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HOUSING HUMANS

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Housing Humans

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ABSTRACT

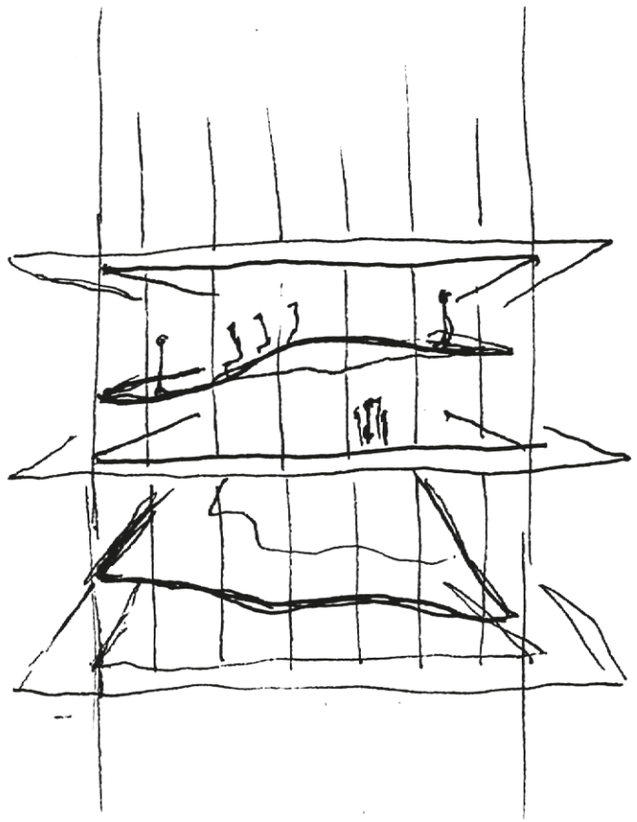
We are animals. The most cognitive developed animal we know of and the current master of this planet, but still, an animal. Like other animals we developed during a vast period of time slowly adapting to our surroundings in directions that gave us the best conditions to thrive. We acquired a natural habitat, a combination of environmental elements that when present has positive effect on us.

Recently we started shaping our own surroundings leaving our innate preferences for habitats behind. The contemporary urban life of single households in compact apartments has very little in common with the environments and lifestyles during our billion years of development. This deviation is suggested to have negative impact on mental health and quality of life.

This thesis questions the contemporary building typologies and its inadequate support for human needs. By referencing research on human behaviour within neuroscience, psychology and physiology a couple of human needs crucial to psychological wellbeing are defined. The needs are translated into architectural principles and digital design tools used to guide and optimise the design of a psychologically sustainable living space.

The aim of this work is to shed light on the importance of designing with the human brain in mind. By bridging the gap between scientific research and architectural practice a greater understanding of how architecture is perceived by the human brain is achieved.

The architectural principles and design tools developed are here used to design a living space in a contemporary urban context. The result argues that a more psychologically sustainable living space can be realised when questioning the current norms of living and introducing scientific research in the design.



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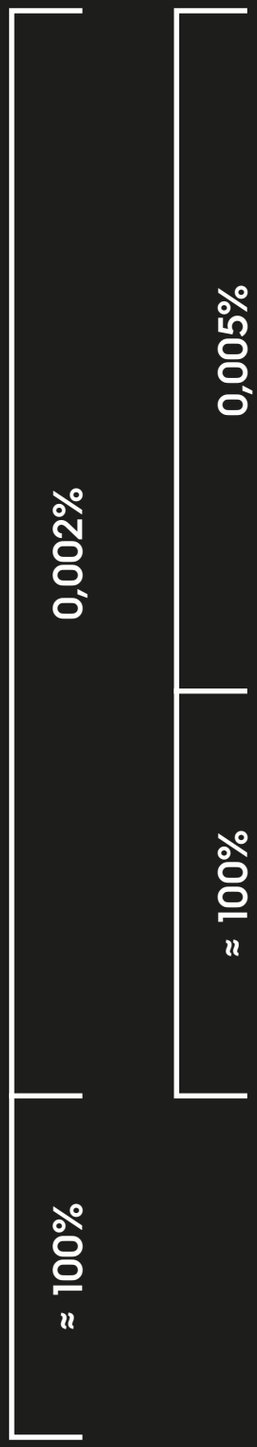
1. PERSPECTIVE

THE EVER-CHANGING IDEA OF NORMAL



0 **Today**
Humans are striving for independency

200 **The Industrial Revolution**
Family and community is replaced by state and market

500 **The Scientific Revolution**
Humans acknowledge their ignorance, birth of capitalism

2 500 **Politics and Belief**
Societies share a universal politic order and belief

5 000 **Writing and Money**
First kingdoms are formed

12 000 **The Agricultural Revolution**
First permanent settlements

70 000 **The Cognitive Revolution**
Humans express fictive ideas in language

200 000 **Homo Sapiens**
Appears in East Africa, other species of Homo have spread across the planet

2 500 000 **The Genus Homo**
Developed from the ape genus Australopithecus in Africa

4 500 000 000 **Planet Earth**
Atoms and molecules forms organisms

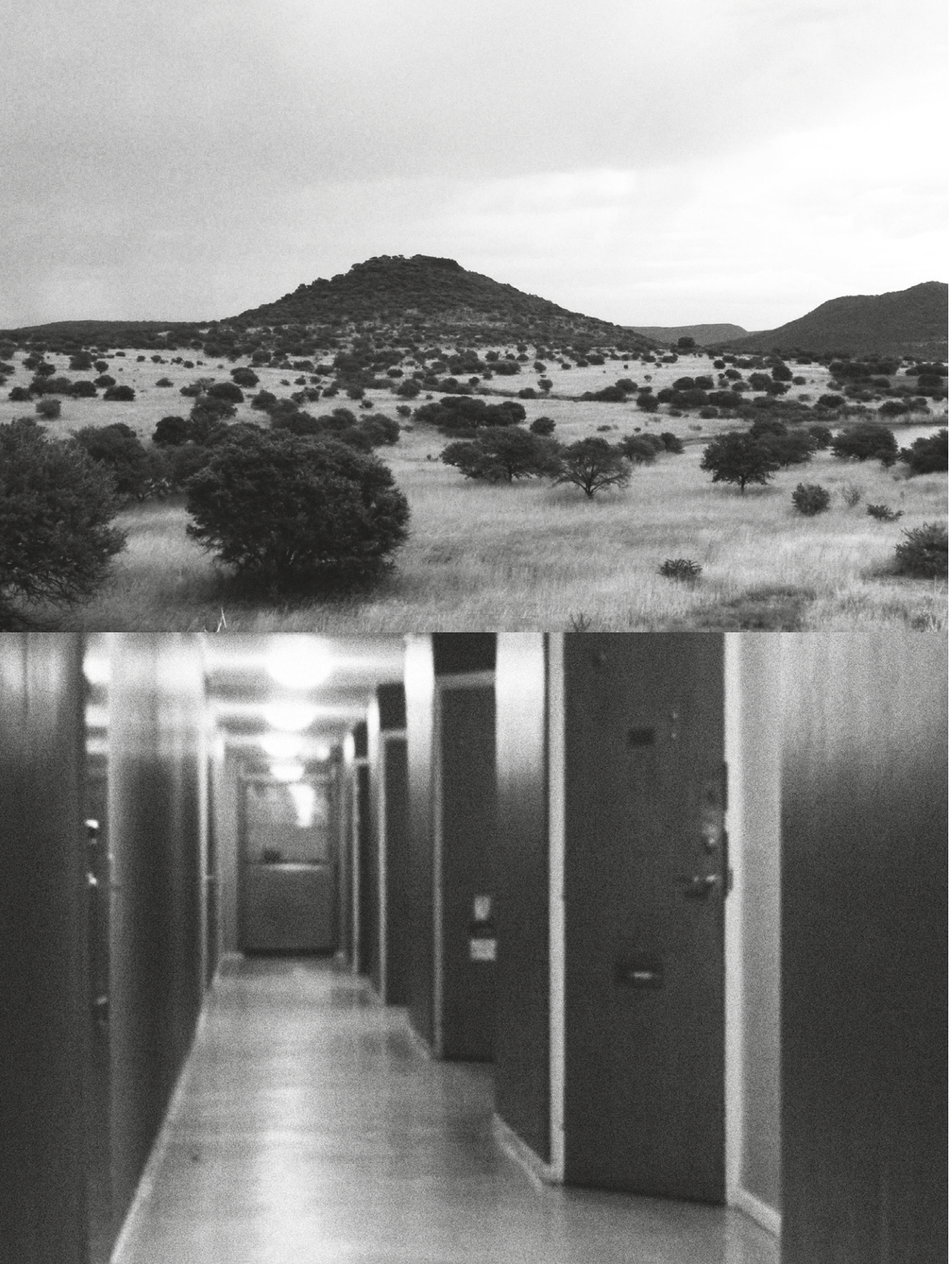
13 500 000 000 **Big Bang**
Matter, space, time, energy, atoms and molecules

When thinking of our way of living in western societies it is easy to assume we are doing it right. That this is how it has always been and how it always will be. Living in small apartments in dense cities alone or with your partner and perhaps children. On weekdays you go to work, on weekends you are free. We have come up with a system, a norm, and as long as you are part of it, you are safe.

However, looking at the history of not only humans but universe itself can make you question this made up answer to how one is supposed to live one's life. Our earth and its inhabitants have been in constant development for billions of years whereas humans first appeared quite recently. During our rapid two and a half million years of existence we have made several discoveries that came to drastically change our ideas about what is normal (Harari 2012).

We have repeatedly changed our eating habits, how we form families and engage with relatives, our approach to time, our belief and even our interest in progress itself. A positive change of one habit inevitably led to the change of others, sometimes without reflecting over the outcome. Discovering agriculture made us live in permanent settlements and as social welfare systems grow stronger close relations to relatives have become less important.

Do what we consider normal today represent the most suitable lifestyle for human beings or is it the result of endless coincidences occurring over millions of years?



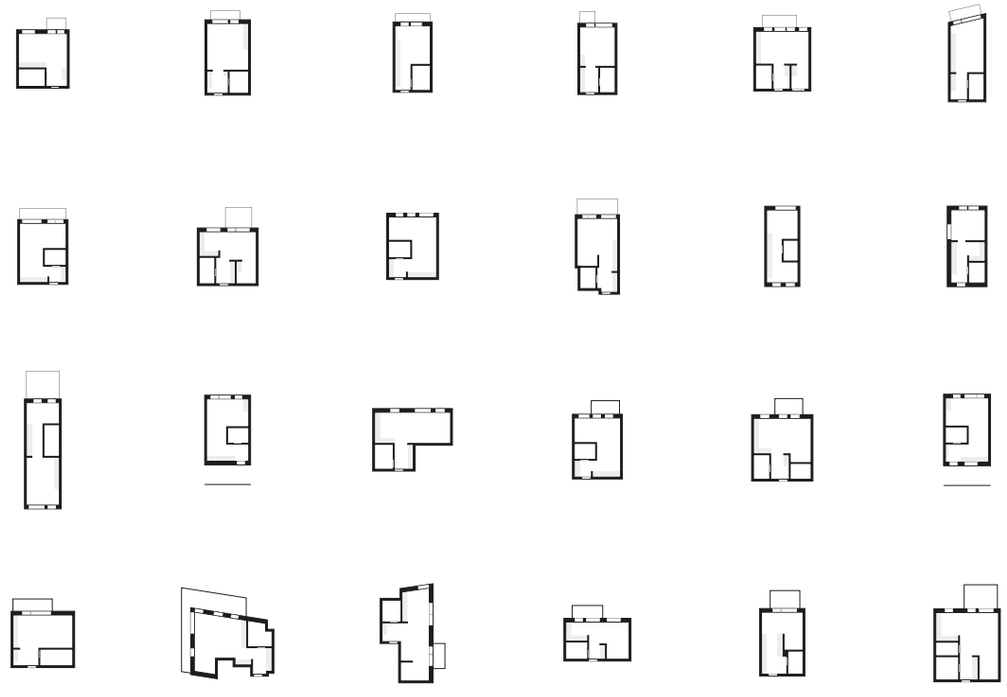
CONTRASTING REALITIES

A couple of thousand years ago we spent our lives outside. We where living on the African savannah and had been doing so for some million years. A vast period of time which formed the modern human and its brain (Eberhard 2009). The time we have been sitting inside our apartments and offices is negligible compared to that.

The evolutionary human is basically the same today as it was then meaning we have the same needs now as we had then. Adapting to new situations takes more than a couple of thousand years. Cultural norms have come and gone but we still psychologically perceive and react to our surroundings through the filters of a human of the savannah.

Our need for social interaction, endorsement and safety to name a few all relates to the lifestyle of that distant period and where developed to increase our chances of survival. Unfulfilled needs still today evoke negative reactions while a content need evokes positive reactions that may increase our sense of wellbeing.

The daily life on the savannah shaped our innate needs and guided us through life. For millions of years we lived in harmony with our needs. The drastic change of lifestyle during the last couple of thousand years have left us in situations where we are in discord with our needs. The independent urban life of office work striving for self-realisation while living in introvert apartment blocks may be fulfilling in regards to the current cultural norms but not ideal considering our innate needs.



A WELFARE STATE OF STACKED BOXES

Sweden accelerated the move towards individual independency in the 1970's by introducing extensive political ideas about social welfare. Former prime minister Olof Palme said: "Each person shall be treated as an independent individual and not as an appendage of a provider. Economical and social conditions have to be constituted that make individuals self-sufficient".

While paving way for increased gender equality the ideas are also claimed to be one of the reasons behind Swedens high share of single households (Gandini 2015). Today almost 40% of all Swedish households are single households. We have become self-sufficient individuals able to go through life without the economical support or collective efforts of friends and family. Whatever happens in life the social welfare systems will now take care of you.

While our innate needs have yet to adapt to this new lifestyle the building industry is on top of it. The increasing demand for apartments aimed at single households and the densification of urban areas have triggered a trend of space efficient layouts only meeting the bare minimum building regulations. Along with current production constraints this results in a limited set of apartment designs being produced, rarely considering any of our psychological needs.

The standard single household apartment is a 35 square meter box including a kitchen, bathroom and hallway, all painted in white. The residual space is referred to as the living room and supposed to house the rest of our daily activities. The apartments are often facing one direction and accessed through a cramp stairwell making them introvert by default.

The luxury of independency and privacy has become a curse of loneliness and spatial monotony.

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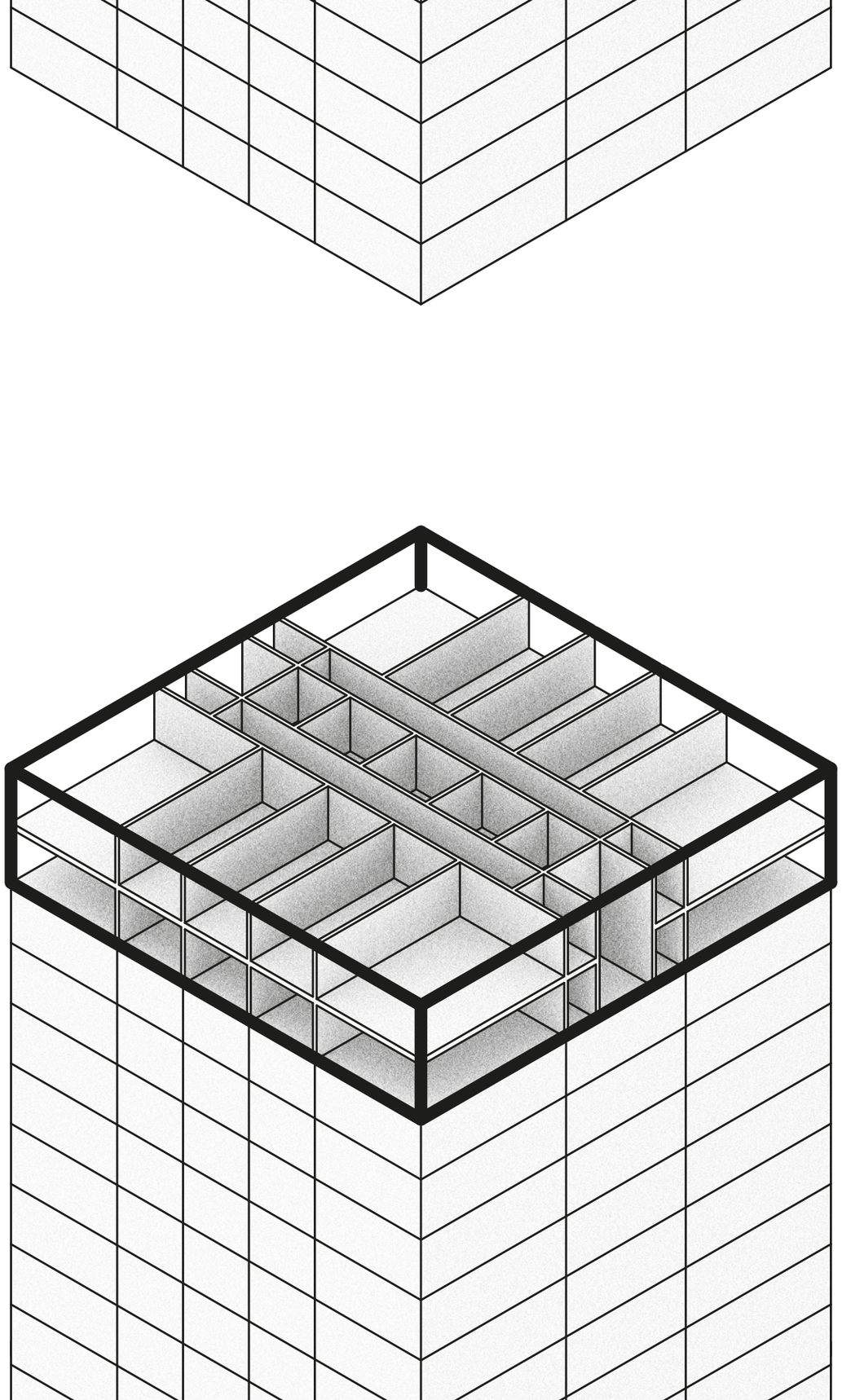
1.3 Present



SHORT-TERM INTERESTS

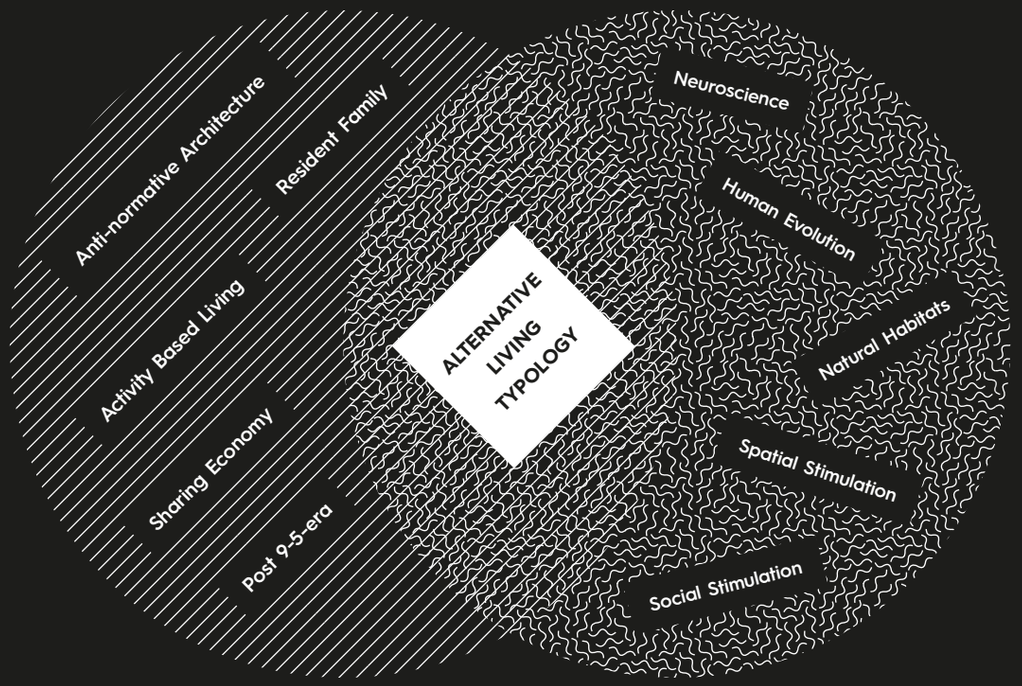
Are we on a path towards complete isolation? Developers are enjoying the high revenue of compact apartments without considering any long-term effects of what is being built. There are now large scale developments focusing entirely on single dwellers as the two residential skyscrapers Tellus Towers at Telefonplan in Stockholm (SSM, 2017). The project will consist of almost 1300 apartments of 1-2 rooms each applying the standard concept of introvert isolated boxes advertised as ”Dwell smaller, live larger”.

Projects like this raises many questions. Is it sound to deliberately create highly concentrated blocks with little chance of economical or social diversity? And is it sustainable to raise concrete towers tailored to current cultural norms without knowing the norms of tomorrow? Regardless the developers incitement, these are questions a conscious architect is responsible to reflect upon.

We have learned throughout history that norms change, that they are ideas reflecting our current way of living. What will happen to projects like Tellus Towers then? Will it be demolished and replaced by another norm-tailored project or will it survive at the expense of our ability to live in larger groups? The homogenous housing market might create an abundance of isolated boxes forcing us to live alone even as norms are changing. This has to stop.

As the understanding of our innate human needs increases an alternative to norm-focused architectural design emerges. What if we set our ever-changing norms of living aside and instead designed our environments to mainly support our needs? By rather creating preconditions for wellbeing we might ensure the usefulness of what is built far beyond the existence of a specific norm while avoiding repressive architectural structures.

2. RESEARCH



A DISCOURSE BEYOND NORMS

A new direction of architecture with emphasise on psychological needs rather than cultural norms force the profession to look beyond its own field of knowledge. We are used to rely on our intuition as artists to guide us when creating environments with certain spatial qualities but as other sciences progress we have to stay alert.

To confidently claim the impact of the buildings we design requires a profound understanding of the relation between brain and space. Only then can we be assured that the spaces we design are psychologically sustainable and supports our innate needs. The emerging interdisciplinary field of architecture and neuroscience is researching what spatial features that triggers specific behaviours creating new knowledge elementary to the architectural profession. This will increase the understanding of our innate needs and how they relate to architecture and our resulting wellbeing.

To advance the field of architecture takes more than applying new knowledge on top of existing normative structures. The real progress will come first when you question common routines of living, working, loving and possessing and use the acquired knowledge to guide you to new answers.

This chapter will introduce theories of humans innate relation to environments written by biologists, geographers and architects that become more and more relevant as they gain support by neuroscience. The chapter will also start finding answers to this works two main research questions:

How can an anti-normative approach to living create environments that better support our innate human needs?

How can research conclusions on psychological wellbeing inform an architectural design process?

BORN GENIUS OR INNATE INTUITION

The importance of understanding in what environments and lifestyles our brains developed, as previously discussed, was emphasised by biologist Edward O. Wilson (1984). He introduced theories about the need for humans to connect with nature and other forms of life relating to our vast evolutionary development. Emotional reactions to parameters like weather, landscape and the presence of plants and animals that used to define our chance of survival where suggested to still affect our sense of wellbeing.

Similar ideas had been introduced by the contemporary geographer Jay Appleton (1975) whose prospect-refugee theory suggested that humans inferior physics made us rely heavily on survival tactics based on how we positioned ourselves in the landscape. The criticised theory references our ability to find safety while looking out for intruders (Dosen & Ostwald, 2016). Situations with good outlooks are described as open, well lit and elevated allowing us to surprise the animal we hunt. Places for safety and refugee are hidden, dark with obstructed views from one or two sides. The prospect-refugee theory suggests we prefer to see without being seen.

Architectural historian Grant Hildebrand translates Appleton's theories to the built environment focusing on the works of Frank Lloyd Wright (Hildebrand, 1991). Hildebrand claims that Wright, intentionally or not, designed according to the prospect-refugee theory. Abstractions of the relation between open landscapes and dark woods, outlooks and safe places, are often occurring with the use of deep niches, long overhanging roofs and heavy materials creating a calm and private atmosphere while extensive use of windows provide visual control over the surroundings. All of which are reoccurring features of Wright's Robie House from 1909 shown on the adjacent page.

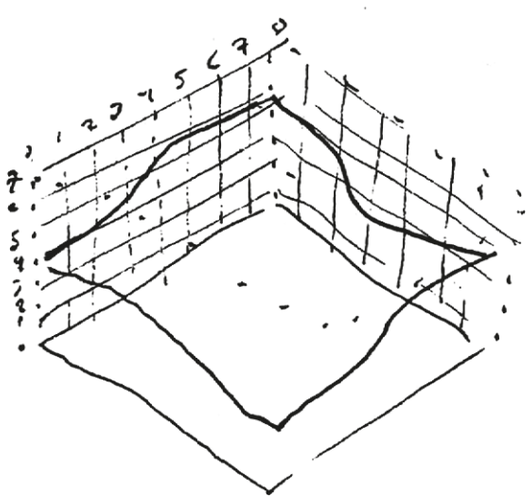
ACTIVITY BASED LIVING AND WORKING

While Wright developed design principles relating to our innate needs his partner Rudolf Schindler made works that questioned the normative way of living still relevant today. The Schindler House is a cooperative living and working space for two couples built in 1922. Instead of traditional rooms for sleeping, eating, working etc. the house is made up of four studios and a utility room for cooking and laundry with an additional guest room. Each member have their own studio where daily activities takes place and a rooftop sleeping basket shared with their partner.

The floor plan of The Schindler House draw on Wright's design principles. Solid walls shields of views and creates a safe environment while a fully glazed wall brings outlooks to every room. Schindler has been said to design "as if there had never been houses before", a mindset that seems very distant in todays normative building industry (Lunenfeld, 2008).

Although driven by economic incitements of efficiency the design of office spaces is however in constant development. The resource demanding and private cubicle was replaced by the more space efficient open landscape which is now about to be superseded by activity based workplaces where workers move around the office during the day using the environment most suitable to their current task.

To confidently design environments that support the current activity, whether it be sleeping, reading or talking, architects have to gain new knowledge from outside their own field.



ACADEMY OF NEUROSCIENCE FOR ARCHITECTURE

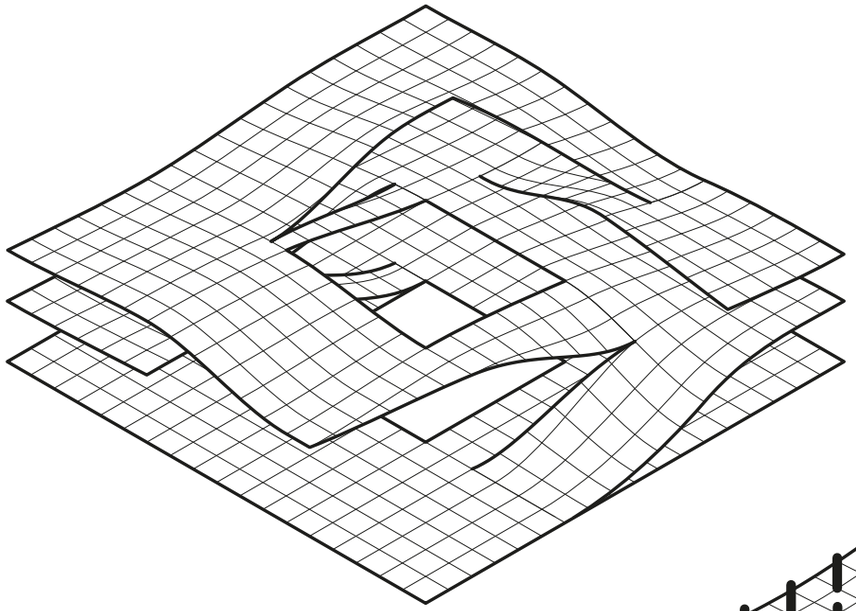
German dramatist Bertolt Brecht wrote in his play Galileo that "The aim of science is not to open the door to infinite wisdom, but to set a limit to infinite error". Brecht was later quoted by John P. Eberhard in his book Brain Landscape where he makes one of the first attempts to hypothesise on the benefits of interdisciplinary work including architecture and neuroscience (Eberhard, 2009).

Eberhard also founded the Academy of Neuroscience for Architecture (ANFA) as a platform for sharing knowledge on human responses to the built environment. The conference "Connections - Bridgesynapses" hosted by ANFA at Salk Institute of Biological Studies in San Diego in September 2016 gathered scientists, architects, artists and philosophers to present and discuss new research findings relating to the field.

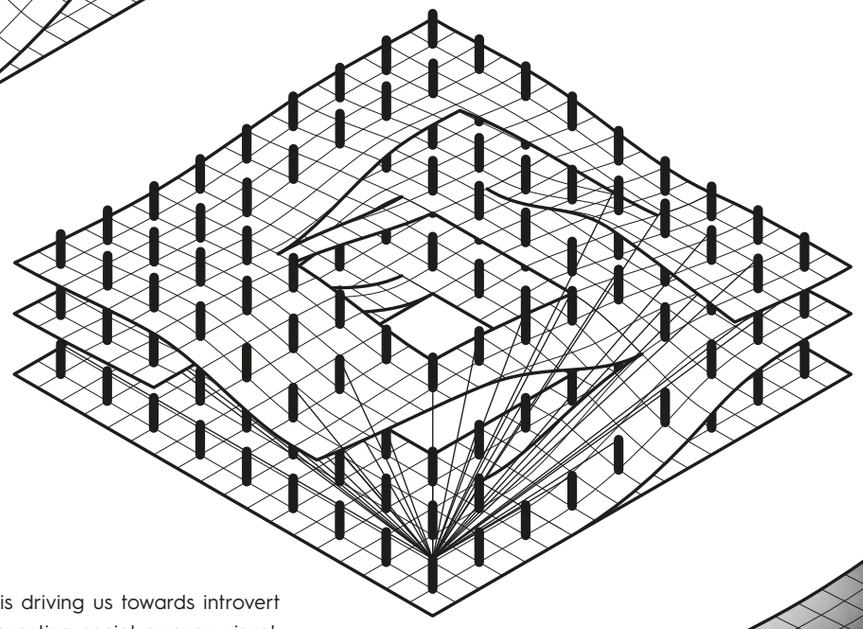
The conference covered a field consisting of an increasing amount of research on how architecture and its spatial and social qualities affects humans both psychologically and physiologically. Creativity, anxiety and sense of wellbeing are just some of the parameters being studied. This knowledge has the potential to revolutionise the way we shape our surroundings but the progress is slow. There is a gap, a missing link between science and practise. For this knowledge to be practically useful there needs to be new tools and design methods developed.

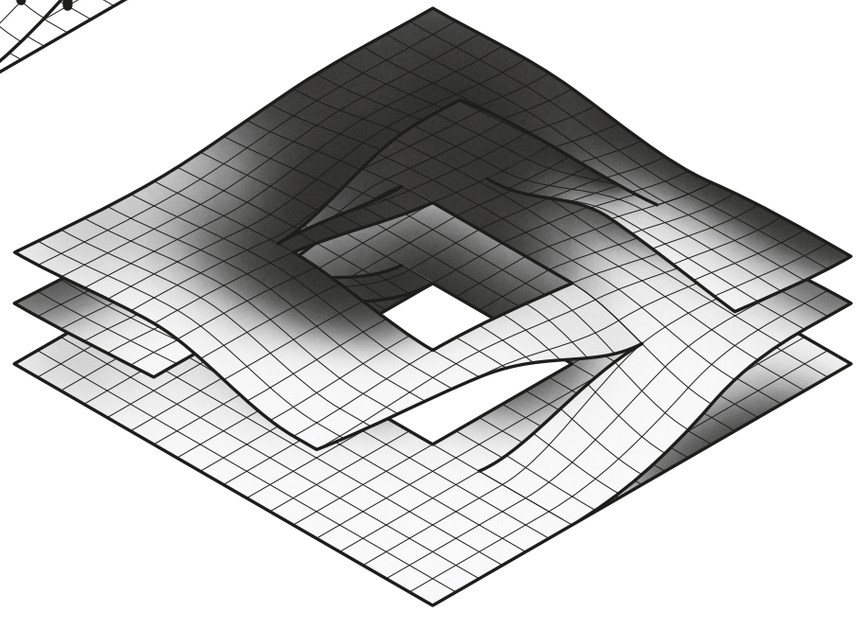
The following spread summarises five recently published articles from this field with conclusions highly relevant to the architectural profession. The researchers conclusions are translated into architectural applications to guide design processes focusing on psychological needs rather than cultural norms →

Short	**High vs. low ceiling height triggers different thought processing.**	**People react less intensively to stress if the space they are in has openings.**	**Spaces that are only partly enclosed are more aesthetically pleasing and makes people stay there longer.**	**Enriched environments increases brain development.**	**Being part of a group increases ones wellbeing.**
Title	The Influence of Ceiling Height: The Effect of Priming on the Type of Processing That People Use	Can architectural design alter the physiological reaction to psychosocial stress? A virtual TSST experiment	Architectural design and the brain: Effects of ceiling height and perceived enclosure on beauty judgments and approach-avoidance decisions	Environment and Brain Plasticity: Towards an Endogenous Pharmacotherapy	To belong is to matter: sense of belonging enhances meaning in life.
Author **Format, Year** **Publication**	Meyers-Levy et al. Journal article, 2007 Journal of Consumer Research	Fich et al. Journal article, 2014 Physiology and Behavior	Vartanian et al. Journal article, 2015 Journal of Environmental Psychology	Sale et al. Journal article, 2014 Physiological Reviews	Lambert et al. Journal article, 2013 Personality & Social Psychology Bulletin
Method	A range of task-solving studies with between 32 and 100 participants where conducted in identical rooms but with varied ceiling height.	49 participants took part in a virtual Trier Social Stress Test (TSST) with stereoscopic projections giving the room either closed or open walls while they where asked to perform stress related tasks infront of a virtual committee.	18 participants viewed 200 images of interiors while their brains where scanned using functional magnetic resonans imaging (fMRI).	A large database of laboratory tests on rodents and primates are summarized. The difference in brain development have been measured while living in impoverished compared to enriched environments.	Four methodologically diverse studies including 105 to 248 participants where conducted online asking about their subjective sense of belonging and perceived life meaningfulness.
Conclusion	Participants made more abstract and creative conclusions in rooms with a relatively high ceiling compared to a low ceiling. Participants where more item-specific and remembered more details in rooms with low ceiling.	Participants produced a significantly lower amount of cortisol when the room was equiped with openings. Cortisol is a hormone strongly related to stress, blood presure and body weight.	Participants were more likely to judge spaces as beautiful if they were open than enclosed, and more likely to opt to exit them if they were enclosed than open.	Enriched environments increased brain plasticity which is fundamental for the adaptability of ones behavior, for learning and memory processes, brain development and brain repair. The results are transferable to humans.	Relationships that promote a sense of belonging also promote a belief that one's life is meaningful. It is likely that belonging to a large social group play a particularly strong role in this experience.
Reflection	The study is well described and includes many parameters. The researchers do however mention that it might not only be the ceiling height but the volume of the room that triggers the different types of processing.	The experiment is a pilot and the author clearly states that more research needs to follow to draw any solid conclusions. The intereseting result that the environment had an impact on cortisol levels do however suggest that we are physiologically affected by architecture.	Previous experience and the setting of the test in a laboratory environment might have had an impact on participants judgement. However, a correlation between beauty judgement based on room height and enclosure and activity in specific areas of the brain appeared.	Although most of the experiments includes rodents and primates the authors sees clear parallels to humans. The animals natural habitat proved to be even more benificial than the enriched environments created in laboratories.	The diverse methods and the inclusion of participants with different cultural references makes it a useful material.
Application	Spaces should have a range of different volumes to trigger a variation of thought processing.	Spaces intended for stressful activities should provide views to adjacent areas.	Spaces for long-term activities should have an open character while spaces for transportation could be more enclosed.	Spaces should provide rich and varied experiences similar to our species natural pre-urban habitat.	Spaces should allow for visual or auditory relations with other people.



BRIDGING SCIENCE AND PRACTICE





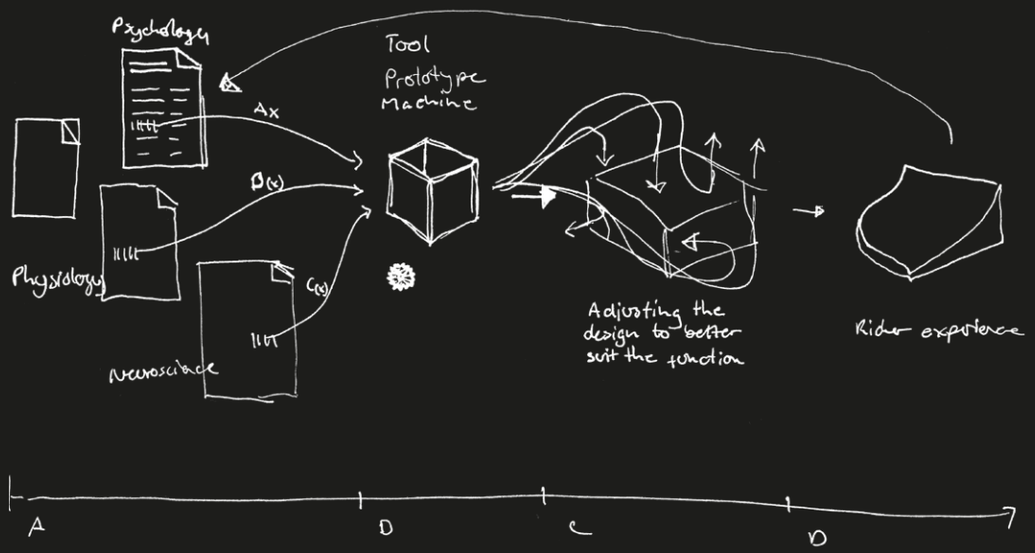
The research covers things like the influence the volume of a space has on our way of thinking and solving problems, how open and airy spaces can help to reduce stress, that enriched environments with a high variation of spatial stimulation keeps our brain active and prevents it from ageing.

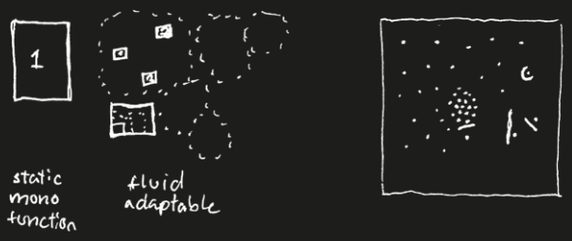
The architectural applications concluded are made in relation to the available apartments for single dwellers. For instance, since open and airy spaces with lots of options to position yourself in helps to reduce stress, perhaps an apartment box of 35 square meters isn't the best option for humans? Or, since a high spatial variation can keep our brains from ageing we should live in a space that provides us with lots of different spatial options rather than a compact room combining kitchen, sleeping and living?

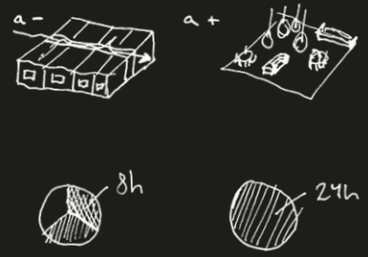
A large study also concluded that being part of a group increases your sense of wellbeing and even enhances your experienced meaning in life (Lambert et al., 2013). This conclusion is particularly interesting since our current strive for independency is driving us towards introvert apartments preventing social or even visual interaction.

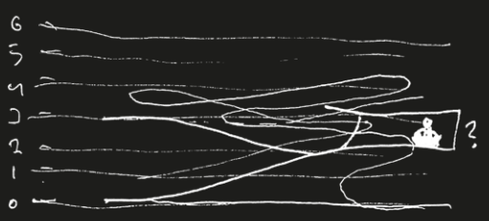
To make this finding practically useful in design processes a digital design tool was created. The Exposure Analyser (EA) divides a space into squares and measures the visibility of people standing in each square. The tool can be used to create spaces with a level of exposure that supports the activity taking place while ensuring that people are always part of a social context. Documentation of the Exposure Analyser is available in Appendix 1.

3. PROCESS









CREATING SUPPORTIVE ENVIRONMENTS

Introvert, compact, one-room apartments are often the only available option for people living without a partner. Since Sweden have the highest number of people living and dying alone it is about time to question our normative way of living (Gandini, 2015). Considering that humans have been around for millions of years, our current way of living doesn't even make up one percent of that time. We have to consider our way of living as a work in progress, ready to be questioned.

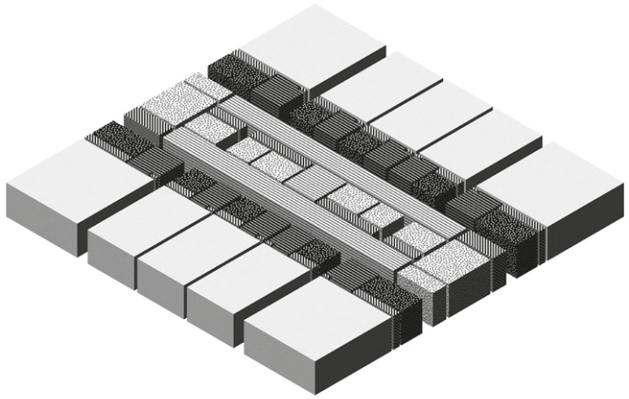
This work will focus on the psychological sustainability of single dwellers. While many people in western societies are enjoying an extreme level of freedom striving for self-realisation and independency, the built environment aimed at this group is perhaps the most harmful.

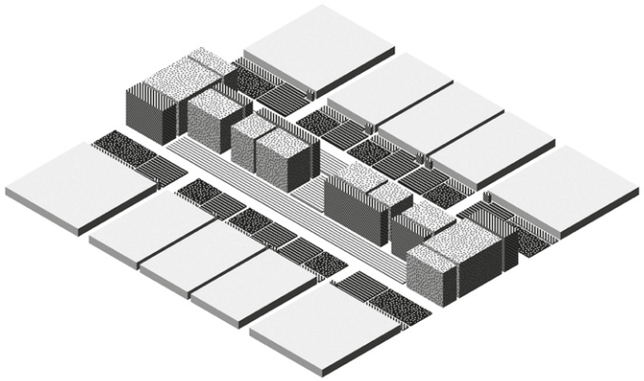
How can we continue to develop our freedom of living without ending up as isolated individuals?

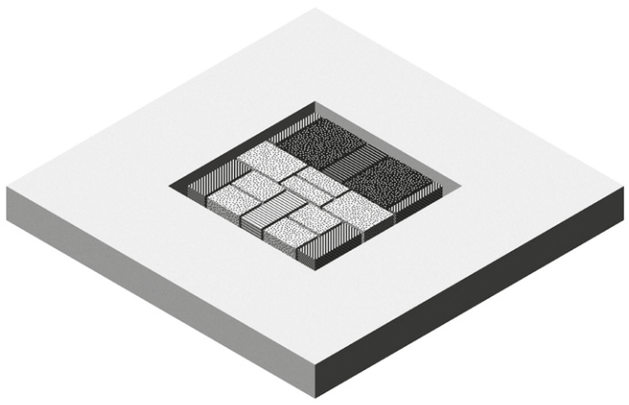
The architectural applications relating to psychological needs previously featured are used to guide the design of an alternative living typology not influenced by our current way of living.

The primary aim of the design is to create preconditions for wellbeing by supporting our innate need for social coherence.

The secondary aim is to create a rich environment with a variation of spatial stimulation that increase brain activity and tailors to different activities.





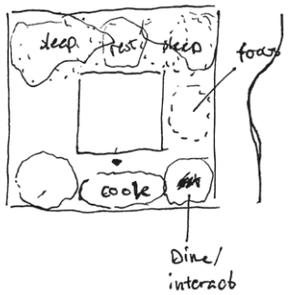


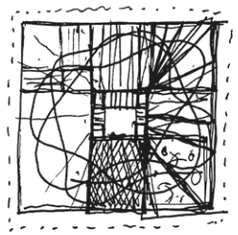
MAKING SPACE

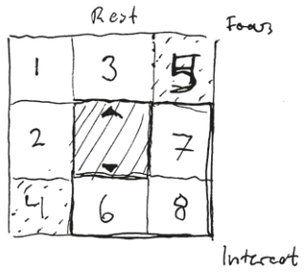
To design for social and spatial stimulation requires space. While spatial stimulation is achieved by creating a wide spectra of environments through different scales social stimulation will need for people to be surrounded by other people. Both of which current cramped apartment typologies are unable to provide. Without using any additional space, how can the sought stimulation be achieved using the volume of a one room apartment as a basis?

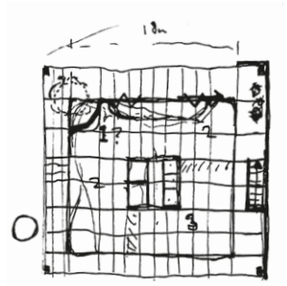
Studying the industry standard apartments of Tellus Towers floor plan (top left) clearly reveals how inefficient and resource demanding our lifestyle is. People approximately spend 6 waking hours (25%) in their apartment each day. The rest of the day it is empty or used for sleeping. Yet all 10 apartments on each floor provide the full spectrum of functions, kitchen, bathroom, bedroom, living room etc. Using the available space in a more collective way will provide residents with a more varied and rich environment. We have to start sharing.

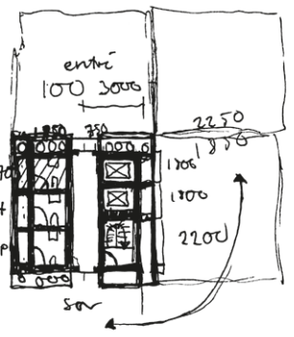
Using the combined volume of 20 one room apartments, 10 on each floor, creates a large un-programmed box for 20 individuals to habit. Scarcely used functions are reduced and efficiently shared among residents to gain more space. The large residual volume constitute the base for architectural experimentations in the search for a socially and spatially stimulative environment.

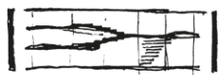


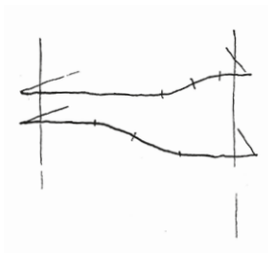


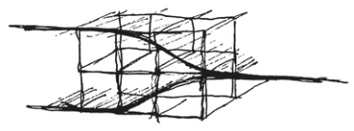


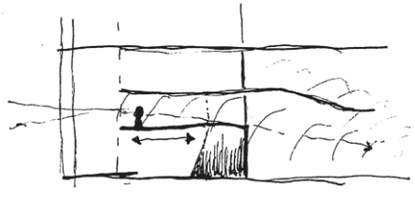


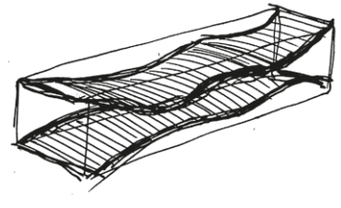


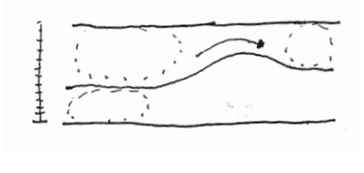


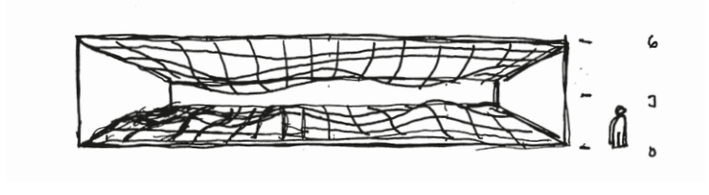












ARRANGING RELATIONS

The initial design process is carried out using exposure and isolation as the two main parameters. A number of activities are defined and graded by their appropriate level of exposure. The level of exposure while sleeping is for instance set to 1 while cooking is set to 8. The activities are then arranged within the volume in a scheme allowing for people to gradually increase or decrease their personal level of exposure by moving to the adjacent activity.

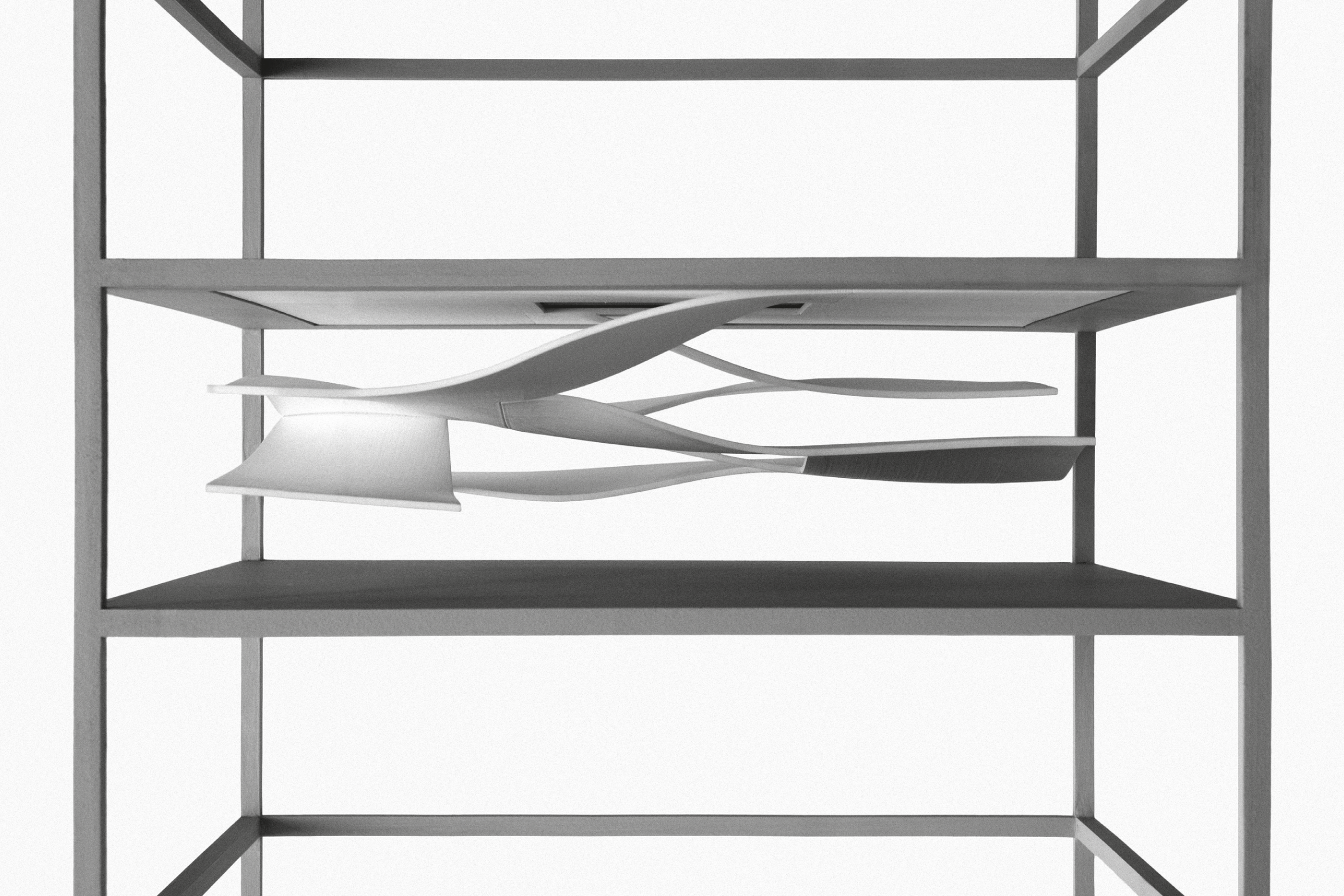
As the sketches evolves a set of design principles are defined. To emphasise the sense of gradually moving between activities and levels of social interaction rather than defined rooms with predetermined functions no interior walls or levels are drawn aside from the central core of functions.

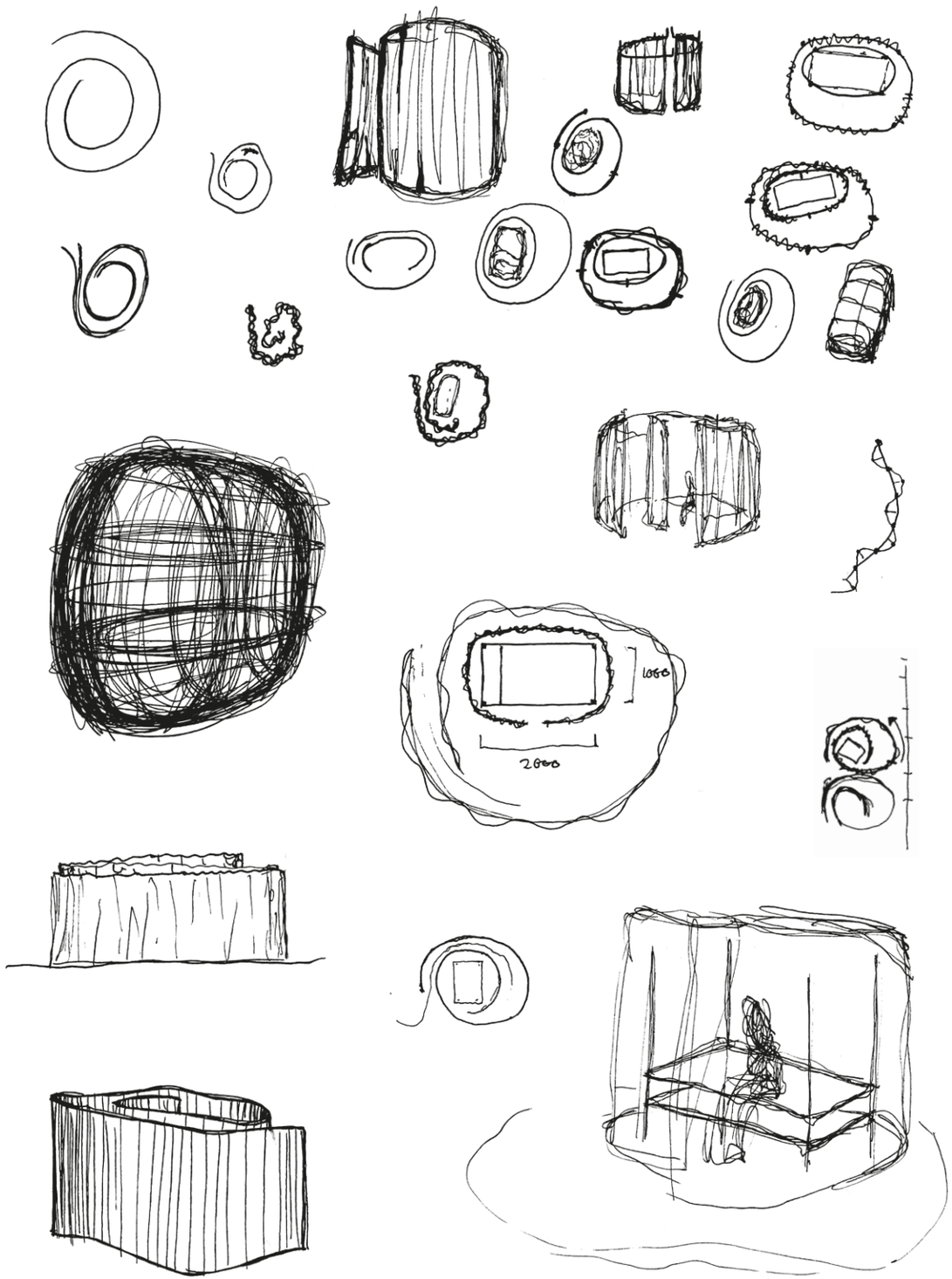
Instead the use of undulating floors is explored to define space while preserving the openness and visibility of the large volume. It creates a stimulating way of moving and makes it possible to create a great variation of secluded and public spaces in a coherent structure.

The main advantage of using undulating floors is however the continuous sense of coherence. Except when residents actively choose to isolate themselves, they will always perceive the visual or auditory presence of others.

The design iterations are modelled digitally and run through the Exposure Analyser to test the landscapes' varying levels of exposure.

The following spread shows the spatial model (36x36x12cm, scale 1:50) and its undulating floors in a high-rise context model.





A PRIVATE ENCLOSURE

Based on the studied material a conclusion was made that people are more likely to increase their sense of wellbeing if surrounded by other people. Meanwhile it was also stated that the available apartments aimed at single dwellers are more likely to create a society of isolated individuals. Peoples lives are made up of portions of both situations.

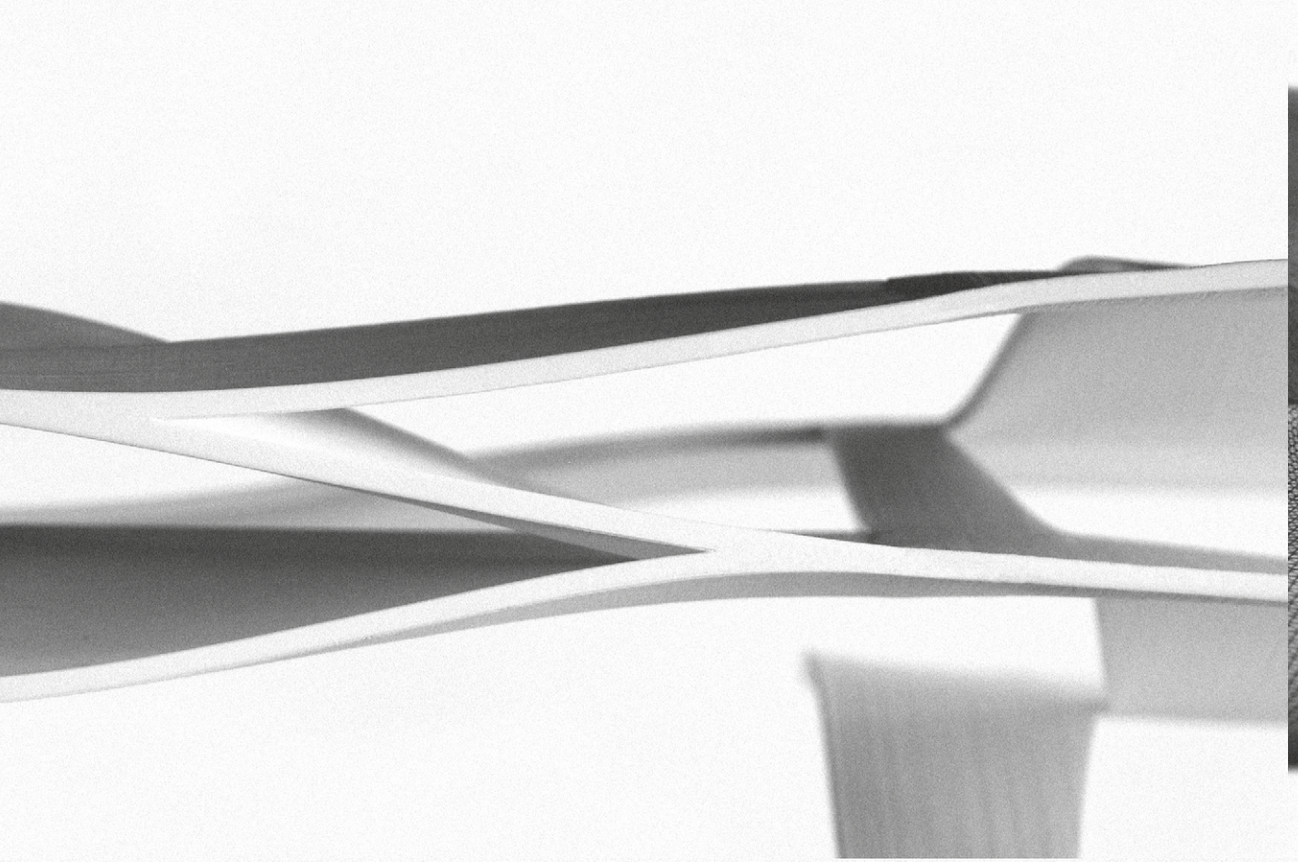
Although the aim of this project is to create an environment that supports our need for social coherence people need to have the ability to retract and isolate themselves during the day. The undulating floors are able to define spaces with appropriate levels of exposure for most of the daily activities inside the volume but it struggles to create a sufficient level of isolation.

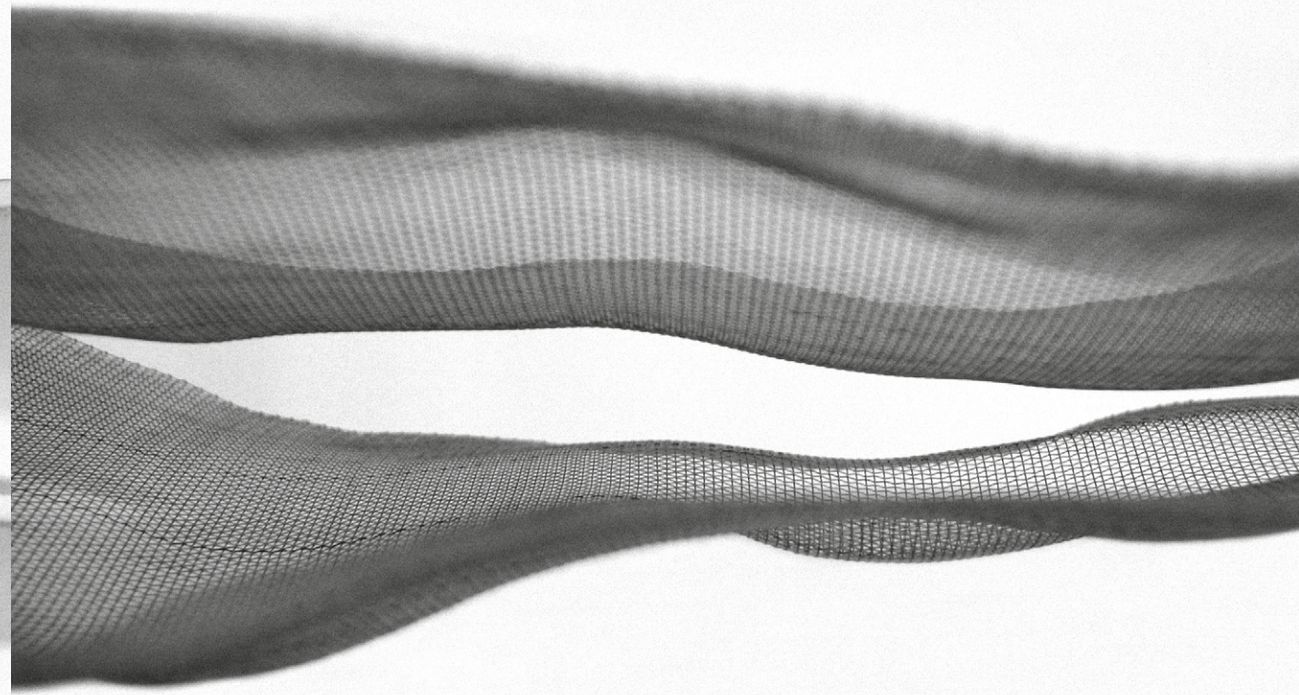
A search for something to complement the coherent structure of floors resulted in sketches of a free-standing swirl shaped structure. A private enclosure where people are completely isolated from each other. Since space is the most valuable resource in this design process the private enclosures are stacked next to each other in favour of more social and space demanding activities.

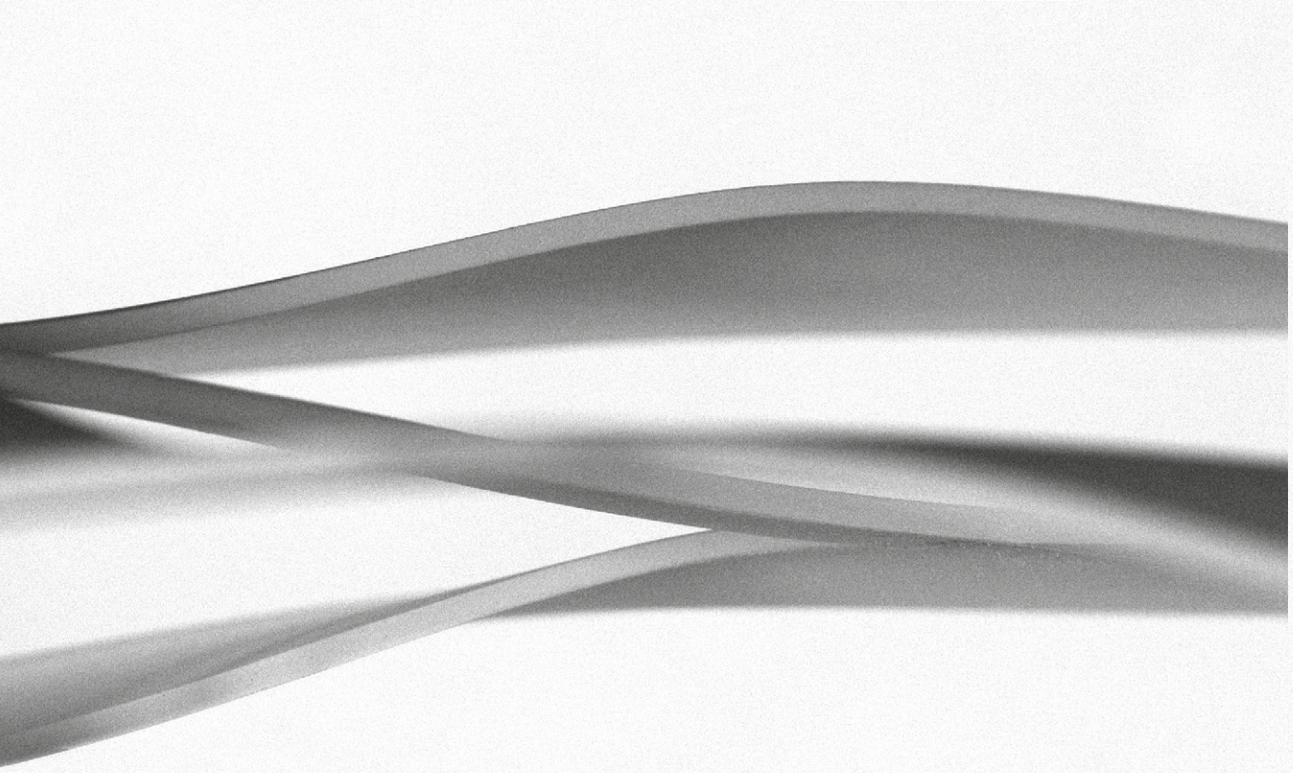
While the actual distance between people who retract in their private enclosure is limited the swirl shape enhances the experienced distance. As people enters the enclosure they walk between two narrow sinuous sheets of thick felt in a maze-like swirl before reaching their private space. Compared to closing a conventional interior door behind you this procedure creates a stronger sense of seclusion and privacy.

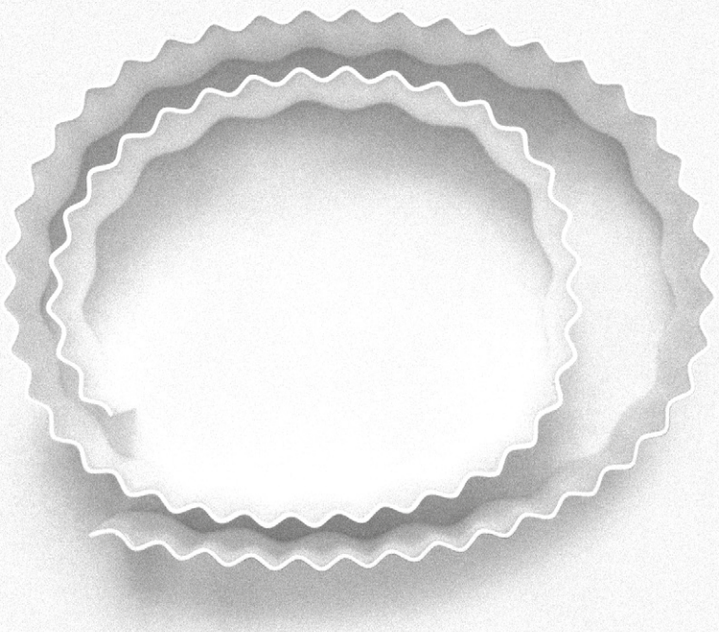
The following spread shows models made and used during the design process.

1. Spatial model, Detail, 36x36x12cm, 3D-print
2. Spatial model, Detail, 36x36x12cm, 3D-print
3. Research model, 60x60x20cm, Wire mesh
4. Enclosure model, 17x13x9cm, 3D-print

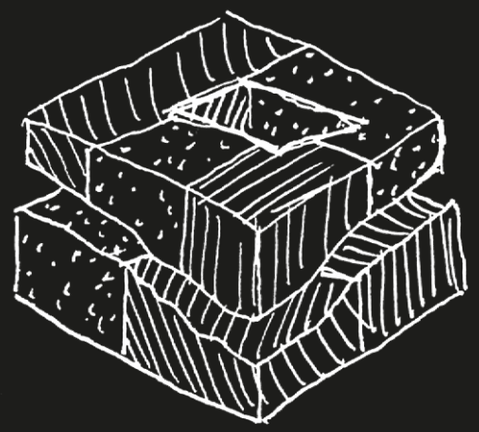








4. THEORY



A LIVING CLUSTER BASED ON HUMAN NEEDS

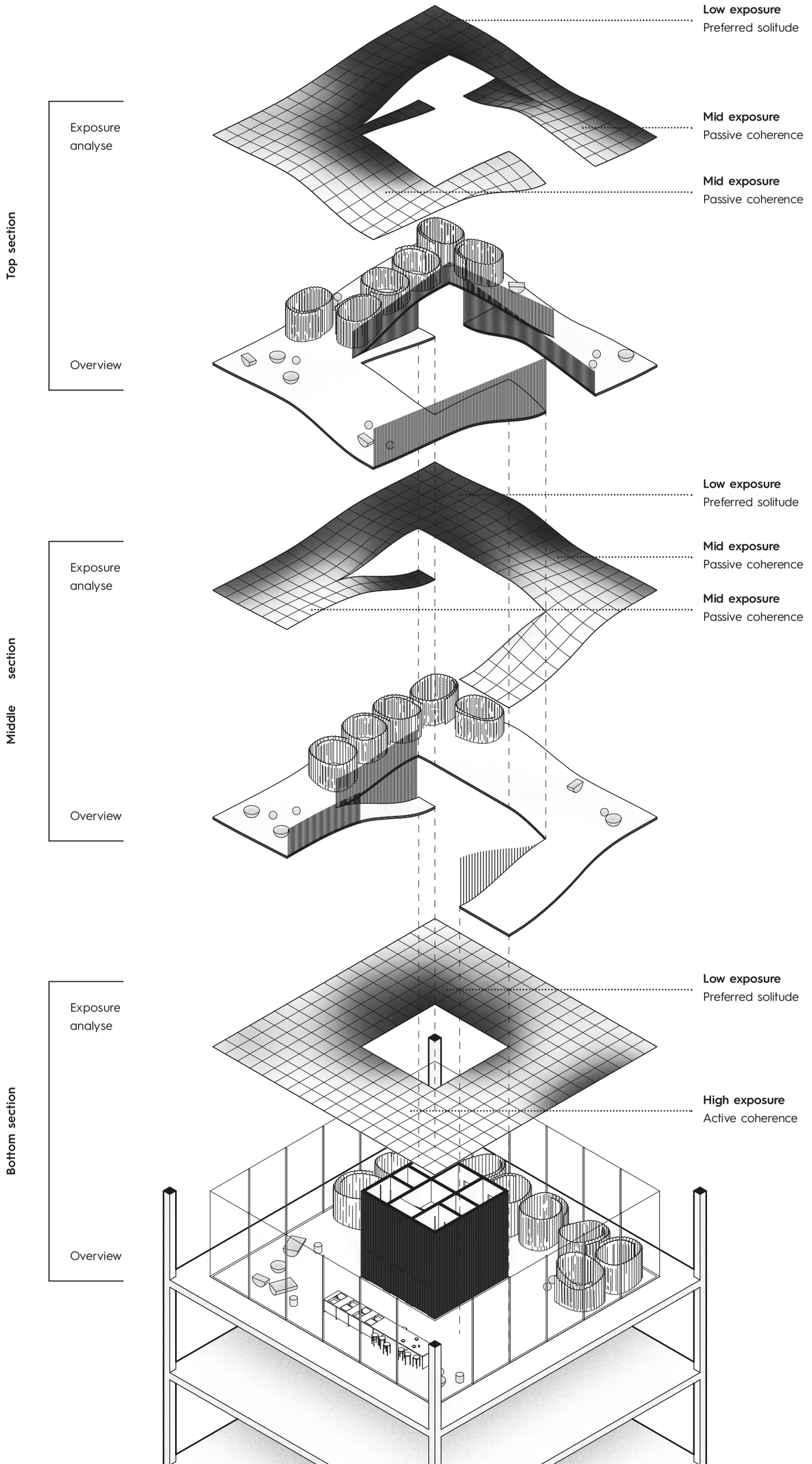
The concept of a living cluster has the potential to house people of all todays normative constellations but this work will focus on single dwellers. 20 individuals living their lives in an urban context with the cluster as their common base. Many people pursuing their own independent life founded on personal values are erasing the traditionally sharp division of working and living. The living cluster encourage this behaviour by providing space for all life's activities. The challenge of designing a living cluster is to arrange these spaces of different characters in a coherent volume while avoiding disturbance and unnecessary isolation.

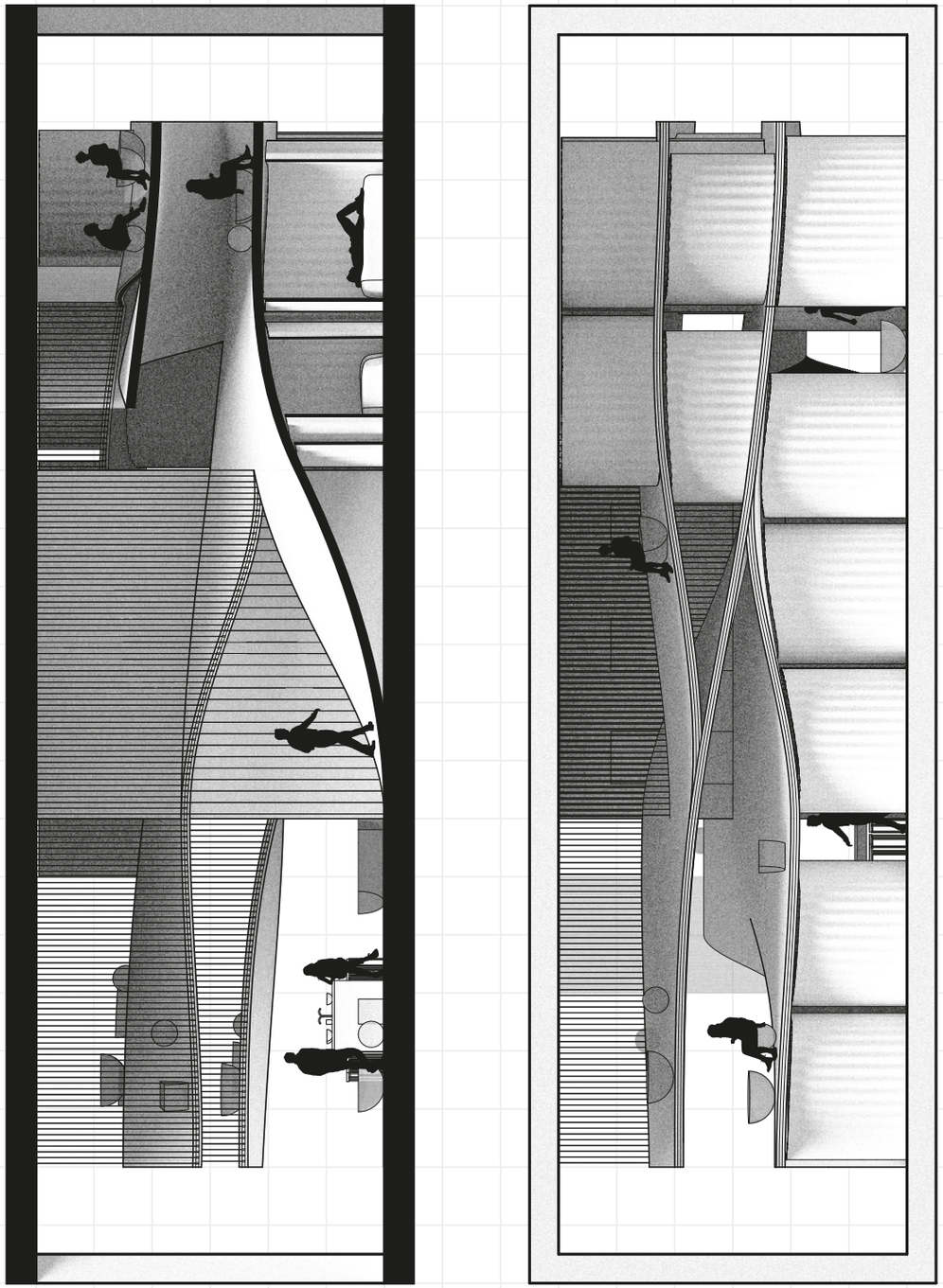
The main purpose of living in a cluster is not to gain a new family or even to make new friends. The most important outcome is to belong. Residents may be living parallel lives but they all belong to the same context.

The research studied during this work could be summarised as humans are not humans without the presence of others in a rich environment.

Life in the cluster is told through four human needs concluded from the studied research: Spatial Exploration, Active Coherence, Passive Coherence and Preferred Solitude. These are far from all the innate needs of humans but their presence strongly affects our wellbeing.

The following spread presents an overview of the living cluster and how the Exposure Analyser guided the design and arrangement of activities in accordance with the four human needs. →


Top section
Exposure analyse
Overview
Low exposure
Preferred solitude
Mid exposure
Passive coherence
Mid exposure
Passive coherence
Middle section
Exposure analyse
Overview
Low exposure
Preferred solitude
Mid exposure
Passive coherence
Mid exposure
Passive coherence
Bottom section
Exposure analyse
Overview
Low exposure
Preferred solitude
High exposure
Active coherence



HUMAN NEED 1
SPATIAL EXPLORATION

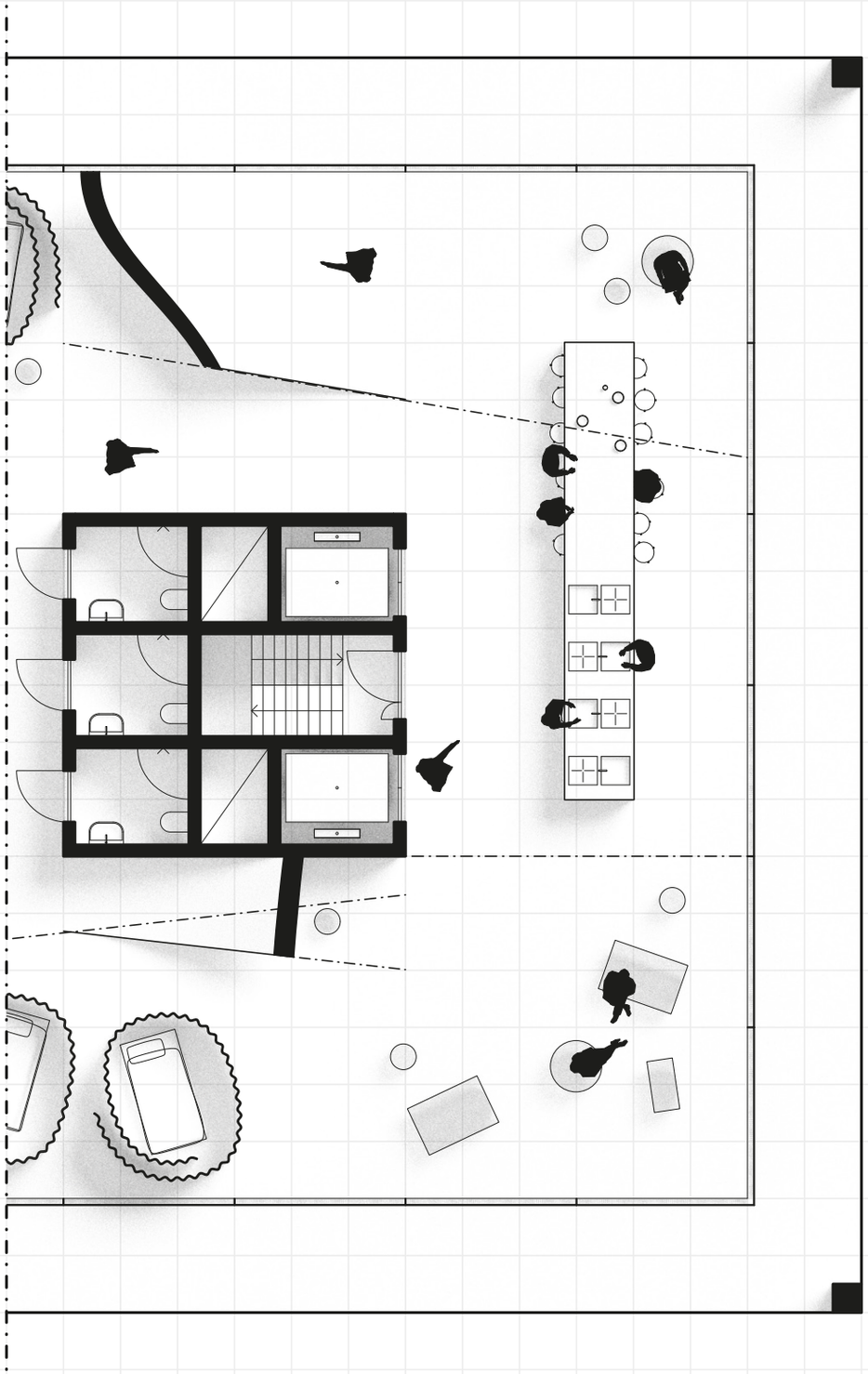
The studied research on how humans react to different spatial environments resulted in a central aim during the design process to provide residents with effortless spatial stimulation. Regardless of what activities residents engage in during the day they shall always be exposed to a variation of spatial environments.

The experimentation with undulating floors resulted in a three-dimensional continuous landscape of activity areas. Each tailored to support a specific activity. Instead of using levels and rooms to define space the undulating floor gradually shapes areas by sweeping through the cluster.

Walking the landscape provides residents with lots of different paths. When entering the cluster into a spacious communal area residents immediately get the option to retract and continue into a more narrow space with less head room and more dull lighting or to follow the natural light out into a space using the volume's full height.

Continuing the unobstructed movement through the landscape reveals paths cramped between two floors where walking intuitively slows down and tone is lowered. Some remote areas are even too narrow to stand upright and rather invites residents to sit or lay down. Other areas are more open and airy providing an overview of the cluster.

Residents are able to use the landscape actively and to their own advantage by finding the most supportive spatial stimulation for their current activity.



HUMAN NEED 2
ACTIVE COHERENCE

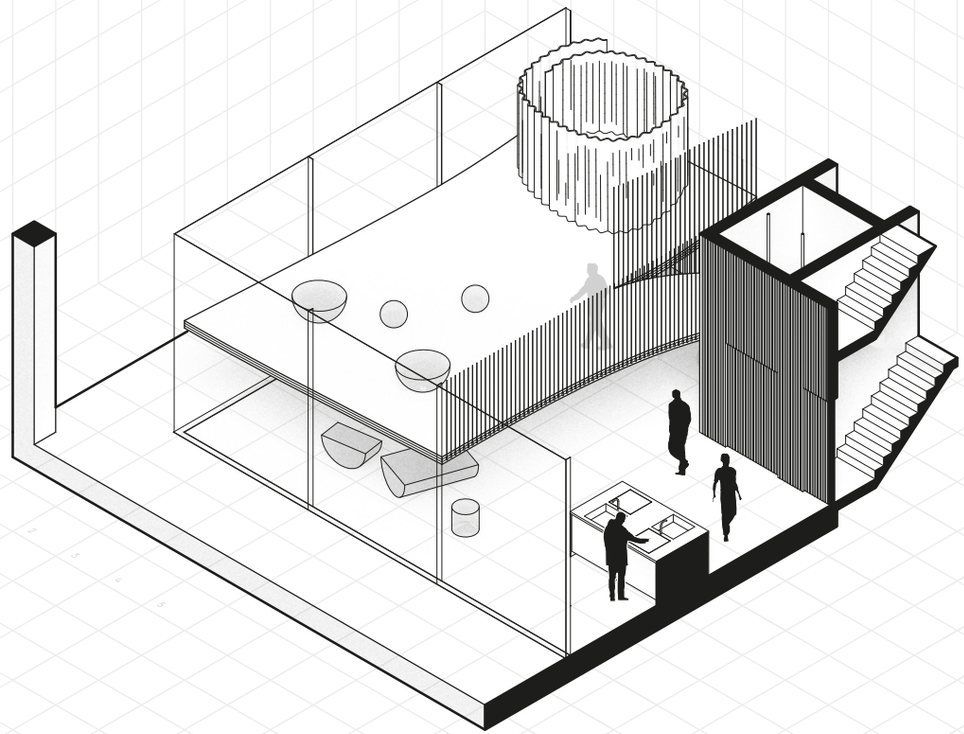
To make residents feel they belong to a context increase their sense of wellbeing and was the primary aim during the design process of the living cluster. As resident's need for coherence varies during a day areas supporting both active and passive coherence are created. The need for active coherence is supported by designing obvious places for interaction.

One of them is the kitchen located right by the entrance. It is the first and last area residents pass as they enter and leave the cluster making it the place where people circulate the most. Since the kitchen is also a place for preparing and eating food people stay for a while during their daily visits.

The kitchen is where residents are most likely to meet other residents. This is where they go when they feel the need to be surrounded by other people or when they are actively looking for social interaction.

It is also a place where residents can focus on personal activities while still being open to engage in the life of others.

The gradually shifting levels of exposure inside the cluster lets residents choose to what extent they want to interact and be approachable. As illustrated by the results of the exposure analyser in the overview spread the kitchen is the most exposed area of the cluster while all adjacent areas are less exposed. The various activity areas and their associated exposure levels all interact to create the sought stimulation in each area.

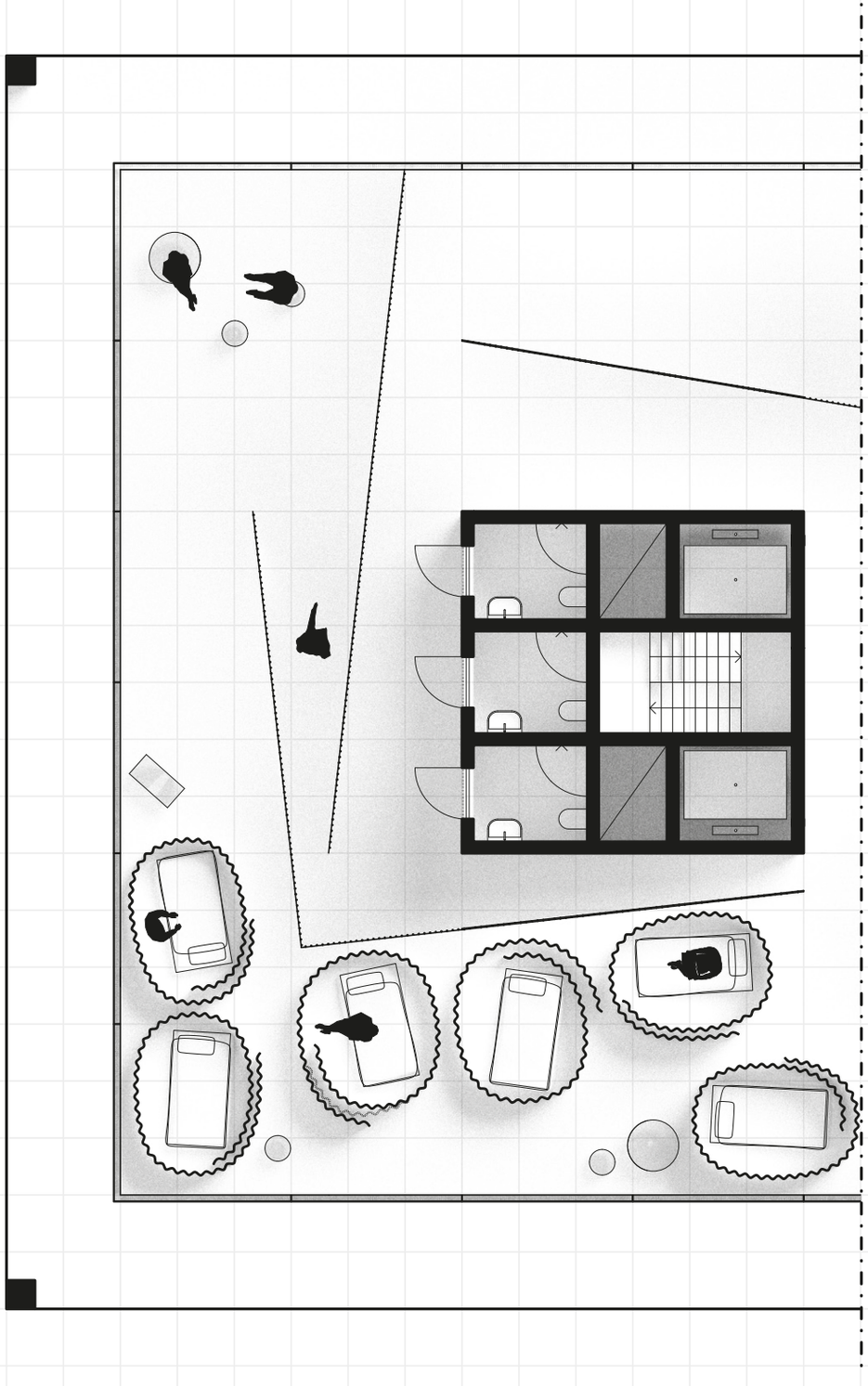


HUMAN NEED 3
PASSIVE COHERENCE

The sense of belonging is achieved in various ways inside the living cluster. In addition to areas supporting active coherence several smaller areas are tailored to peoples need for passive coherence. These areas are semi-exposed, somewhere between complete isolation and full exposure. Residents are able to sense the presence of others while engaging in their own activities.

Areas supporting passive coherence are elevated overlooking more exposed and occupied areas. The wires suspending the undulating floors creates disruptive curtains decreasing the immediate visual relation between different areas. This creates a more private atmosphere in the otherwise airy landscape.

Depending on where residents reside inside the cluster the experienced presence of others can be either auditory, visual or both. Some passive areas are tailored to only accommodate one resident at a time while others allow for groups of people to occupy simultaneously. The common understanding emphasised by the spatial organisation is however that no social interaction is expected from either of the occupants. No conversations, just belonging.

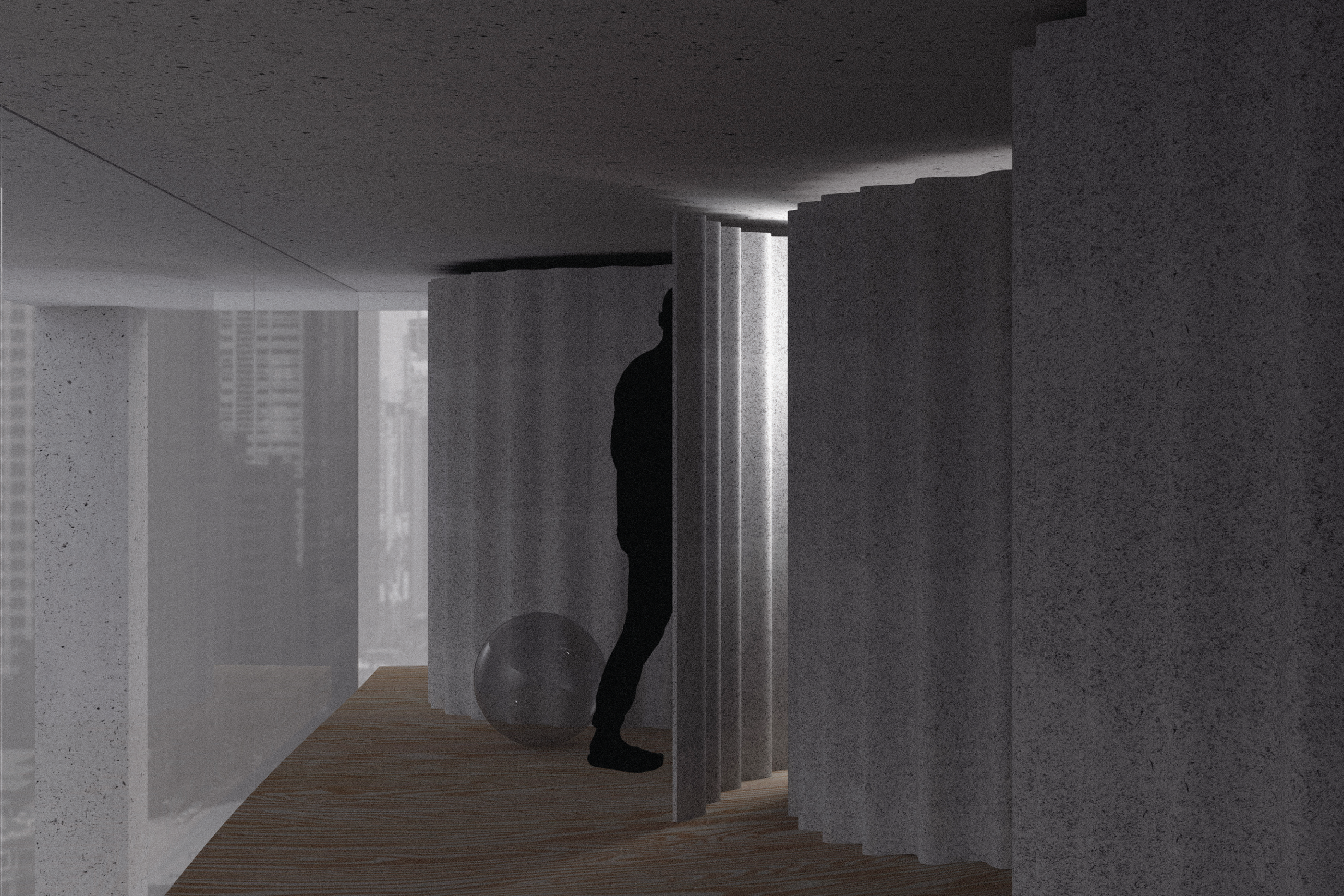


HUMAN NEED 4
PREFERRED SOLITUDE

All areas of the living cluster is part of a carefully designed balance of isolation and exposure including the most secluded ones. While the overall aim is to support an increased level of social and spatial stimulation the occasional need for solitude must also be supported to achieve wellbeing.

The living cluster features 20 private enclosures that residents can access whenever they like. The enclosures completely isolates residents from each other, both auditory and visually. All enclosures are located in the most cramped and least exposed areas of the cluster with low ceiling and dull lighting. Along with the narrow paths formed between the enclosures the spatial setting evoke a sense of calmness.

The space inside the enclosure is limited and only intended for the most private functions. All other activities are encouraged to take place in the open structure of the cluster.



5. SUMMARY

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5.1 Discussion

DISCUSSION

Housing humans requires constant attention and challenge. This work stresses that the progress of architecture can not be left to market driven stakeholders with short-term interests lacking critical perspectives. To create space is a great responsibility. Introvert and isolating architecture is affecting peoples sense of wellbeing with societal consequences far beyond the blocks of stacked boxes.

The overall purpose of this work has been to research an alternative architectural design process based on our innate needs rather than normative apartment typologies. While studying living in a both historical and evolutionary perspective it became clear that housing has to be seen as an endless work in progress. Regardless of what is perceived as normal today there can never be any truths about tomorrow.

The emerging interdisciplinary field of architecture and neuroscience will continue to advance its role in the design of environments as new design processes develop. The digital design tool for analysing environments exposure levels developed during this work contributes to bridging this apparent gap between science and practise.

The result of this work argues that a more psychologically sustainable living space can be realised when questioning the current norms of living and introducing scientific research in the design.

Addressing the psychological sustainability of our built environment is one of the most important tasks for architects ahead. To fully understand how humans react to different environments and to use that knowledge to inform the design while questioning the norms of our daily life will enhance the architectural profession and its positive impact on society.

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5.2 List of references

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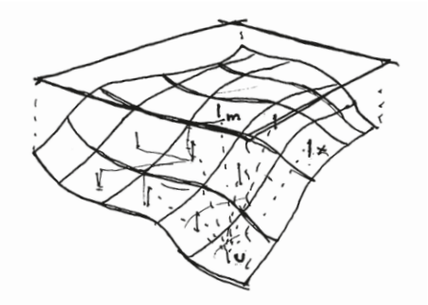
6. APPENDIX

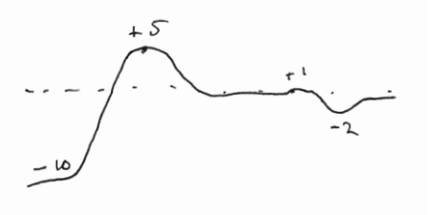
EXPOSURE ANALYSER

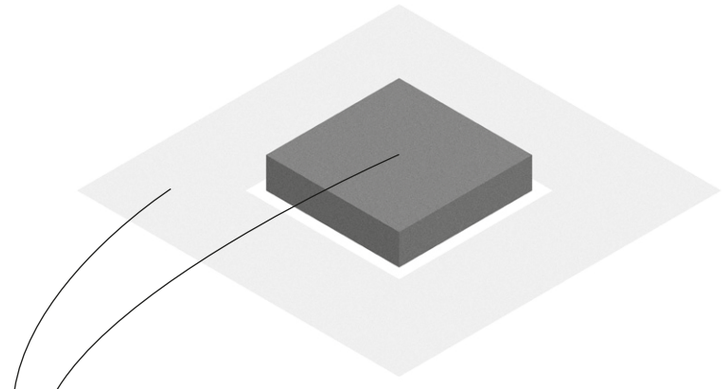
This work highlights the increasing amount of research on how architecture and its spatial and social qualities affects humans both psychologically and physiologically. For this knowledge to be practically useful there needs to be new tools and design methods developed.

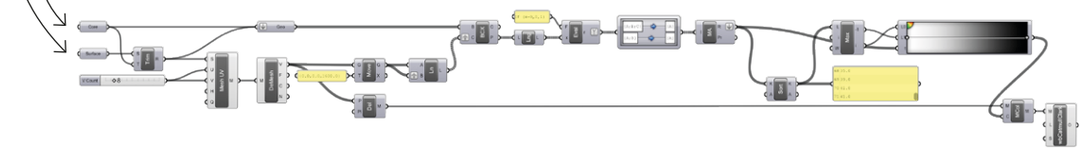
The conclusions made in the article on increased wellbeing in regards to the presence of other humans (Lambert et al., 2013) was translated into a digital design tool. A Grasshopper definition was written to measure how the level of exposure to other humans varies in an undulating landscape modelled in Rhino.

The tool was created to analyse the intuitive design of the living cluster and to ensure it includes spaces with a variation of exposure levels.



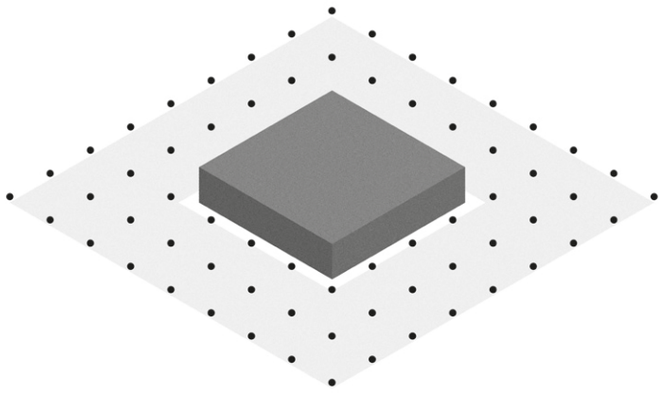


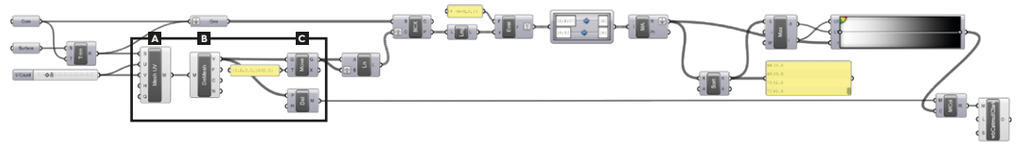




1. Setting the objects

The floor (surface) and the central core is created as separate objects and mapped to the Grasshopper definition.



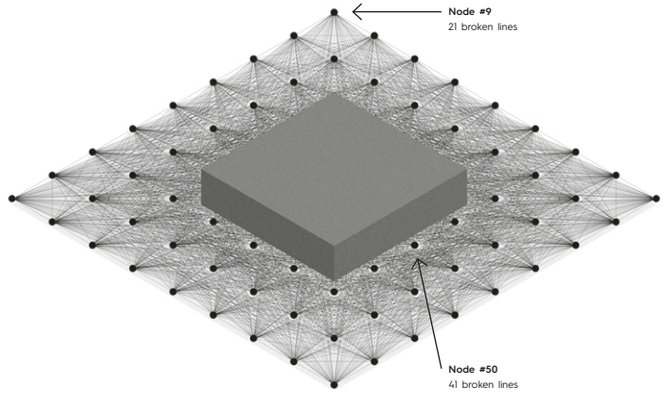


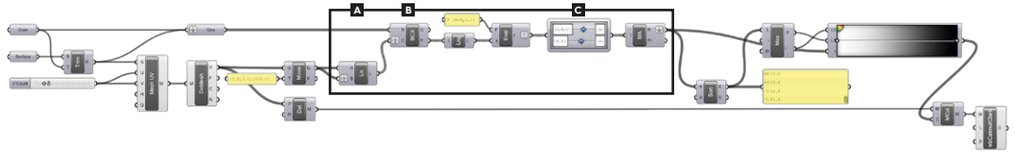
2. Placing nodes

A. The surface is divided into a grid of 8x8.

B. A node representing a person is places in eachcorner of the grid.

C. Nodes are elevated to eye level.





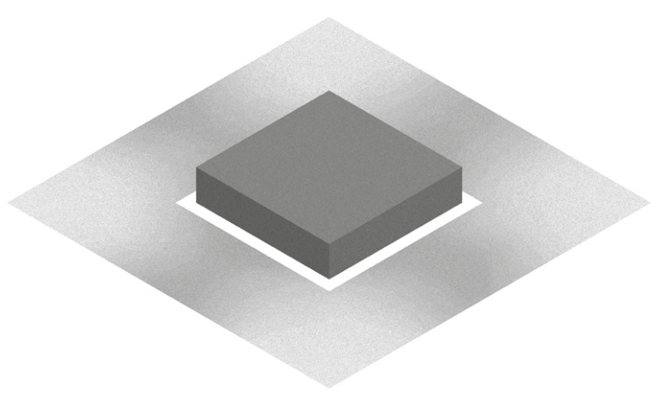
3. Creating sightlines

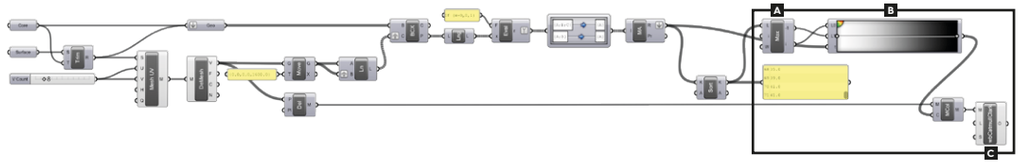
A. All nodes are connected to each other by lines (sightlines).

B. Intersections between a line and the surface or the core is calculated.

C. Each line may have several intersections but as long as it has one intersection it is considered broken.

The number of broken lines belonging to a node determines the nodes exposure to other nodes. More broken lines equals lower exposure.



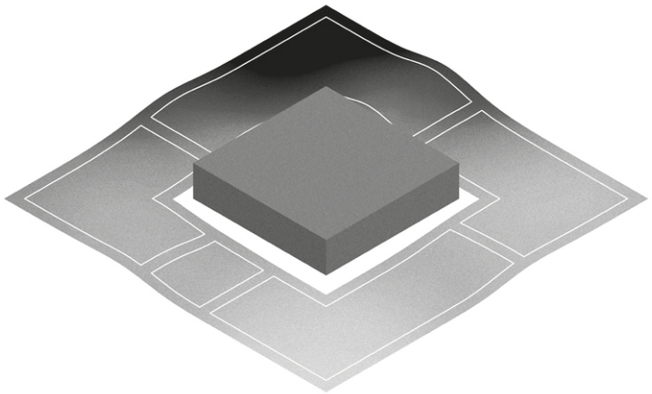


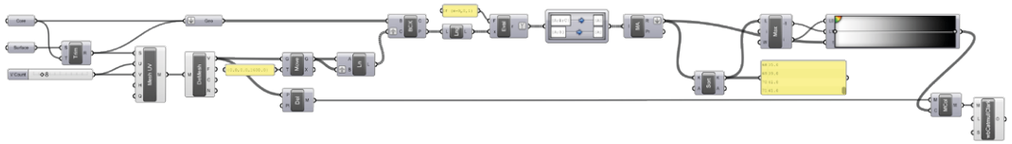
4. Visualising result

A. The highest and lowest number of broken lines is used to set the limits of a visualising gradient component.

B. The gradient component reads the number of broken lines belonging to a node and colors the surface area where the node is placed in a corresponding level of black. More broken lines equals a darker color.

C. The last component is used to even out bent surfaces and to blur the gradient.

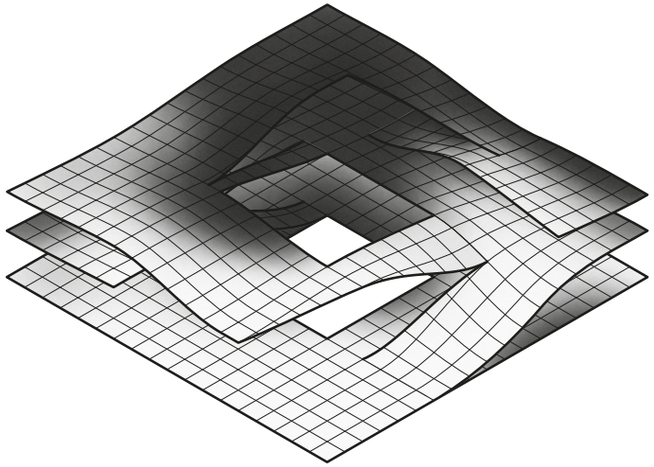


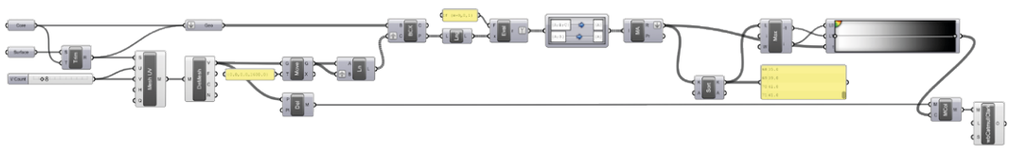


5. Adjusting surface

Each time the surface is modified a new gradient is calculated. When the surface is bent enough to break lines the level of exposure is starting to shift.

In this example an isolated area with low exposure to the rest of the surface is created in the upper part of the model by creating hills that breaks sightlines.





6. Complexity

The design tool was later used to analyse the final design of the living cluster. The undulating floors are creating a wide range of exposure levels with a varied spatiality without using partition walls.