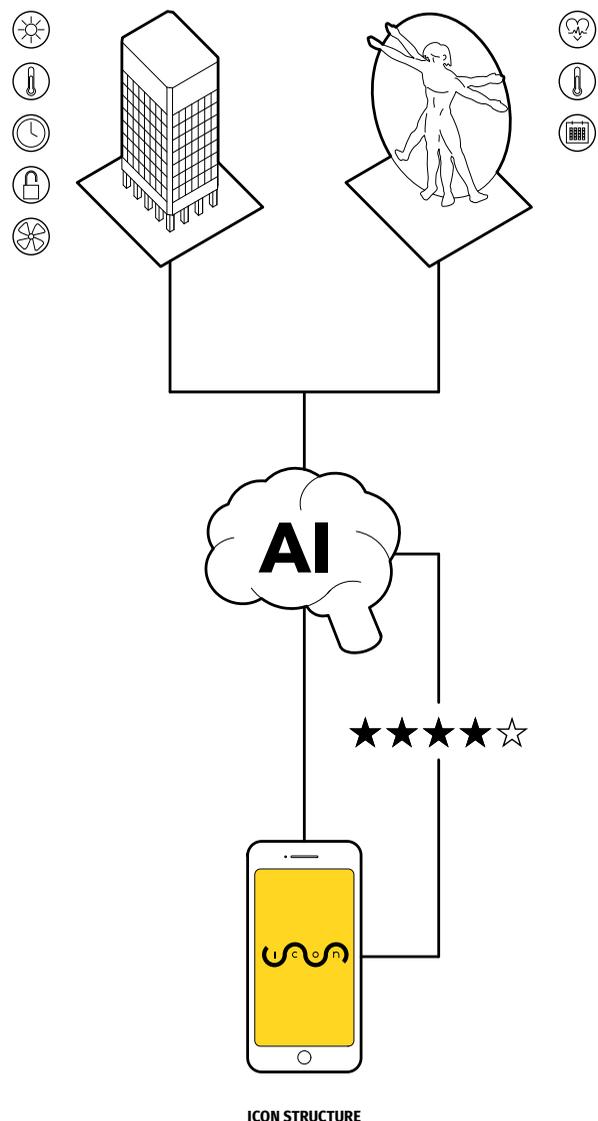
The AI-System collects the building and user data to communicate the ideal workstation at any given moment with the user interface while continuously processing user feedback.

INTELLIGENT COMFORT OFFICE NAVIGATION
ICON consists of two integral components. On the one hand, the system is based on an Artificial Intelligence (AI), which learns from user and building data and makes it possible to find ideal workstations based on current, individual parameters. On the other hand, there is the user interface, which enables users to search for and find these locations.
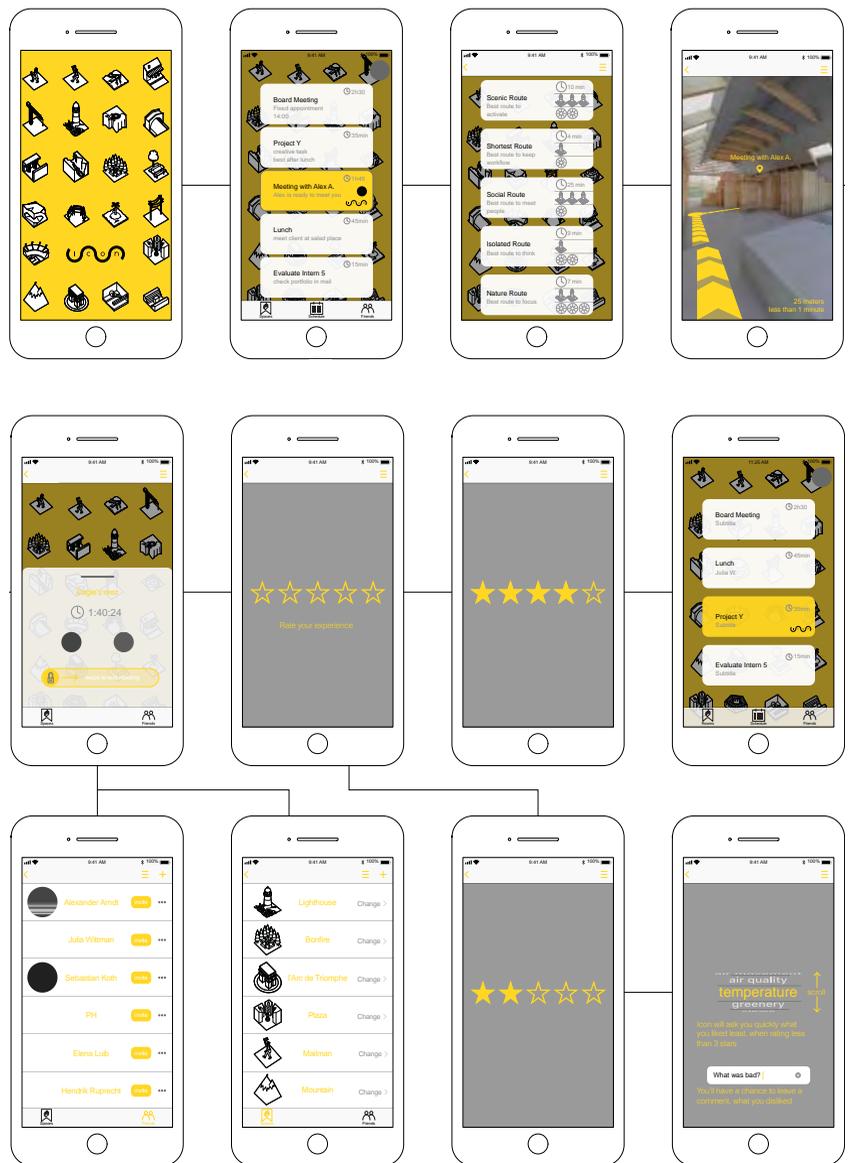
ICON INTERFACE

The Interface branches depict a exemplary usage of ICONs navigation and all its possibility of choosing a route, inviting friends and rating the experience.

INVESTIGATION

In order to collect data for a first database, we examined a contemporary office building in Gröbenzell where we examined indoor climatic conditions and user behaviour.

We focused on two main areas during the investigation, one being the behaviour of the passively cooled building and the other being the users. At building scale, the aim was to investigate the variety of indoor climates within a passively operated building.

During our measurements we were able to record various microclimates, even though the office floor we investigated has a comparatively open plan with a small building depth. Both the facade orientation and the shading and opening elements have significant effects on the interior temperature and brightness. Since the latter are not automated, it offers the possibility to observe the direct consequences of user behaviour on indoor climate. All participants showed changing comfort ratings over the course of the day. This is an indication that uniform indoor climates are contrary to human behaviour.

The extent to which individual preferences influence microclimates was demonstrated by some participants. They closed the external blinds in the morning and sat in a dark room all day without turning the lights on. The measured lux values were significantly below the legal requirements. This means that even extreme environments that are incompatible with today's regulations must be part of an ICON architecture.

Contrary to the assumptions that in classically organized offices only few movements can be registered, underlined by statements of the employees that they would only move rarely, we detected numerous changes of location. ICON therefore utilizes existing movements.

PARTICIPANT 1

82 kg
male
54 years old
175 cm

CEO
29, South-West facade
334 min at desk
ø 2.40
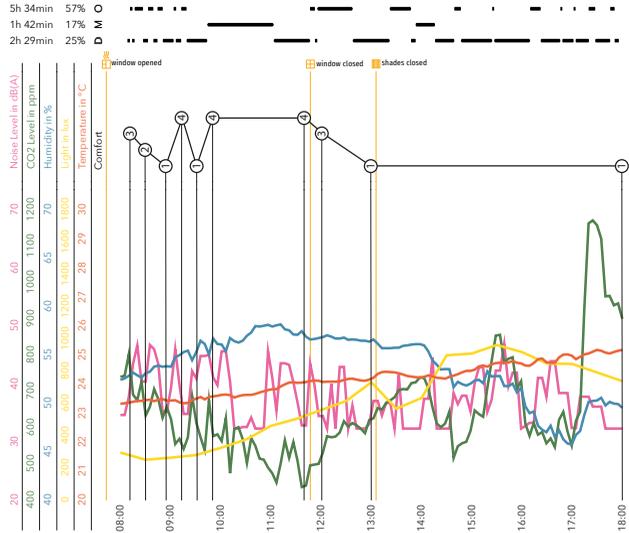
DATA COLLECTION

A total of 10 participants where tracked and 6 rooms underwent measurements. The colorfull graphs show the climate-data the black graph and irregular dotted lines show the comfort and movement of the Participant 1.

SURVEY

Next to the data collection, 25 participants answered the questions shown in the graph as part of a survey, rating different comfort parameters. This helped us to understand differences in comfort perception according to facade orientation.

IMPACT ON ARCHITECTURE

By linking the user-relevant data and creating complex user profiles, it is, for the first time, possible to react intelligently to real requirements that are detached from standards and therefore, to ensure maximum user satisfaction in existing buildings. As already illustrated, ICON offers suggestions for an ideal workplace according to the comfort preferences and the specific daily routine of the user. Hence, it is worth inspecting the quality of these workplaces in closer detail.

The three main influences that significantly define individual comfort are of thermal, visual and acoustical nature. The thermal component is taken care of by ICON. This means that the architecture of the workspaces is influenced primarily by the visual and acoustical parameters. Different work situations, from concentrated and isolated individual work to exposed and dynamic group work, require different environments. We therefore generated a variety of conceptual working typologies that each meet the requirements of a work situation. The purpose of these concepts is to provide the ICON architect with an associative design basis in order to set up a user-oriented space program. The omnipresent goal is to respond to the wishes of all users and to dimension the

spaces norm-independently. Through ICON the architects get to know their users, which includes their daily routines and behavior. Consequently, the spatial program can be detached from assumptions and rigid, partly outdated guidelines. When upscaled, the data and therefore comfort preferences provided by ICON generates a truly human centric, data-based design basis.

THE HANDBOOK

The handbook provides a guideline and delivers strategies for a truly human-centric architectural design approach.
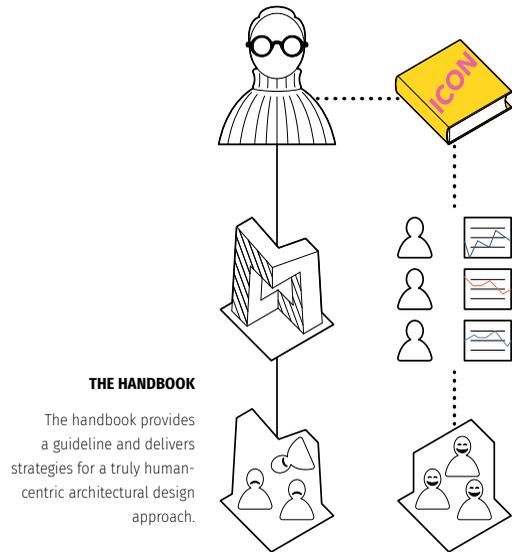
THE MATRIX

The 24 developed concepts of workstations can be clustered into individual, small group and big group work. Defining focused workstations (blue) and communicative (yellow).

Individual		Small Group		Big Group	
Focus	Dynamic	Focus	Dynamic	Focus	Dynamic

This image shows the agent schedules in combination with their comfort preferences at a given day.

Participant 1

Agent A

COLD	COOL	NEUTRAL	WARM	HOT
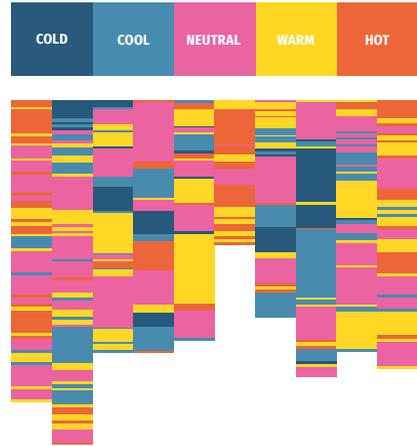
AGENTS

In order to translate these comfort preferences provided by ICON into an adequate architecture, however, we need a component that did not appear in our data collection due to the lack of a user interface: feedback in real time.

We therefore created the agents based on the profiles of the participants and their specific comfort development over the course of the day: Real characters, who were supplemented with associated data and are presented in this manual as stereotypical prototypes - a step that would be carried out by the software itself as a result of the implementation of ICON and thus relieved of the architect.

Their day-dependent schedules, including acoustical, visual and climatic preferences were investigated, since in a user-oriented design, the agents become the central element on which all subsequent decisions and assumptions must be based. Unlike earlier architectural designs, where the user is confronted with the building, the architecture developed by ICON confronts the building with the user - it is entirely based on actual needs, requirements and desires.

In the course of the survey, body specific data such as age and weight were considered. The participants were asked to rate various parameters such as noise, temperature and fresh air according to their preferences. Based on this, the participants were supplemented with as-

AGENT A
CEO
54
175 cm
82 kg

AGENT B
Executive
42
178 cm
87 kg

AGENT C
Jr. Manager
31
183 cm
76 kg

AGENT D
Employee
34
187 cm
82 kg

AGENT E
Jr. Manager
28
167 cm
46 kg

AGENT F
Executive
37
164 cm
65 kg

AGENT G
Assistant
45
167 cm
72 kg

AGENT H
IT
40
183 cm
78 kg

AGENT I
Intern
25
155 cm
42 kg

AGENT J
Office M.
37
167 cm
115 kg

AGENT A

Movement //		
Activity // kitchen	0750	0758
Movement //		
Work // crane	0758	0857
Movement //		
Activity // kitchen	0857	0914
Movement //		
Work // bonfire	0914	0930
Movement //		
Activity // phone call	0930	0931
Movement //		

AGENT B

Movement //		
Activity // walk	0814	0829
Movement //		
Work // mailman	0829	0834
Movement //		
Activity // talk	0834	0838
Movement //		
Work // bridge	0838	0846
Movement //		
Activity // talk	0846	0851
Movement //		
Work // gulch	0851	0907
Movement //		
Activity // talk	0907	0909
Movement //		
Work // igloo	0909	0914
Movement //		
Activity // walk	0914	0920
Movement //		

AGENT C

Movement //		
Activity // kitchen	0900	0910
Movement //		
Work // beergarden	0910	0945
Movement //		
Activity // toilet	0945	0955
Movement //		
Work // cave	0955	1030
Movement //		
Work // beergarden	1030	1135

AGENT D

Movement //		
Work // beergarden	0845	1105

SCHEDULE EXTRACT

The extract presents the agent's daily routines listed in detail, in which the ancillary functions and movements are also located climatically.

sociated parameters and set up as agents in the adjacent figure. In addition to information such as size, age and weight of the agents, which play an important role for ICON in the development of user profiles and can be linked to basic comfort parameters, the adjacent Business Cards of the agents also contain their individual climatic comfort range. Taking a closer look at the Business Cards, we see differing acceptances for the various climates ranging from cold (dark blue) over neutral (pink) to hot (red). These are decisive for the following timetables of the agents.

In order to be able to set up a user-oriented room program including climatic requirements, we need to further investigate the user's wishes. Hence, the timetables of our research participants were translated into the timetables of the agents. They were then supplemented by the previously presented work typologies as well as intermediate activities and movements. In addition, the typologies were adapted to the climatic preferences of the respective agent at a specific point of time. In this model, temperature remains independent from degree values, but is merely based on the building's real-time average temperature and the adaptive theory.

MEANING

So far, user-oriented designs have been based on the analysis of the context of usage and the definition of requirements, but above all on the experience of architects. Users were consequently confronted with the finished building, thus, strongly influencing their behaviour and daily routines. For an architectural design that is truly user-friendly, however, more than just rigid assumptions and dilatory evaluations are required. After all, these have the disadvantage of always having been surveyed at only one specific point in time. They are therefore not adaptive - a disadvantage that can be eliminated today by the linkage of existing data and the implementation of participatory software.

In modern office buildings, building-specific data is collected and tracked around the clock. In this way, the desired climates can be constantly maintained, while intelligent shading systems align themselves with the sun and react to wind. The same applies to the user: thanks to modern technologies such as smart phones and watches, which have long since become an integral part of our everyday lives, movements, pulse, body temperature, calorie consumption and numerous other body-specific data are collected and stored. ICON provides for the linking and effective use of building and body data in order to be able to respond to the preferences of its users while consuming less energy - and to do so in real time. By storing the data, a holistic user profile can be created, including preferences and wishes that depend on the time of day. ICON then predicts the user's behaviour and reacts intelligently to it even before discomfort occurs.

In the long run, ICON would develop an architecture that has the well-being of the individual as its highest goal. Working shifts from a static matter to a dynamic working day and therefore the user's movement is the focal point. This supports activity-based architecture - but resting upon comfort. In addition, a movement-oriented architecture counteracts health damage caused by continuous sitting. Further, it puts the user in direct contact with various colleagues and thus strengthens the sense of communal belonging throughout the office staff.

MOVEMENT

This diagram depicts the shared use of typologies, overlays and intersections of two agent's paths.
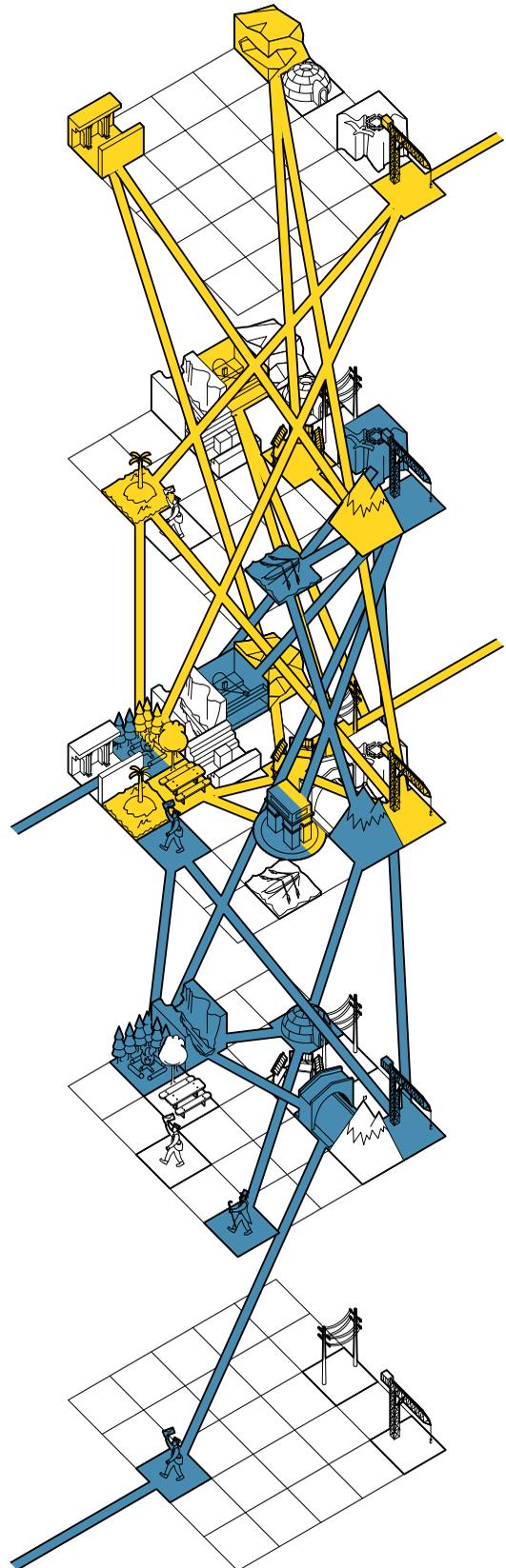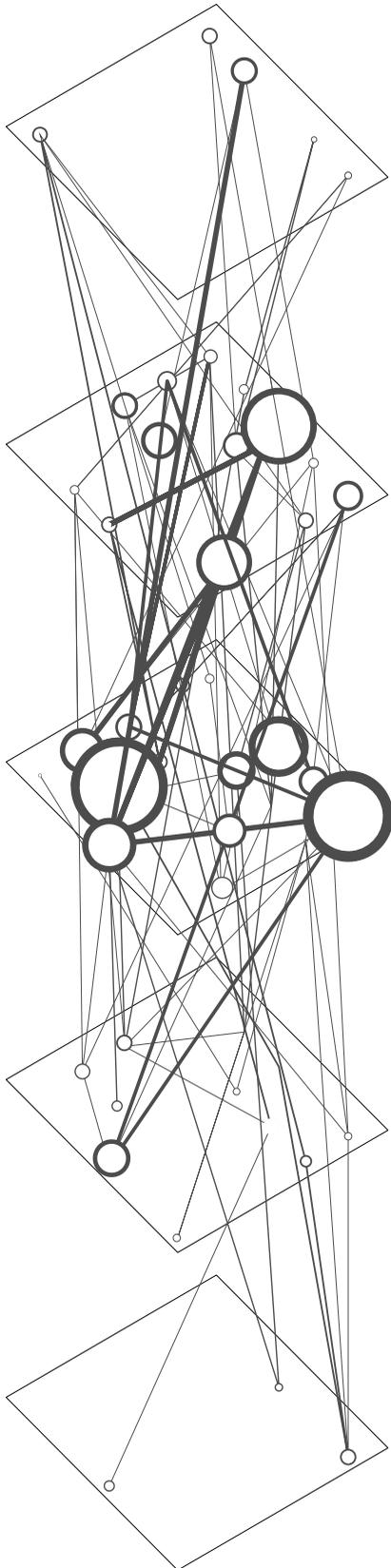
FREQUENCY

When upscaled, by adding all agents to the equation, the movement mapping can generate an understanding of how frequently the typologies are used.
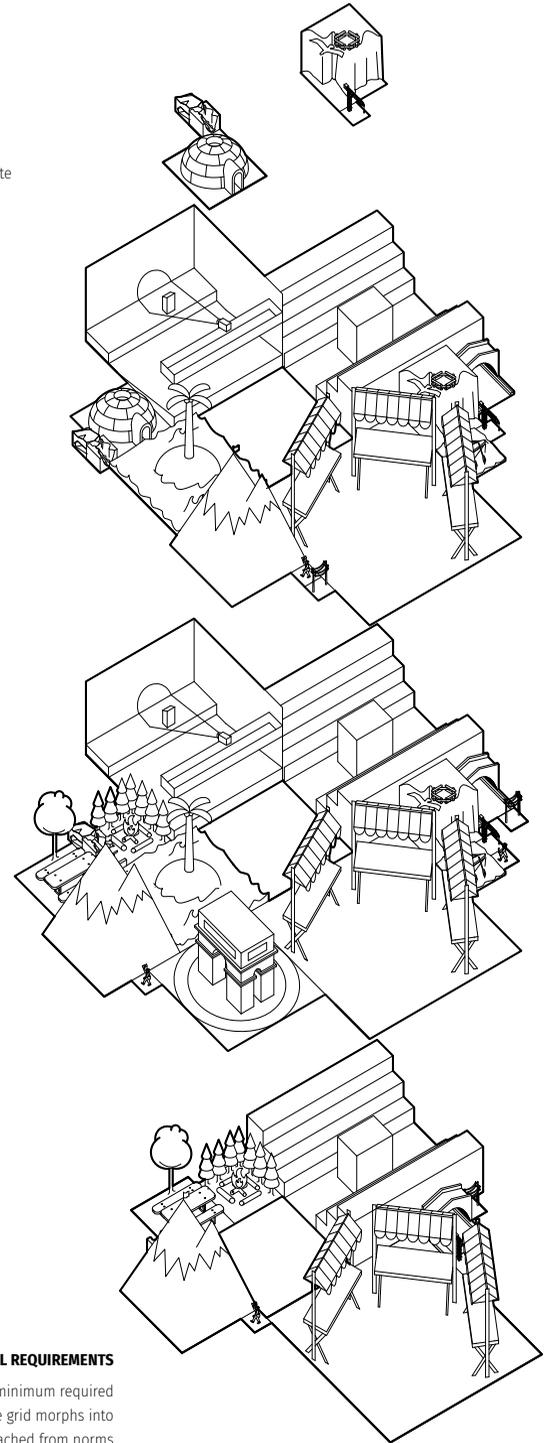
SPATIAL REQUIREMENTS

If calculated according to the minimum required area for short-term stays, the grid morphs into the shown area ratios, detached from norms and guidelines.
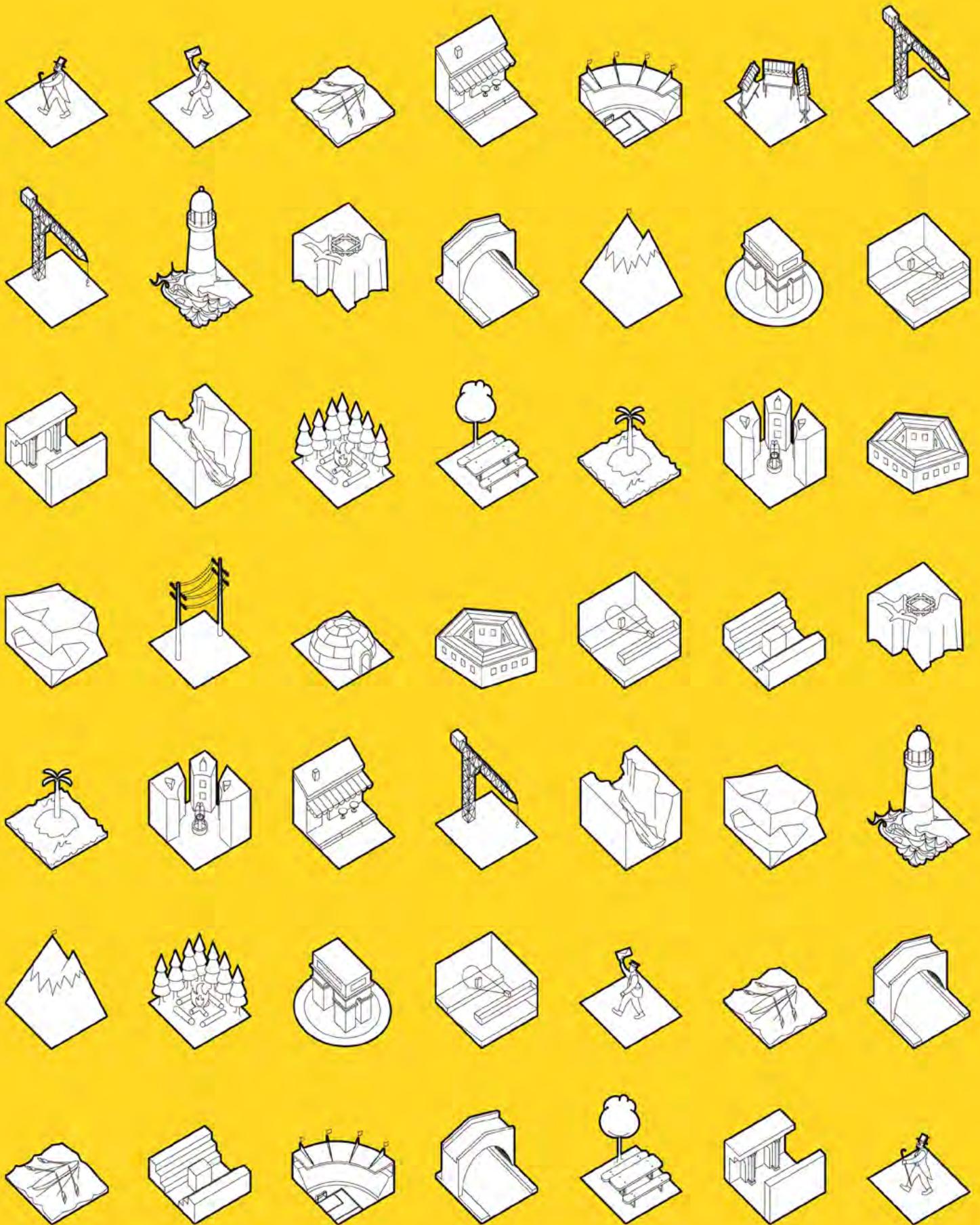
CONVERSATION

with <u>THOMAS AUER</u>, <u>KASPER JENSEN</u> & <u>MICHAEL HELD</u>

Thomas Auer, Kasper Jensen and Michael Held are interviewed on the Future of Workplaces.

<u>**David Selje (DS)**</u>**: How did the idea come up to make a course on this specific topic?**

<u>Thomas Auer (TA)</u>: We are interested in understanding how dynamic conditions can change people's health and well-being. Our environments today are homogeneous: we have homogeneous temperatures, homogeneous light, we have homogeneous acoustics and it is the same with air quality. So the question was, given the fact that people feel different, how we would create rather dynamic environments and whether the people would enjoy these environments. Then of course, if we could distribute and integrate this approach with office environments.

<u>Kasper Jensen (KJ)</u>: Indeed, this course was about researching through experiments and exploring human relations, interactions and comfort was the starting point. We started in a scale where we can understand the interaction, and then went into a 1:1 exploration. So the concept has been to start from the inside, start from the theory and put it into practice directly.

<u>Michael Held (MH)</u>: It is a very interesting topic. Temperature, lighting and climatisation are always in the top 3-5 complaints in any office. It is always something that is a problem, and lately becoming an even bigger problem because people now have to respond faster, collaborate more, yet at the same time find themselves in need of quiet areas to do their own focused work – so it is quite challenging to put all of these things together in the kind of static environments we have today. Also, from the well-being perspective, we know that static environments do not require the body to change – you can buy the perfect chair and sit on it for eight hours a day and it will not be so great, on the other hand if you change your posture and the way you sit frequently, you will be healthier and you will feel better. I think in the same way, diverse lighting and acoustics contribute to overall well-being in a similar way. This is something we also validated from feedback from customers, architects and designers, and several studies support this approach as well.

QUESTIONNAIRES BY TEAM WORKSCAPES

During the studio, students were required to build 1:1 mock-ups, test them in different scenarios and get user feedback in order to re-evaluate their designs.

> **Sandra Persiani (SP): What is for you the main innovation this studio has introduced in terms of method or content?**

KJ: In 3XN we know that architecture shapes behaviour. We have seen in some projects how we can get people to explore space, how people connect, how to stimulate curiosity. But we also know that behaviour shapes architecture. In that way, some of these ideas have been scaled-up this semester at TUM, and it has been quite amazing. This is taking your own medicine - which in this case is made by the students, so that is quite interesting.

TA: What was very different in terms of education and teaching in this studio was that it was very much related to hands on mock-ups, testing and experiments. Also doing experiments in the scale 1:1 where students were able to do tests with people, do questionnaires, get feedback, use the feedback – let's say not on a statistically relevant level but on an approach that is also research related. That was very different from previous studios we did: our studios were always computationally, therefore more numerically driven – this time it was about mock-ups, testing and hands-on experiments. This was very innovative for us and very interesting to see.

MH: That's also the aspect that I really liked about it, it's not just because as a designer it's maybe closer to what I do, but I love how user-focused the students were approaching their questions and really had to build prototypes, had to test them, had to learn from that. I think it is a more humbling exercise than relying purely on data, I think of course you need the rational, factual side of things as well; but if you are blind to believe it, you will probably not going to be successful. I think you always have to have open eyes for reality and talk to your users and customers and work with them to find a solution that is most suitable for them. I think it was very close to classical design-thinking processes, with lots of iterations, lots of prototyping, hypotheses that need to be validated and refined until we come to one where we believe it is good enough to present it. Projects are never finished. »

" *...lots of iterations, lots of prototyping, hypotheses that need to be validated and refined until we come to one where we believe it is good enough to present it. Projects are never finished.*

DS: What is the interest of working practice or academia in the studio context?

TA: I think it is very important for students to relate their work to the real world and to have studios, which are also related to research. I think it is very important that students, especially in architecture, start to recognize that a university also has a scientific aspect in academia that it is not only about teaching. In our case, our research is about understanding well-being and understanding environmental quality – architecture is all about environmental quality. We build spaces for people, so it is very important that we have this kind of human-centric approach. There is a lot of research going on at TUM and in the world, and I think it is very important for us to expose students also to this aspect of the university, but at the same time we cannot disconnect them from what is going on in practice. Architecture somehow is always applied research, so if we are not capable of bringing things together, it is then just for paper - it becomes meaningless.

...our research is about understanding well-being and understanding environmental quality – architecture is all about environmental quality. We build spaces for people, so it is very important that we have this kind of human-centric approach. 🙶

FIELD STUDY BY TEAM ICON

In order to document human behaviour in existing offices, some teams examined real workspaces. On the left is seen a sankey path-diagram by team ICON, showing people's movements throughout an entire day.

This study helped the team reveal how much time people actually spend sitting on their desks, and doing other activities. The proportion of time spent on different activities led the team to rethink the spatial distribution and network.

KI: I think current practice really is trying to add new layers to how we approach architecture. We have always been able to solve and rethink the brief and come up with new ideas – but the challenge to add the way we behave, interact or feel is tough for an architectural practice running for competitions and commissions. So the possibility to take that departing point has been really unique.

MH: For me, it is interesting to experience different ways of thinking. There are many students that have a slightly different approach from what I am confronted every day, some are quite similar, some are very different, so I think it is refreshing. For long time we regarded everything that is built as built-in-stone, as something final. Bu now as a company we think more about our spaces as a prototype, because we know it's not going to be perfect forever and we know it is the best we could achieve at the time of planning but once you move in, we already know that we have to change stuff, we have to continuously learn. That is what I previously meant a little bit by "humbling experience" – it is similar to the projects of the students. Maybe at start they were thinking that they could come up with an idea, and build it, and it is this perfect thing that you take photos of like you want to see in the magazines, and everybody wants to talk about it. But who cares if the people who have to go there every day and work there, or live there don't feel the same way? So in the end of the day it is more important for the people who actually use it how they feel about it rather than other people in their own function critique.

TA: It is like in architecture: There is architecture which is only loved by architects.

MH: There is value in that too, every function has to develop. But it's a great experience to just have these different types of ideas and focus on the actual people. »

EXPERIENCE YOUR OWN DESIGN

Students were encouraged to be part of their own experiments at some point, so that they could identify with future users of their creations.

On the right is seen team SymBio, having a group meeting in their own 1:1 mock-up.

Bilge Kobas (BK): What is your own experience of office spaces? What would you change?

MH: For the past ten years, I did not have my own desk and I did not feel like I wanted one. I need my work tools and I need my data or a notebook to write in, but apart from that, I can work anywhere. I think it is recognition of personal freedom that also allows me to leave the office and work somewhere else without being not productive. So this whole "I have to be present and I need to sit at this desk in order to do this kind of work" approach is something that I find far too limiting - my personality doesn't really fit this. When I am in a company that works like that, I think I would be unable to work. Today obviously in offices what I think needs to change the most is that people recognize that they have freedom and they can use space in a different way than just the prescribed way. I think the biggest problem today is not so much "is this the right or the wrong furniture", it's that a lot of the furniture in the space is static and only allows you to use them in particular ways and usually people get comfortable and they conform to the space rather than saying "this doesn't work, let's change it". This is the thing that holds us back the most.

TA: It's more like coping.

MH: Yeah coping! Because it is such a passive thing, nobody is listening to me anyway, I am just going to shut up and do my thing.

TA: And the interesting thing if you do post-occupancy survey it starts to embarrass you, when you recognize that almost half the people at certain points in time start to feel unhappy in your building. It's not a small percentage...

MH: Even if we look at engagement levels in companies, how engaged you are when you work, I really think this has to do with education how we bring up people, how much confidence you give them. Many people just do not have a lot of confidence in their ability to change much; they all respect this kind of coping thing. But then obviously there are people, companies or teams that are different and those I think are really refreshing and this is when then others say "why are they doing this?". This, thinking for themselves and trying and making mistakes and learning from

...usually people get comfortable and they conform to the space rather than saying "this doesn't work, let's change it". This is the thing that holds us back the most. 🙶

> *How we work is not just about the content of the work, but actually how we do things.*

these and improving over time, I think is something really needs to happen more at work. How we work is not just about the content of the work, but actually how we do things.

TA: I am biased as well, as everybody, when it comes to this question. I also do not have a desk in my office anymore, I gave it up, around five years ago and I do not miss it. I have my office here at the university, but it is the most underutilized space we have. And the funny thing is that my most efficient work-time I have every week is when I'm on the train. Efficient in terms of getting things done: we always consider the other work being inefficient, but of course, when I get to the office or when I get here to the Chair, there are many people who want to speak to me. I come home in the evening and think about what have I done today, what have I produced, but this is also very efficient and important work! So the question really comes back to, what kind of environment do we need to work? If I relate it to me, I don't need a desk, I only need an environment where I can meet and interact with people.

DS: Is the train environment so special because you don't have any social interaction?
TA: Nobody can call me, that's the first thing. Reception is so bad I can't use the cellphone. That's already good. And you have this kind of background noise that works like white noise and I'm not sensitive when it comes to this kind of background noise. I go crazy if somebody is on the phone behind me, when I start to understand when I get the audibility I understand what people talk about, then I'll take my headphones but for whatever reason this is always very productive, two hours train ride, nothing else.

MH: That`s one of the reasons why people like to work in Starbucks and other coffee shops: anonymity. People don't know you so there is no judgment, nobody is looking, and there is this background noise which in the office sometimes can be quite disturbing, but in public spaces allows you to focus because you know that you don't have to pay attention, there is nothing interesting happening next to you, unless somebody talks in a way that you start to understand the words. Then it starts to become problematic, it's tricky, because you can't turn them off. Your eyes you can always close, but the ears are hard. »

SP: What are the challenges in the current practice to adopting a more human-centric approach?

MH: I think it's tricky because human-centric as a word is already tricky. There are many people who write the rules about how work should happen; they probably think they are very human-centric, because they want to protect workers. A lot of this today comes from a time when children were sent into mines, and we said, "No, children have a right for education, people have to be protective". That's why we have 400lx on the work surfaces, otherwise you go blind, if your employer only gives you candles or something. But we also have to recognize that we are not in a world like this anymore, we are not in a world of scarcity and abusive employers. Most employers today are happy if you work for them, they have a hard time getting good people. Many of these problems do not exist anymore, so human-centric today does not mean just to understand what the human in average needs, the ergonomic human factors, what is the medium, the best average for that percentile – it is now more becoming individualized, personalized, being really human, recognizing a person first and the corporation later.

TA: Absolutely right! For the past hundred years we always thought about minimum standards – what are the minimum standards that we have to provide? And now suddenly it is about excitement: can we create spaces that create excitement for the user? So it goes beyond minimum standards, it is very different. When you look at the pure numbers of productivity, then you see how important it is. But at the same time we, in terms of thermal comfort, always thought

...we are not in a world of scarcity and abusive employers... so human-centric today does not mean just to understand what the human in average needs, what is the medium, the best average for that percentile – it is now more becoming individualized, personalized, being really human; recognizing a person first and the corporation later. "
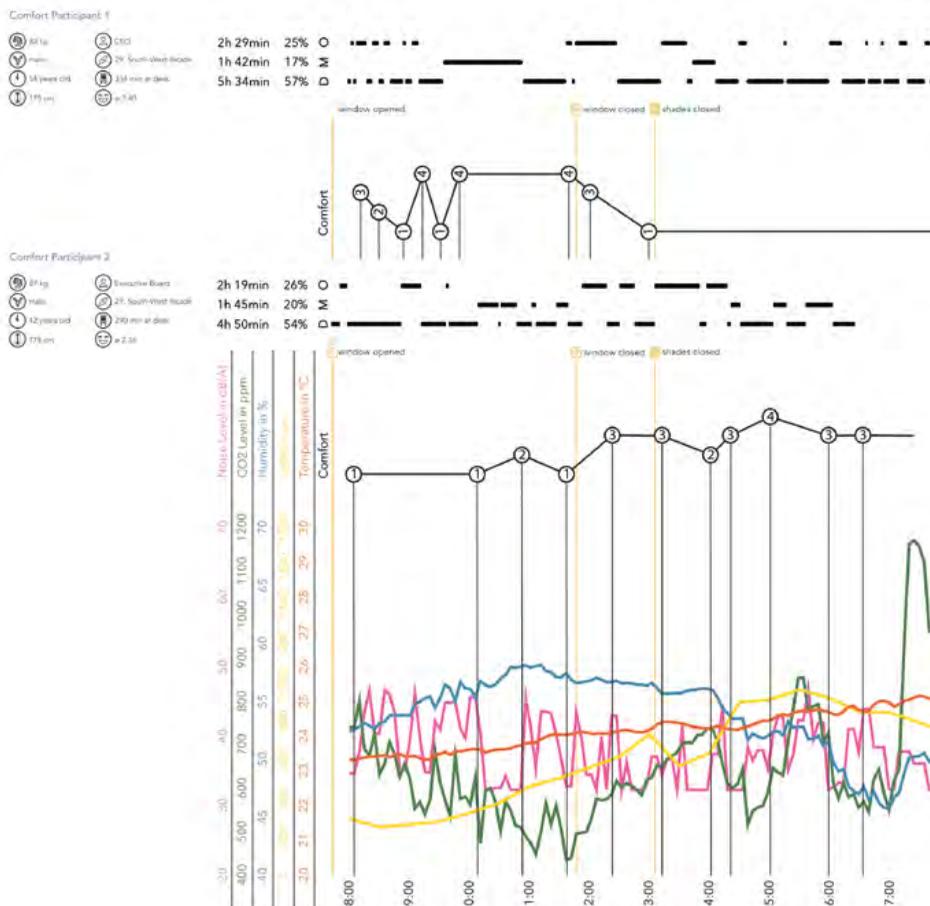
WHOSE COMFORT?

Through measuring and reverse engineering real-life situations, the students had the chance to see the wide range of comfort conditions and how they can change per each individual. On the left is a graph showing one individual's self reported comfort levels and comfort-related actions, plotted against measured indoor climatic conditions. Graph by team ICON.

about minimum thermal comfort but now all of a sudden we talk about thermal sensation, but we have no understanding of what thermal sensation can mean. What do people enjoy; to what extent, and so on. We know that people love the sauna but we don't want to design a sauna in an office. What are these kind of dynamic environments people would really consider exciting? We still do not know and that is why we need this kind of research and tap research into education.

MH: I love the maximum standards in spaces for excitement.

KJ: Another aspect relates to technology, which many of the projects have briefly discussed. I think we will see a future with a lot more data and feedback from our buildings. I think in the future we will see the buildings as a part of an ongoing relationship rather than masterpieces, so I hope that the architects will stay with the buildings and engage with the users, and keep developing after delivering the key and having the opening ceremony.

BK: How is the outcome of the studio compared to your expectations and did it affect your visions?
TA: We gave the students a lot of tasks, a lot of challenges to solve so therefore some aspects got a little lost on the way, which was very normal. So for us I think it was still a very positive, very good results, very exciting, very good studio, very good students. But now we need to take it to a next level, but the next level cannot happen in a studio environment. It must happen on a research level.

MH: I was quite excited about the level of energy, how much work they put into it, especially in the last few weeks, some of them really evolved their projects until the last moment. A few really really good ideas and they were all worthy of dialogue in the real world because those are really the things that are discussed and that people are excited about. I think a lot of the approaches are things that we haven't quite figured out yet.

KJ: I guess the best output is the one we cannot predict – and I had not predicted this being so much about exploring human scale. We have seen students being excited about making 1:1 mock-ups to understand the effects and importance of design. I had imagined this to be way more technical – so this was quite emotional. I assumed this would be much more about lux levels, decibels, Celsius degrees; but I think also that was quite revealing that human perception was a driving factor behind the students' works.

What is the next step?
TA: Research, applying it to bigger mock-ups. ✖

> **❝ I think in the future we will see the buildings as a part of an ongoing relationship rather than masterpieces... the architects will stay with the buildings and engage with the users, and keep developing after delivering the key and having the opening ceremony.**

CREDITS

and THANKS

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