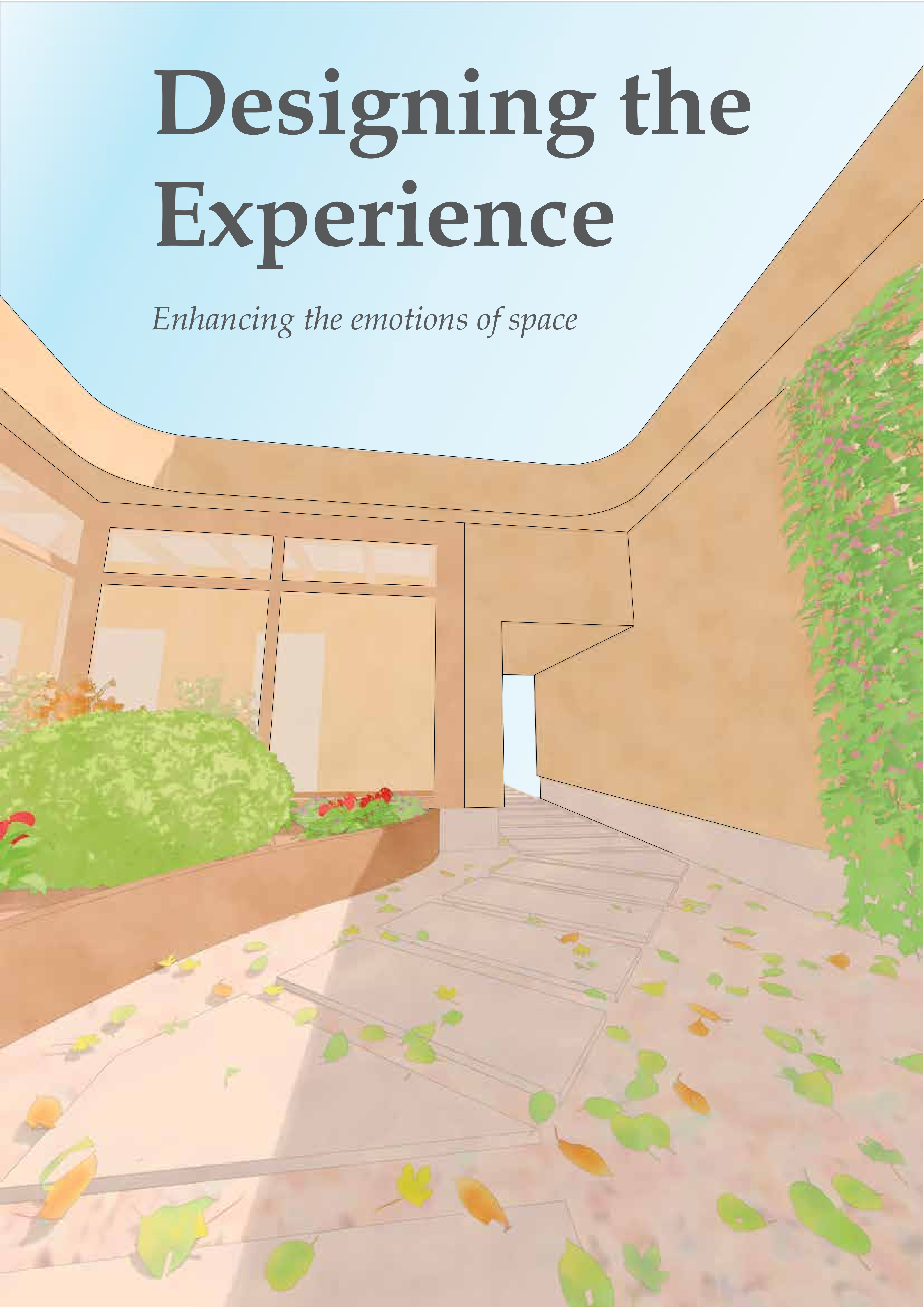
Designing the Experience

Enhancing the emotions of space



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Designing the Experience - Enhancing the emotions of space

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Abstract

Lokeshøj Fællesskab is a design-driven architectural thesis that explores how the sensory and emotional experience of space can inform new ways of dwelling together. Located in a residential area in Svenstrup, Denmark, the project proposes a co-housing model that brings together private and shared life through spatial clarity, atmosphere, and material sensitivity.

The core of the investigation lies in the human perception of space. Drawing from theories by Gaston Bachelard, Yi-Fu Tuan, and Peter Zumthor, the design process has focused on how light, materiality, temperature, texture, and transitions influence our sense of belonging. These ideas are tested through the development of four buildings: three variations of private homes for different family configurations, and one shared common house for social and collective activities.

Through iterative design studies, the project examines how architecture can compose softness and solidity, creating rooms that feel both open and protective, tactile yet structured. Using tools like sensory stimulation, and spatial sequencing, the dwellings support a lived experience that is intuitive, calm, and grounded in everyday life.

Lokeshøj Fællesskab is not just a proposal for housing, it is a spatial framework for coexistence, shaped through care, and rooted in the belief that architecture is first and foremost experienced, not observed.

Reader's Guide

'Co-living' and 'co-housing':
When 'co-living' is mentioned, it is defined as multiple stakeholders living in the same household, sharing multiple spaces.

When 'co-housing' is mentioned, it is defined as stakeholders living in their own private households, e.g. only sharing the common house, laundry room or workshop.

Artificial Intelligence (AI):
AI has been used on all of the text to give a more coherent language. All the text was written by the authors initially and then had AI rewrite it.

Dictionary:
When 'the site' is mentioned in this thesis it refers to all of the unbuild field at Lokeshøj, marked on illustration 9.

Key Findings:
To help conclude on text, key findings will be extracted and presented as bulletpoints at the end of the text like shown below:

- Key Finding 1

- Key Finding 2

- Key Finding x

Illustrations:
Illustrations throughout the thesis has been produced by the authors.

Digital tools used during the project development:

SketchUp – Primary tool for 3D modeling and spatial exploration.

Enscape – Used for rendering and virtual reality walkthroughs.

ChatGPT – Assisted with concept development and text refinement.

Be18 – Used for energy calculations to meet BR18 standards.

ClimateStudio – Simulated daylight and overheating conditions.

Adobe Suite – Used for drawings, diagrams, and presentation layout.

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Motivation

In contemporary architectural practice, the design and construction of buildings are frequently driven by financial imperatives and the pursuit of profit, often at the expense of the nuanced needs and well-being of the people who inhabit these spaces (Illustrarch, 2024). This profit-oriented approach can result in environments that are generic, uninspiring, or even detrimental to users' physical and mental health, as the focus shifts away from creating meaningful and supportive spaces.

A growing body of research and architectural discourse, calls for a fundamental shift: from building for profit to designing for people. Human-centered architecture places the needs, perceptions, and experiences of individuals at the heart of the design process, recognizing that the ultimate goal of architecture is to enhance the quality of life for its users (UCEM, 2024). This approach extends beyond aesthetics and functionality, acknowledging that human sensory perception, shaped by elements such as light, texture, and spatial arrangement, profoundly influences emotions, behaviors, and a sense of belonging within a space (Quicktakes, 2025; Re-thinking The Future, 2024).

Designing with human perception as a focal point means creating environments that are not only functional but also intuitive, comfortable, and emotionally resonant. It involves considering factors such as ergonomics, accessibility, and multisensory experiences that contribute to well-being (Re-thinking The Future, 2024). Human-scale design fosters social interaction, inclusivity, and a sense of place, making buildings more livable and engaging for all (ArchDaily, 2025).

By shifting the focus from profit to people, architects and designers can create spaces that support happiness, productivity, and community, demonstrating that human-centered design is not only ethically imperative but also economically and socially beneficial in the long term (LinkedIn, 2023). This thesis explores how an understanding of human perception can inform better design strategies, resulting in built environments that enhance the experiences of lived spaces.

illustration 1. repeated houses

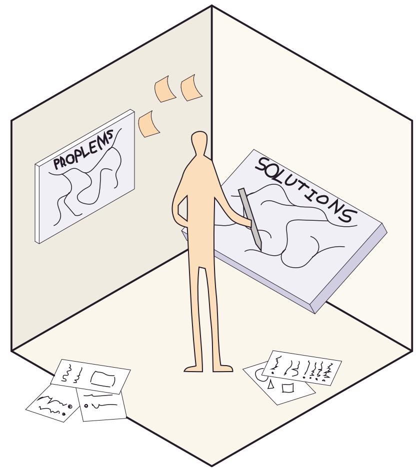


illustration 2. how designers think

Methodology

Design is not merely the act of creating form; it is a cognitive and sensory journey that responds to complex problems and engages with the full spectrum of human experience. This project explores how design thinking and architectural education can be integrated with an embodied understanding of space. By combining Bryan Lawson's insights into the cognitive processes of design with Mary-Ann Knudstrup's Integrated Design Process (IDP) within a Problem-Based Learning (PBL) framework, a comprehensive methodology emerges; one that bridges abstract problem-solving with real-world, interdisciplinary collaboration. Complementing this methodological approach are theoretical foundations from Gaston Bachelard, Yi-Fu Tuan, and Peter Zumthor, whose works highlight the poetic, emotional, and sensory dimensions of architecture. Together, these perspectives provide a layered understanding of how designers think, how design is taught, and how space is felt and remembered.

The Integrated Design Process and How Designers Think

Throughout this project, a combination of two methods will be applied: The combination of Bryan Lawson's insight into the cognitive processes of design and Mary-Ann Knudstrup's educational integration of the Integrated Design Process (IDP) within Problem-Based Learning (PBL). These two perspectives, while originating from different domains; professional design thinking and academic pedagogy, offer complementary methods that can be effectively applied to project work in both practice and education.

Bryan Lawson, in "How Designers Think", characterizes design problems as inherently "ill-structured". Such problems are often ambiguous, lacking a single correct solution, and require designers to simultaneously define the problem and develop a response. Lawson emphasizes the importance of problem-solution co-evolution, where the act of designing is a process of constant reinterpretation, iteration, and adaptation. Lawson's approach advocates for an open-ended, exploratory approach that values fluid thinking and the iterative refinement of ideas. (Lawson, 2006)

Mary-Ann Knudstrup, on the other hand, introduces a pedagogical framework that blends the Integrated Design Process (IDP) with

illustration 3. integrated design process

Problem-Based Learning (PBL), primarily in the context of architectural education. IDP originates from sustainable building practice and emphasizes the **early integration of multiple disciplines**: architects, engineers, consultants, and clients to set shared goals and address environmental performance from the beginning. IDP is grounded in **systemic thinking**, collaborative iteration, and measurable feedback, often using tools like energy modeling and daylight analysis. PBL complements IDP by fostering real-world problem-solving in group settings, mirroring the collaborative nature of professional design practice. It promotes critical reflection, hands-on learning, and a deep engagement with real-life challenges. (Knudstrup, 2004)

When applied together in a design project, these two approaches offer a holistic and dynamic methodology. Lawson's model encourages teams to **remain flexible and inquisitive**, constantly re-evaluating the problem space as new insights emerges. This nurtures creativity and responsiveness, allowing for a deeper understanding of context and user needs. Simultaneously, the IDP framework ensures that the design process remains **structured, collaborative, and sustainability-driven**, embedding technical and environmental performance criteria from the earliest stages.

Perception of Space

The perception of space in architecture goes beyond the functional and aesthetic elements because it involves bodily components that work together to create the experience. The following literature will provide an understanding of the relationship between people and built environment: Gaston Bachelard's *Poetics of Space* discusses the psychological elements of spatial environment, Yi-Fu Tuan's *Topophilia* explores the emotional and cultural connection with space and Peter Zumthor's *Atmospheres* describes the sensory and material aspects of architecture and its effect on the body.

These theories combined help to understand that physical space is not just geometric shapes, but is a complex phenomenon that affects memory, identity and perception.

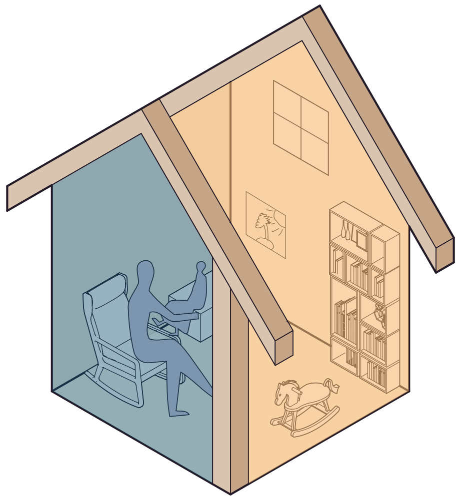


illustration 4. poetics of space

Theoretical Foundations

The Poetics of Space

In the book Poetics of Space (1958), Bachelard comes up with the concept of architecture and how space is perceived through memory, dreams and imagination not just through material aspects.

Bachelard starts off by talking about how daydreaming about one's house occurs and how occupants of the home dream about feelings of safety and protection with the house acting as a cradle of protection from outside influences.

"*Life begins well, it begins enclosed, protected, all warm in the bosom of the house.*" (Bachelard 1994 p. 7)

As the house serves as the bosom for human protection, Bachelard also discusses that every niche, nook and attic are all attributed to certain memories and represent previous lived experiences through atmospheres. However, when the experiences in the attic were lived, it seemed, at times too cold, too warm, or too small. By recalling, let's say the attic, it through memory seems to be everything at once, small and large, hot and cold, always providing comfort. (Bachelard 1994)

"*Thus we cover the universe with drawings we have lived. These drawings need not be exact. They need only to be tonalized on the mode of our inner space.*" (Bachelard 1994 p. 12)

Here Bachelard explains, very poetically, that our lives are filled with memories (drawings) that are not remembered to perfection, but that only the important tonality is. This allows us to remember, maybe relive, the experience that comes to mind. By this logic it means that the final design needs to set the tone in order to enforce certain stimuli.

Further on in the book, Bachelard explains how memories are triggered by moving up or down, using the attic and cellar as examples. These spaces are always tied to certain memories and allow for compartmentalization of the memories. Bachelard explains how the stairs connecting the rooms act as a physical change, but also an emotional change; ascending the stairs can feel uplifting, while descending can feel grounding. (Bachelard 1994)

Also, Bachelard discusses the relation between inside and outside and how the boundary between the two is not just physical but also represents existential conditions. The inside is associated with intimacy and protection while the outside is associated with exposure and the unknown. However, the

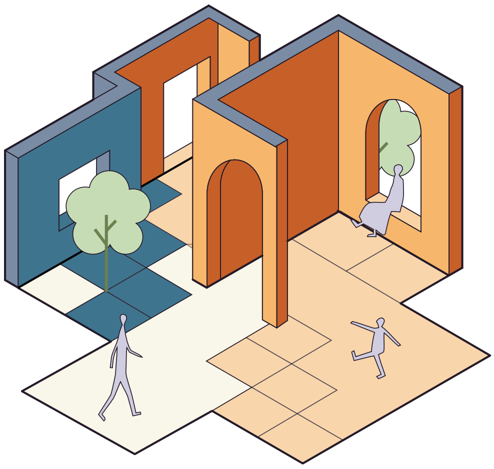


illustration 5. topophilia

house, even though it is associated with the protected inside, still communicates with the exposure and unknown of the outside through doors and windows. (Bachelard 1994)

This posts us as designers with an interesting opportunity to work with the intimacy and protection of the inside while exposing it to the unknown of the outside to some degree.

Topophilia

In his book *Topophilia* (1974), Yi-Fu Tuan develops the concept of place attachment (topophilia) which is deeply tied to memory and personal experience, which means that our environment affects our feelings and who we are. Tuan discusses how people develop their own way of looking at spaces, while looking at aspects such as geography, the senses and individual life. By understanding how people form attachments to their surroundings, architects can craft environments that evoke belonging, comfort, and identity.

Tuan emphasizes that our relationship with place begins at the sensory level; what we see, hear, touch, and even smell. Architecture engages the senses through materiality, light, sound, and texture, all of which contribute to how a space is perceived and remembered. The tactility of natural wood, the coolness of stone underfoot, or the diffused glow of light filtering through a screen can evoke warmth, tranquility, or awe. Sensory engagement fosters a sense of presence, making spaces feel lived-in rather than merely occupied. (Tuan 1974)

Certain spaces become meaningful not only because of their design but also due to the life events that unfold within them. A childhood home, a city square where one spent afternoons, or a sacred site of cultural heritage carries an emotional weight beyond its physical form. Architects can design with an awareness of how spatial memory functions, using elements like thresholds, courtyards, and intimate enclosures to create spaces that feel familiar, grounding, and enduring. (Tuan 1974)

This idea closely overlaps with Bachelard's *The Poetics of Space* (1994). Bachelard explores how the home, particularly childhood spaces, serves as a vessel for intimate memories and dreams, describing it as a psychic space where past experiences become layered into its structure. Similarly, Tuan acknowledges the affective power of places like childhood homes, emphasizing how personal and cultural histories embed themselves in space. Both thinkers argue that spaces hold emotional weight beyond their material form. Furthermore, both Tuan and Bachelard view memory as central to how people experience place. Bachelard speaks of oneiric houses; places that live in our memories and continue to shape our sense of belonging. Similarly, Tuan argues that places become meaningful because of the life events that occur within them, emphasizing the interplay between lived experience and architectural form.

Tuan distinguishes between different scales of spatial attachment, from intimate, enclosed environments to expansive landscapes. Architects can reinforce topophilic connections by designing spaces that encourage human interaction at different levels. Courtyards, porches, and semi-private thresholds foster community, while large civic spaces, parks, and grand halls create a shared sense of belonging. The scale of a space influences how people relate to it; cozy interiors invite introspection, while open plazas promote social engagement and collective identity. (Tuan 1974)

Architecture is shaped by and in turn shapes cultural perceptions of place. Tuan elaborates on how vernacular architecture, which evolves in response to climate, materials, and cultural traditions, often fosters strong topophilic bonds. By integrating regional materials, traditional building techniques, and cultural narratives into contemporary design, architects can create structures that feel rooted in their context rather than imposed upon it. (Tuan 1974)

Topophilia is not static; it is shaped by movement through space. The way architecture choreographs experience, through pathways, framed views, and sequences of light and shadow, can enhance spatial attachment. Designing spaces that encourage exploration, pause, and reflection allows for a richer engagement with the built environment. (Tuan 1974)

This idea closely aligns with Bachelard's *The Poetics of Space*, particularly his discussion of the stairway as a metaphor for movement through space and shifting psychological states. Bachelard describes the staircase not just as a physical transition but as an element that evokes different moods. Similarly, Tuan's argument that architecture choreographs experience suggests that spatial transitions, whether through staircases, thresholds, or framed views, shape emotional and psychological responses to the built environment. Bachelard also highlights the significance of pauses in movement, which mirrors Tuan's emphasis on how architecture should encourage exploration, pause, and reflection to deepen spatial attachment. Both suggest that spaces are not just passed through but actively felt and internalized, with architectural elements functioning as chapters in an unfolding narrative of experience.

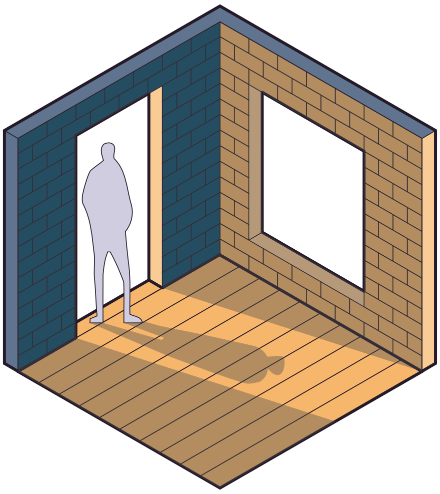


illustration 6. atmospheres

Atmospheres

Peter Zumthor changes the point of view of conceptual and emotional relationships of architecture to the sensory and material aspects in his book Atmospheres (2006). As an introduction Zumthor gives an example of how he sits at an arcade, observing the square in beautiful weather with people talking and walking, different sounds which he claims all together make up 'Magic of the Real'. In order to achieve this magic (atmosphere), it is necessary to understand what components are needed.

Throughout the book Zumthor explains that there are **9(+2)** key points that have to be taken into account when trying to achieve atmospheric spaces.

1. **The Body of Architecture** – The physical presence of a building, its form, structure, and how it occupies space.

2. **Material Compatibility** – How different materials interact and contribute to the overall sensory experience.

3. **The Sound of a Space** – The acoustics of architecture and how materials shape sound perception.

4. **The Temperature of a Space** – The warmth or coolness of materials and how they influence comfort.

5. **Surrounding Objects** – The role of objects, furniture, and details in shaping atmosphere.

6. **Between Composure and Seduction** – The balance between wanting to stay in place and wanting to explore at ones own discretion.
7 **Tension Between Interior and Exterior** – The way inside and outside relate, influencing transitions and thresholds.

8. **Levels of Intimacy** – How spatial design guides experiences from exterior to interior, creating different emotional effects. Differences in mass in contrast to ones own body.

9. **The Light on Things** – The role of light, both natural and artificial, in revealing texture,-form and reflectance. As well as how shadows are cast.

10. **Architecture as Surroundings** – The idea that buildings create atmosphere by being part of a larger context.

11. **Coherence** – The unity of all architectural elements to form a harmonious, immersive experience.

By applying the initial 9 points, it is indeed possible to achieve certain atmospheres but are they able to achieve anything if they are not coherent, which is why the last 2 points are equally important, if not more important. These two points ensures that form relates to the context and creates an instinctive first impression and makes sure that everything works together. Of course, one can choose a single focal point, but that would be at the cost of another, to some degree.

"*I think architecture attains its highest quality as an applied art. And it is at its most beautiful when things have come into their own, when they are coherent.*" (Zumthor 2006 p. 69)

Zumthor also talks about how a room is perceived based on the first impression and that sometimes the emotion takes hold before a single thought about why and how. This must mean that there is something subconscious that decides how we feel, even before thinking about it.

Zumthor's ideas in *Atmospheres* (2006) significantly overlaps with Tuan's emphasis on sensory experience and presence. Both Zumthor and Tuan argue that architecture is not just about physical form but about how a space feels and is experienced through the body and senses. For Zumthor, materiality, sound, and light are key to shaping architectural atmospheres, much like how Tuan describes the feel of stone, wood, and filtered light as evoking warmth or tranquility. Tuan's focus on materials, such as the tactility of wood and the coolness of stone, aligns with Zumthor's belief that materials carry memories and emotions, reinforcing a sense of spatial presence. Likewise, Tuan's mention of "the diffused glow of light filtering through a screen" resonates with Zumthor's idea that light is a fundamental element in crafting atmosphere, guiding perception, and creating emotional depth.

Theories Intersect and Architectural Relevance

All these books give a perspective on how the built environment influences our perception and experiences from an architectural viewpoint. Bachelard and Tuan give insight into the importance of **materiality, movement, and memories** and how they all interplay with each other. Finally, Zumthor gives a deconstruction of how architectural elements, and the environment impact the atmosphere of a place. Together, these perspectives form a conceptual foundation for understanding the experiential qualities of architecture.

Building on this theoretical framework, it becomes possible to translate these insights into tangible design tools that can be adjusted and manipulated throughout the design process.

Level of Movement – referring to the ease or difficulty of transitioning from one space to another, as well as the degree of spatial or experiential change encountered during this movement.

Level of Stimulation – encompassing the quantity and variety of sensory inputs such as objects, colors, textures, and materials present in a space.

In summary, the theories of Bachelard, Tuan, and Zumthor collectively emphasize that architectural experience is shaped not only by physical form but also by how we move through space, the materials that surround us, and the memories spaces evoke. Movement influences the emotional journey, materiality engages the senses, and memory anchors personal meaning. Together, these elements form the foundation for creating architecture that resonates on both a sensory and emotional level; spaces that are not merely occupied, but deeply experienced.

Theory

The Mind's Understanding of the Built Environment

The conventional understanding of cognition assumes that all mental processes are confined within the brain. From an early age, we are taught that thinking occurs in the brain and that it governs our bodily functions. While this is neurologically accurate, contemporary theories suggest that the mind extends beyond the brain, engaging with both the body and the surrounding environment.

Most of the five "traditional" senses, sight, hearing, smell, and taste, are processed through sensory organs located in the head, reinforcing the illusion that perception is a purely cerebral experience. However, emerging research in perception, embodied cognition, and the extended mind theory challenges this notion (Clark & Chalmers, 1998). Instead of being an isolated entity, the mind is increasingly understood as an active participant in a dynamic exchange between the body, space, and external stimuli.

This perspective suggests that cognition is not merely an internal process but is deeply intertwined with our physical and spatial surroundings. Architectural forms, materials, and spatial configurations influence not only how we perceive our environment but also how we think, feel, and interact within it. Theories on visuospatial exploration, form perception, and embodied experience indicate that our cognition is shaped by external structures just as much as by neural activity. Consequently, understanding the mind requires an examination of how space and architecture contribute to human experience and mental processes.

A wide range of studies and experiments have been conducted to examine how the built environment shapes human perception and experience. These studies vary significantly in their focus and methodology, employing approaches that range from verbal assessments of intuitive reactions to advanced fMRI scans measuring neural activity. Key areas of investigation include room dimensions, spatial openness, shapes, and colors, all of which contribute to our psychological and emotional response to architectural spaces.

Research findings reveal several design principles that influence how spaces are perceived:

Ceiling Height: Rooms with high ceilings are generally perceived as more aesthetically pleasing. They also stimulate visuospatial exploration, engaging brain regions responsible for spatial perception, navigation, and attention (Vartanian et al., 2015).
Openness vs. Enclosure: Open spaces are viewed as more inviting, encouraging users

to enter, whereas enclosed spaces can evoke feelings of discomfort or even fear, as indicated by increased activity in the amygdala, a brain region associated with emotional processing (Vartanian et al., 2015).

Form and Edges: Soft, curved forms are generally preferred over sharp, angular edges, which are often linked to subconscious fear responses (Whalen et al., 2008).

Color and Temperature Perception: Warmer colors (red, orange) create the illusion of a higher temperature, while cooler colors (blue, green) produce the opposite effect (Ho et al., 2016).

Ceiling Color and Spatial Perception: Light-colored ceilings create the illusion of greater height, whereas dark ceilings can make a space feel lower and more enclosed (von Castell, Hecht and Oberfeld, 2018).

These insights can serve as **design tools** to shape user experiences and elicit specific emotions. However, the effectiveness of these principles often relies on contrast and contextual application. For instance, while curved forms are generally preferred over sharp edges, this does not imply that all architectural elements should be rounded. Instead, an interplay of curved and straight lines enhances the perceptual impact of both. Similarly, contrast in spatial configurations can be leveraged to define atmospheres suited to different functions—for example, dining and living areas, which foster social interaction, may benefit from forms that evoke comfort and aesthetic pleasure.

By understanding how these architectural elements interact with human cognition and perception, it is possible to create spaces that not only fulfill functional needs but also enhance the emotional and psychological well-being of their users.

Impact of Nature

While the built environment significantly shapes human perception and experience, the natural environment also plays a crucial role in overall well-being. Numerous studies have demonstrated that exposure to green spaces has a positive impact on mental health, reducing stress and enhancing cognitive function (Weir, 2020). Notably, even a visual connection to nature can contribute to these benefits, underscoring the importance of integrating natural elements into architectural design. By incorporating green spaces within the built environment, the overall user experience can be enriched, fostering a sense of well-being and adding additional quality to the home.

Designing Ownership of Space

The Unconscious Mind

To design a sense of ownership, it is relevant to know why we experience this feeling. For this reason, an exploration of the different stages of unconsciousness will be explained and one will be chosen as a focal point as basis for upcoming design iterations.

For starters we have the subconscious mind, which refers to the part of mind that a person is not aware of. Early on, it was believed that the subconscious mind consisted of animalistic and sexual urges, which belief was later changed by Carl Jung (psychiatrist, psychotherapist, and psychologist), who for starters argued that instead of being inferior to the conscious mind, the subconscious was simply unconscious and just as important. Jung argued that the unconscious mind affects people's behavior and thinking, which has become the popular belief. (Fakri, 2022)

Exploring further, Jung categorizes the unconscious as 'personal' and 'collective'. The personal unconscious includes anything which is not presently conscious but can be. The personal unconscious is made up essentially of contents which at one time have been conscious but have disappeared from consciousness through having been forgotten or repressed. The personal unconscious is like most people's understanding of the unconscious in that it includes both memories that are easily brought to mind and those that have been repressed for some reason. (Fakri, 2022)

The 'collective unconscious' refers to a part of the unconscious mind shared by all human beings, containing memories and experiences that are universally inherited and not shaped by personal experiences. Unlike the personal unconscious, which is unique to each individual, the collective unconscious is a deeper layer that holds symbols and mythological themes common across cultures and throughout history. (Fakri, 2022)

As this project is about the perception of spaces in a newly built environment it is relevant to cater to the majority of stakeholders, meaning that the design should focus on the collective unconscious.

Designing for the Unconscious Mind

Recent advancements in neuroscience have increasingly illuminated the subtle yet profound ways in which the built environment influences human perception, cognition, and behavior. Neuroarchitecture, a field situated at the intersection of neuroscience and spatial design, proposes that architectural features can guide human experience through unconscious sensorimotor responses (SMRs). These responses are not general forms of bodily coordination, but rather, automatic adaptations to environmental features (EFs) that modulate behavior without the need for conscious awareness. (Djebbara et al., 2022)

The interaction between humans and their spatial context is governed by what is referred to as the action-perception loop. Within this loop, perception is not a passive reception of stimuli, but rather an active process driven by prediction. According to the framework of predictive processing, the brain continually generates hypotheses about incoming sensory data and adjusts behavior in response to discrepancies, termed prediction errors, between expected and actual inputs. (Friston, 2010; Djebbara et al., 2022) This loop is tightly coupled with movement and is fundamentally shaped by the affordances of the environment, that is, the perceived possibilities for action offered by spatial features (Gibson, 1986).

Central to this framework is the role of transthalamic pathways, particularly those involving the pulvinar nucleus of the thalamus. The pulvinar acts not merely as a relay station, but as an integrative hub that synchronizes cortical activity and modulates attention based on environmental and bodily signals. Through this mechanism, architectural features, such as the shape of a corridor, the curve of a wall, or the openness of a threshold, are translated into sensorimotor responses that subtly bias behavioral outcomes. (Djebbara et al., 2022)

For example, studies have demonstrated that spatial transitions involving gentle curves (as opposed to sharp corners) elicit smoother and more relaxed movement trajectories, suggesting a calming effect on users. Conversely, environments with abrupt changes in optical flow, such as those caused by narrow turns or high-contrast visual cues, can induce heightened arousal or caution, prompting users to slow down or adjust their gait. These effects occur at a subconscious level, often without the user's explicit awareness, and are mediated by rapid neural processing involving visual and sensorimotor integration. (Ludwig et al., 2018; Djebbara et al., 2022)
These findings highlight the capacity of architectural form to engage the unconscious mind. Even small manipulations, such as narrowing the spacing of road lines or changing the texture of flooring, can alter perception of speed or direction, with measurable effects

on behavior (Thaler & Sunstein, 2021; Manser & Hancock, 2007). Such interventions harness the body's automatic calibration to sensory stimuli, optimizing environments for safety, comfort, or navigational clarity.

While the article by Djebbara et al. (2022) does not directly address materiality or color, the theoretical model of SMRs and EFs can reasonably be extended to encompass these dimensions. Textures, colors, and lighting conditions are all capable of eliciting sensorimotor resonances based on learned bodily associations, suggesting a rich terrain for further empirical exploration.

In sum, designing with the unconscious mind in view requires an understanding of how environmental features resonate with the body's predictive and sensorimotor systems. Architectural design thus becomes a means of modulating perception and behavior by shaping the sensory landscape in which cognition unfolds. This approach repositions architecture not only as a visual medium, but as a tool for structuring human experience at the most fundamental biological level.

Sub Conclusion

Designing a sense of ownership in space involves engaging the unconscious mind, particularly the collective unconscious, where shared human instincts and responses reside. By integrating insights from psychology and neuroscience, architecture can subtly guide perception and behavior through environmental features that resonate at a sensorimotor level. When design aligns with deep-rooted needs like self-protection and kin care, space becomes intuitively meaningful and supportive. Ownership, then, is not just about possession, but about spaces that feel inherently aligned with who we are.

Key Findings:

- The **collective unconscious** (Jung) offers a shared psychological foundation for designing spaces that resonate universally.

- **Self-protection and kin care** are fundamental human motives relevant to spatial design.

- **Neuroarchitecture** shows that environmental features trigger automatic sensorimotor responses (SMRs) that shape behavior unconsciously.

- The a**ction-perception loop** means our brains predict and adapt to sensory input from space, influencing how we move and feel.

- Architectural features like **curves, thresholds, and textures** influence user behavior and emotion at a subconscious level.

- Subtle design choices can support developmental needs and foster a **deeper sense of belonging** and ownership.

Indoor Environment

Indoor Comfort and the Perception of Space

Indoor comfort transcends technical optimization and involves a complex interplay between physical conditions, sensory experiences, and human perception. As research on thermal comfort evolves, it becomes increasingly clear that comfort is not solely defined by maintaining precise environmental parameters but by creating spaces that resonate with human needs, preferences, and adaptive behaviors. Understanding indoor comfort from a human-centered perspective requires a holistic approach that prioritizes psychological well-being and personal control, as well as the multi-sensory nature of spatial experience.

Perception of Comfort: Moving Beyond Technical Standards

Historically, indoor comfort has been approached from a technical perspective, primarily driven by the needs of the HVAC industry to standardize thermal conditions and maintain a perceived "neutral" environment (Nicol & Roaf, 2017). These approaches often focus on fixed temperature and humidity levels, assuming that a controlled and stable indoor climate ensures comfort. However, studies have shown that comfort is inherently subjective and influenced by factors such as personal adaptation, cultural context, and individual preferences (Sansaniwal et al., 2022).

The adaptive thermal comfort model challenges traditional static standards by emphasizing how people naturally adjust their behavior and expectations based on context and personal habits. For instance, James F. Nicol and Susan Roaf (2017) highlight that occupants in different climates exhibit tolerance to a wide range of temperatures, demonstrating that comfort is not universally defined but culturally and environmentally conditioned. (Nicol & Roaf, 2017)

Furthermore, personal control over the indoor environment significantly influences comfort perception. Research shows that when individuals have the ability to manipulate their surroundings, such as by opening windows, adjusting thermostats, or modifying lighting, comfort satisfaction increases, even when objective conditions deviate from conventional standards. However, the increasing automation of building systems can sometimes undermine this sense of control, leading to dissatisfaction despite optimal technical performance. (Hellwig et al., 2020)

illustration 7. indoor comfort

The Role of Sensory Experience and Human Perception

Comfort in indoor environments is not purely physiological but is deeply intertwined with sensory and psychological responses. A comfortable space is one that aligns with the human desire for connection, familiarity, and personal agency. Sensory stimuli such as light quality, sound levels, material textures, and air movement, directly affect how occupants feel and respond to a space. (Fransson et al., 2007)

Visual Comfort: The way light interacts with surfaces, the presence of natural daylight, and the absence of glare are crucial to visual comfort. As noted by Frontczak and Wargocki (2011), lighting quality influences not only visual perception but also emotional well-being. Dynamic lighting systems that mimic natural light variations throughout the day have been shown to support circadian rhythms and enhance mood. (Frontczak & Wargocki, 2011)

Thermal and Tactile Comfort: Beyond achieving a balanced temperature, comfort also involves the tactile experience of materials and the perception of thermal variability. For instance, naturally ventilated buildings often feel more comfortable because occupants perceive natural airflow and temperature shifts as refreshing and invigorating, rather than oppressive or stifling (Sansaniwal et al., 2022). This aligns with the concept that mild thermal discomfort can be psychologically beneficial as it promotes a sense of dynamic interaction with the environment (Nicol & Roaf, 2017).

Adaptive and Human-Centered Comfort Models

In contrast to static comfort models, adaptive approaches acknowledge that thermal comfort is a dynamic and subjective phenomenon. Rather than imposing a rigid indoor climate, these models support context-specific comfort strategies that respond to local climates, cultural norms, and occupant preferences (Sansaniwal et al., 2022). Adaptive comfort acknowledges the thermoregulatory behavior of humans, such as adjusting clothing or altering posture, as a fundamental aspect of maintaining well-being (Hellwig et al., 2020).

Research also highlights the importance of personal control in adaptive comfort models. As Hellwig et al. (2020) point out, the balance between automated climate control and manual intervention is crucial for maintaining user satisfaction. When automation is perceived as overly rigid or unresponsive, it can lead to a sense of alienation from the environment, reducing overall comfort despite technically ideal conditions (Hellwig et al., 2020).

Multi-sensory engagement plays a vital role in enhancing comfort. Integrating natural materials, textured surfaces, and variable lighting into indoor environments supports a rich sensory experience that resonates with human instincts for connection and grounding. Comfort becomes an immersive experience rather than just a technical achievement.

Spatial Perception and Emotional Comfort

The perception of space significantly shapes how comfortable it feels. Spaces that balance openness and enclosure foster feelings of safety and relaxation (Fransson et al., 2007). This balance can be achieved through architectural elements like niches or semi-enclosed spaces, which create zones of comfort within larger areas. Additionally, human-scaled design focusing on proportions that align with human interaction, reinforces a sense of familiarity and ease (Sansaniwal et al., 2022).

The emotional quality of space is also influenced by how it accommodates personal rituals and everyday activities. Comfort arises when the environment supports habitual actions, allowing for a personal connection to space. This human-centric perspective emphasizes that comfort is a contextual and evolving relationship between people and their environments (Nicol & Roaf, 2017).

Sub Conclusion

In order to prioritize human-centered comfort, it is necessary to integrate adaptive, flexible, and sensory-rich design strategies such as:

- **Personal Control and Adaptability:** Foster user agency by incorporating adjustable systems that balance automation with manual overrides (Hellwig et al., 2020).

- **Multi-Sensory Design:** Combine natural materials and dynamic lighting to enhance sensory well-being (Sansaniwal et al., 2022).

- **Human-Scaled and Contextual Approaches:** Design spaces that align with cultural norms and local climatic conditions, promoting thermal adaptation and personal engagement (Sansaniwal et al., 2022).

- **Integrative Comfort Models:** Move beyond static thermal criteria by adopting adaptive comfort approaches that reflect real-world diversity and subjective experiences (Nicol & Roaf, 2017).

Indoor comfort is a complex phenomenon that emerges from the dynamic interaction between space, sensory experience, and human perception. Rather than reducing comfort to technical optimization, it must be understood as a holistic and adaptive process that fosters emotional and psychological well-being. By embracing personal control, adaptive strategies, and sensory integration, it becomes possible to craft environments that not only function efficiently but also resonate with human experience and connection.

Key Findings:

- Indoor comfort is not solely about fixed temperature and humidity but a holistic experience shaped by perception, sensory engagement, and adaptability

- Sensory factors significantly impact how comfortable a space feels

- Visual comfort: Natural light, glare control, and dynamic lighting enhance emotional well-being.

- Thermal & tactile comfort: Perceived airflow, material texture, and temperature variation impact comfort more than static thermal control

- User control over temperature, lighting, and ventilation improves satisfaction, even if conditions deviate from standardized norms

Design Toolbox

To ensure the practical application of the selected theory throughout the project, it will be distilled into a series of design tools. The objective is to have a set of adjustable tools that can be modified incrementally. Given the complexities inherent in working with perception and experience, it is often challenging to select a single definitive solution. Therefore, these tools will serve as a framework for understanding the effects of various alterations on the spatial experience, providing insight based on theoretical principles. By adjusting these tools, the impact of each change can be assessed within the context of the theory, leading to more informed decision-making throughout the design process.

Ceiling Height Tool

Adjustable Parameter: Ceiling height (low to high)

Effect on Experience: Higher ceilings create a sense of openness and freedom, enhancing spatial perception and making the space feel more aesthetically pleasing. Lower ceilings make spaces feel more intimate, cozy, and enclosed.

Use Case: Increase ceiling height to encourage exploration and enhance attention, decrease it for comfort or a sense of enclosure.

Openness vs. Enclosure Tool

Adjustable Parameter: Openness (open vs. enclosed spaces)

Effect on Experience: Open spaces tend to feel inviting, encouraging engagement and interaction. Enclosed spaces can feel secure but may also induce discomfort or unease, activating emotional regions of the brain.

Use Case: Design for openness to foster a welcoming atmosphere or incorporate more enclosures for intimacy, security, or privacy.

Form and Edges Tool

Adjustable Parameter: Form (curved vs. angular edges)

Effect on Experience: Soft, curved forms are associated with calmness and safety, while angular or sharp edges can evoke unease or even subconscious fear responses.

Use Case: Use curved and organic shapes to create a relaxing, peaceful environment, or sharp, angular forms providing dynamic, edgy aesthetics with a possible emotional tension.

Color and Temperature Perception Tool

Adjustable Parameter: Color (warm vs. cool tones)

Effect on Experience: Warm colors (reds, oranges) evoke warmth and coziness, often stimulating energy. Cool colors (blues, greens) tend to calm the environment and make it feel cooler, more relaxed.

Use Case: Choose warm colors to create a stimulating, vibrant atmosphere, or cool colors for a tranquil, serene effect.

Ceiling Color and Spatial Perception Tool

Adjustable Parameter: Ceiling color (light vs. dark)

Effect on Experience: Light-colored ceilings give the illusion of greater space, making rooms feel taller and more open. Dark ceilings can make a room feel more intimate but also smaller and more enclosed.

Use Case: Use light ceiling colors to enhance a sense of spaciousness, or dark colors to create a cozy, intimate space.

Level of Movement Tool

Adjustable Parameter: Degree of movement (easy vs. difficult transitions)

Effect on Experience: Spaces with easy movement encourage flow and flexibility, promoting a sense of freedom and exploration. More complex transitions or changes in space can challenge users' navigational skills, creating a dynamic experience.

Use Case: Design for easy movement to encourage interaction and exploration, or more challenging transitions to introduce complexity and engagement with the environment.

Level of Stimulation Tool

Adjustable Parameter: Sensory input (low vs. high stimulation)

Effect on Experience: Spaces with low stimulation (few colors, textures, and objects) feel calm and subdued, while high stimulation spaces are vibrant, dynamic, and full of sensory input, which can engage users more actively.

Use Case: Create tranquil environments by reducing sensory input or energize the space with a variety of textures, colors, and materials for a stimulating atmosphere.

These tools allow for adjustment and fine-tuning of the environment in order to achieve the desired psychological and emotional responses from the stakeholders.

The Site

Throughout this chapter, various site analysis will be conducted to gain knowledge about city life versus suburban life, focusing on Svenstrup as the chosen area for this project. Analysis into Svenstrup as well as microclimate and terrain will be done, to understand the city and project site as well as what opportunities suburban life has to offer.

From City to Suburbia

In recent years, moving from larger cities to suburban areas has become increasingly attractive (Boligforeningsweb, 2024). A primary motivation for this shift is the desire for a quieter environment, being closer to nature and away from urban noise. Additionally, the lower price per square meter in suburban areas makes homeownership and new construction more accessible. For instance, the average price per square meter in Svenstrup is 15,000 DKK (AB Himmerland, 2024), significantly lower than Aalborg's 21,212 DKK (Nordjyske, 2024).

The COVID-19 pandemic accelerated this trend by highlighting the feasibility of remote work (Boligforeningsweb, 2024). The ability to work from home reduces the need for proximity to workplaces, making suburban living a more viable option. The lower cost of housing also allows for greater financial flexibility, including the possibility of owning a car, which further enhances mobility and work-from-home opportunities.

Another advantage of suburban living is the increased sense of security as lower crime rates and reduced traffic contribute to a safer environment for children. Smaller communities often tend to foster stronger social connections, enhancing the overall quality of life for residents.

Key Findings:

- Suburban areas offer cheaper housing
- Quieter environment
- Work from home allows for more time with children
- Safe environment for the children
- Low crime rates

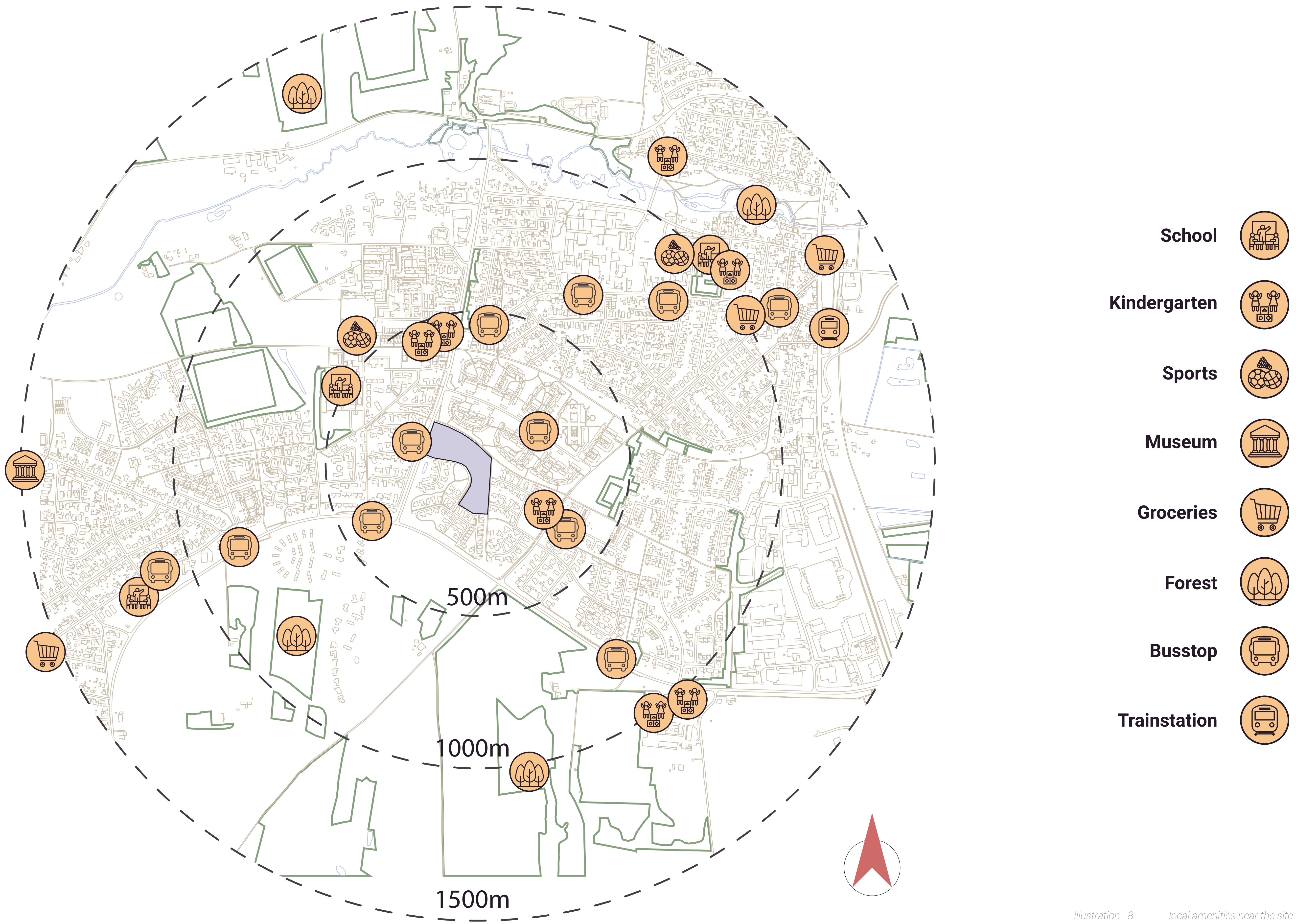


illustration 8. local amenities near the site

Svenstrup

Svenstrup is a small city southeast of Aalborg with 7861 residents (statistik banken 2024). As part of Aalborg Municipality, it strives to be more than just a suburb, offering a strong local community and a range of public facilities (Aalborg Kommune, 2024). The city has a public school, daycare centers, sports clubs, museums, and grocery stores, making it a well-rounded place to live. Thanks to its close connection to Aalborg and easy access to the highway, Svenstrup has great potential for growth (Aalborg Kommune, 2024). It is an ideal choice for new families looking for a quieter, small-town atmosphere while still being just a short drive or train ride from the city. The local train station also makes it convenient for young residents to continue living in Svenstrup while commuting to gymnasium or higher education institutions in Aalborg.

Key Findings:

- Close connection with Aalborg
- Offers a variety of amenities
- Local schools and kindergartens

Lokeshøj

Lokeshøj is a residential area in Svenstrup consisting of single-family brick houses. The residents are families with children, both those where the children are still living at home and those where they have moved out (Dingeo, 2024). The selected building plot for the project is the unbuild field north and east of the roads (see illustration XX). This undeveloped land covers approximately 33,000 square meters and presents a unique opportunity for new development.

The site is located within Lokeshøj and is surrounded by single-storey buildings to the south, a pond to the west, and a dense row of trees to the north and east, which serves as a natural barrier. This arrangement creates a sense of enclosure, providing both physical and visual separation from the larger roads, Langdyssen and Runesvinget, thereby enhancing the site's privacy and sense of isolation

Its quiet and well-connected location makes Lokeshøj an attractive option for new families. With Svenstrup's school less than 500 meters away and the nearest grocery store just 1.1 kilometers from the site, it offers both convenience and a peaceful residential environment.

Key Findings

- Primarily families with small children or grown-up children
- Detached brick houses
- Nestled inside a resident area
- Well-connected to surrounding education and shopping Microclimate

illustration 9. atmospheres

Microclimate

Topography of the Site

Looking at section C+D (a combined section (Illustration 11)) it is clear to see how the site slopes quite a lot from one end to the other. From the highest point in the middle of the site, the terrain slopes downward to each side. The difference in height from the lowest to the highest point is 7 meters. This slope allows for natural water runoff, which possibly can be utilized for recreation, as well as an opportunity to work with the placement of buildings, that takes the slope into account.

Key Findings:

- Potential recreational value

- Typography with a 7-meter height difference

Wind

The following illustrations (Illustration 12) are based on the data from the winds at Aalborg airport. Hence, they should be viewed with a grain of salt and are not a true reflection of how the wind blows at the site

The average direction of the wind comes from southwest with the strongest winds coming directly from West. However, it changes a lot throughout the year:

Spring: During the spring months the winds come from both east and west.

Summer: During summer months the winds come directly from the west.

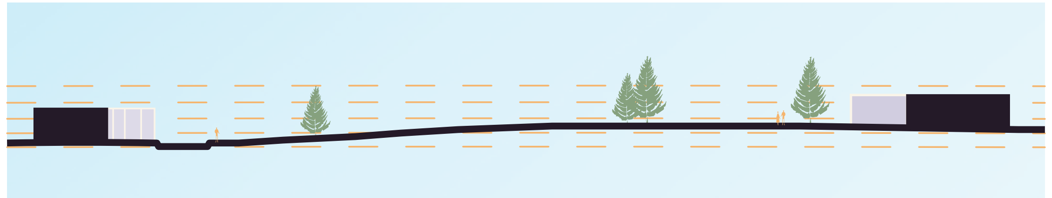
Autumn: During autumn months the winds come from the southwest, but the strongest winds are from the south.

Winter: During winter months the winds come from southwest and northeast, but the strongest winds are from southwest.

Since the site is rising above its context the winds should be considered when placing the houses and outdoor areas. Natural barriers such as the trees towards the east edge of the site could be a solution to counter the wind from the west. However, the direct winds at the site are not necessarily a bad thing as they allow for the possibility to utilize natural ventilation.

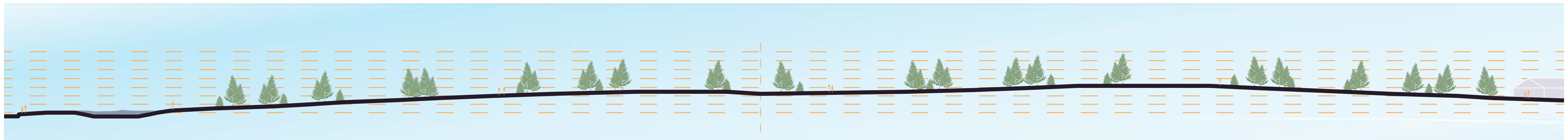
Key Findings:

- Shelter from the primary winds from west



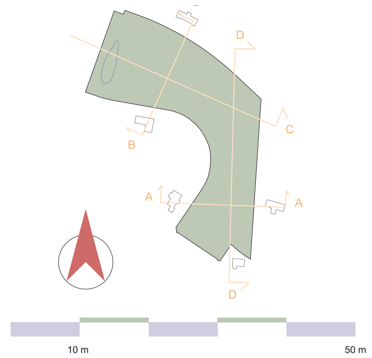
Section A

Section B



Section CD

illustration 10. topography of the site
section A
section B
section CD



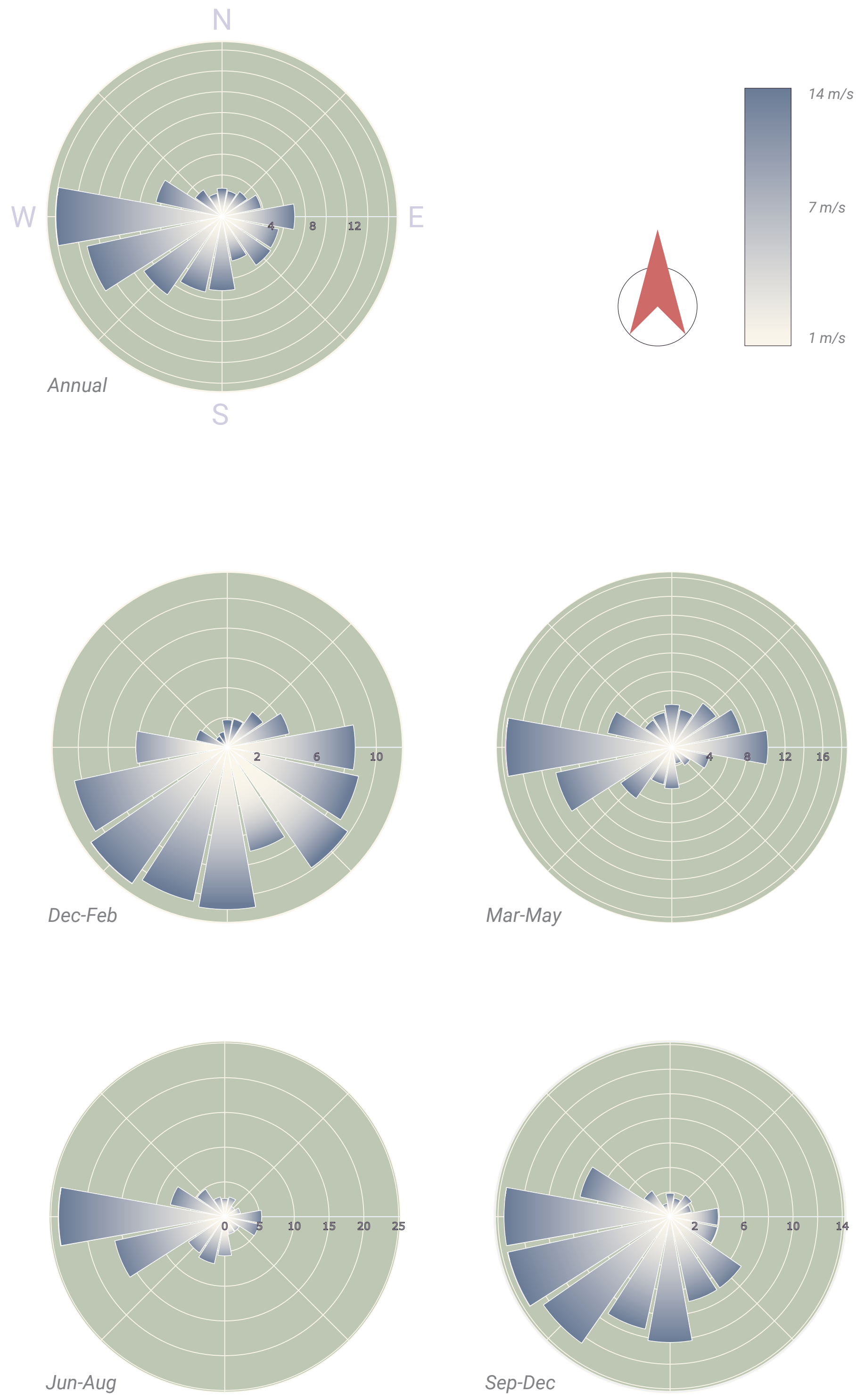


illustration 11. annual and seasonal windroses

illustration 12. bluespot for 30, 75 and 150mm

Bluespot

This series of images (Illustration 13) illustrates how the project site manages heavy rainfall scenarios (30mm, 75mm, and 150mm). As the site lacks roads and other impervious surfaces, water can easily infiltrate the ground. Additionally, the sloped terrain facilitates natural drainage, directing excess water away from the site. Furthermore, the site already contains two Sustainable Urban Drainage Systems (SUDS) designed to manage overflow. These SUDS will be necessary to keep as some of the open field will be covered by impervious surfaces (roads and buildings) (KAMP, n.d.).

Key Findings:

- Existing SUDS are capable of handling additional water on the site

- Water runs off the sloping terrain

Shadows

The images presented (Illustration 14) illustrate how shadows are cast across Lokeshøj throughout the year. Given that the site is located on a sloping hill, shadows cast by the lower buildings will not extend up to the project site. However, a dense row of trees to the east does create shadows during the early hours of the winter months. To ensure that houses receive morning sunlight, they should be positioned outside the reach of these shadows.

The remainder of the site offers ample opportunities to harness direct sunlight, whether for passive heating or the installation of solar panels, optimizing energy efficiency and sustainability.

Key Findings:

- The sloped terrain allows an even distributions of direct sunlight

- Opportunities to harness direct sunlight *march at 9AM, 12AM and 3PM*

june at 9AM, 12AM and 3PM

september at 9AM, 12AM and 3PM

illustration 13. march, equinox and september shadows

Phenomenology

A visit to Lokeshøj was planned to gain first-hand experience of the city, site, architecture, terrain and context.

During the visit to Lokeshøj, the warm sun and lack of wind felt nice and soothing. However, the nice weather did not make the existing buildings feel any less rejecting. The buildings stand with their sharp and monotonous shapes and color schemes which absorb the light, almost to a degree of forgetting that the sun is shining. Despite that, in very few places it is possible to identify some personality and life through the children's toys scattered in the front yard.

Walking around the site, which varies 7 meters vertically, feels almost flat as it is divided into a long distance. It is only when stopping and observing the nearby houses that one becomes aware of how much the terrain changes. Also, the two SUDS on site appear to be mostly dried out, suggesting that natural water will not be standing in any of them, meaning that other functions should be integrated into them. Lastly, around half of the site, dense plantation is present which allows for some privacy on the site. This plantation could also be integrated towards the main road to reduce noise and visual disturbance.

Within walking distance (~1000m) one finds Svanemølleparken which is a very lucrative park which holds lots of grassy areas, a big lake and a creek. Throughout the park there are plenty of places to settle down and enjoy the park and animal life within it.

Key Findings:

- Rejecting atmosphere
- The terrain feels flatter than it is
- Recreational park nearby
- The two SUDS needs to have more functions

illustration 14. genius loci

Sub Conclusion of 'The Site'

In conclusion, the suburban shift from city living is driven by a desire for tranquility, affordability, and safety, especially for families. Svenstrup exemplifies this trend, offering a balanced combination of connectivity to Aalborg, local amenities, and a strong sense of community. Lokeshøj, within Svenstrup, is particularly appealing for new family developments due to its peaceful environment, proximity to schools and shops, and the natural enclosure created by surrounding trees.

Despite Lokeshøj's pleasant natural conditions, the existing architecture feels uninviting, characterized by monotonous and disconnected forms that fail to harmonize with the environment. The subtle 7-meter slope, which feels almost flat due to its gradual change, presents an opportunity to integrate the terrain thoughtfully into the design. This height variation also supports optimal sunlight exposure and energy efficiency. The existing SUDS appear dried out and underutilized, indicating a need for multifunctional improvements to enhance recreational value. Additionally, dense vegetation on parts of the site provides privacy, which could be extended toward the main road to reduce noise and visual disturbances.

Moreover, the proximity to Svanemølleparken, a lush recreational area with grassy areas, a lake, and a creek, adds significant value to the residential experience.

Overall, Lokeshøj's potential lies in harmonizing residential development with natural features, transforming the current sense of rejection into a welcoming and vibrant community while maintaining close connections to the city.

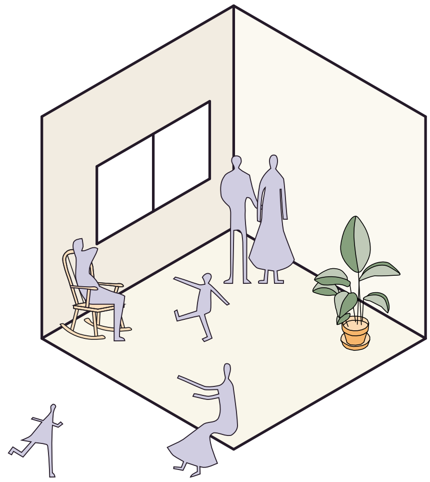


illustration 15. core family

Stakeholders

Main Stakeholders

The selected user group consists of young families seeking an alternative way of living compared to the traditional Danish nuclear family model. While the majority of Danish families follow the conventional structure of two parents and two children, this project focuses on a new generation who prioritize a socially engaged and community-oriented lifestyle.

These young parents, typically aged 25-35, are either expecting their first child or have already started a family. They seek to create a strong foundation for their family life by prioritizing meaningful social connections and shared experiences. Due to high housing prices in urban areas, they are increasingly looking towards suburban environments that offer more space and affordability. However, they are not merely searching for a standard single-family house; rather, they aspire to a housing model that fosters closer family ties and a stronger sense of community. (Arked, 2019)

Secondary Stakeholders

The secondary user group consists of individuals closely connected to the primary user group, particularly the older generation within the family. Their role is to strengthen family bonds and contribute to the household's core values. Many grandparents wish to live closer to their grandchildren, enabling them to take a more active role in their upbringing.

This group can generally be divided into two categories: those who provide support and those who require care. Many grandparents have either reduced their working hours or retired, allowing them more time to assist with childcare, such as picking up grandchildren from school and caring for them while the parents are at work. Conversely, some grandparents may require support themselves but prefer to remain in a family-oriented environment rather than moving into a nursing home. (Arked, 2019)

By integrating multiple generations within a shared living arrangement, this user group contributes to a socially sustainable way of living that fosters intergenerational support and stronger family connections. (AE, 2021)

Multigenerational Housing

In Denmark, it is not common for parents to live with grandparents. This living arrangement is primarily seen among non-Western immigrant families but is gradually gaining popularity among ethnic Danes. While multigenerational living is less prevalent in Western societies, it offers several advantages that challenge traditional housing norms. A generational house will bring unique values to all within the household. (Børsen, 2023)

As for **practical benefits** a household with multiple adults can better distribute everyday responsibilities. Grandparents can assist with childcare, including school pick-ups and supervision during sick days, providing greater flexibility for working parents. Additionally, elderly family members often require support in daily life, making multigenerational living a viable alternative to nursing homes. (Arked, 2019)

Living together can have some **economic advantages**, as it is often more cost-effective than maintaining separate households. Shared expenses, such as heating, rent, internet, and groceries, can significantly reduce the financial burden on individual family members. This makes multigenerational housing an attractive option in times of rising living costs. (Arked, 2019)

Not only does co-living **strengthen intergenerational bonds** and allow children to grow up with a closer connection to their grandparents. This arrangement also fosters mutual learning, as younger and older generations can share knowledge and experiences. Furthermore, the presence of family members ensures a lively household environment, benefiting both children and elderly residents alike. (Arked, 2019)

Sub Conclusion

While distinct in their needs and priorities, both user groups complement one another and contribute positively to each other's lives. By fostering an environment where multiple generations can coexist, the aim is to create a living arrangement that enhances social connections and mutual support. This approach not only strengthens family bonds but also promotes a more sustainable and community-oriented way of living.

Key Findings:

- Young families in Denmark are seeking community-oriented, affordable housing as an alternative to traditional nuclear family models

- Older family members (often grandparents) provide support or receive care within the household

- Shared responsibilities and expenses make this model sustainable and cost-effective

- Strengthens intergenerational bonds and creates a lively, supportive living environment

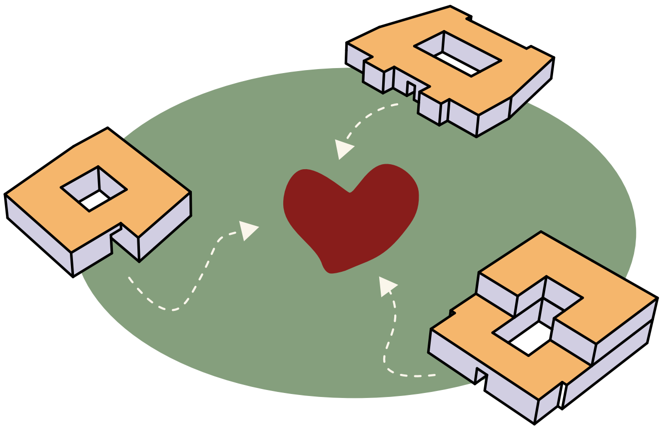


illustration 16. co-housing community

Co-Housing: A Social and Architectural Phenomenon

Co-housing has its early roots in Denmark, dating back to the 1970s, when the first modern examples of this housing concept emerged. These early initiatives aimed to foster social communities, functioning as micro-societies where residents lived in closer proximity and benefitted from shared resources (Bolius, 2023). Today, Denmark is home to approximately 400 co-housing communities, encompassing nearly 10,000 housing units. The most prevalent forms of co-housing are age-diverse communities and senior housing, with the latter accounting for approximately 5,500 housing units, while age-diverse communities comprise around 3,400 units (SBST, 2024).

Key Elements of Co-Housing Communities

A defining characteristic of co-housing projects is the presence of shared facilities that encourage residents to engage with one another beyond the confines of their private homes. One of the most common features is communal dining, where scheduled meal preparation and shared dining arrangements reduce individual household burdens while fostering social cohesion. For instance, a rotational cooking schedule ensures that residents can enjoy pre-prepared meals several times a week, freeing up personal time for other activities (SBST, 2024).

Additionally, shared green spaces, such as community gardens, greenhouses, and orangeries, provide opportunities for residents to cultivate fruits and vegetables collaboratively. This not only promotes sustainability and self-sufficiency but also strengthens the sense of community through shared goals and collective effort. Practical amenities such as workshops and communal laundry facilities further facilitate casual interactions among residents, integrating social engagement into everyday routines (Boligportal, 2023).

Challenges and Considerations

While co-housing offers numerous advantages, it is not suited to everyone. Successful participation in a co-housing community requires an open and social mindset, as individuals must navigate daily interactions and shared responsibilities with their neighbors. Minor disagreements, if left unresolved, can escalate and disrupt the communal harmony more easily than in traditional residential settings. Furthermore, the reduced level of privacy, compared to conventional housing, may not appeal to individuals who highly value personal space (Homes, 2023).

Enhancing Co-Housing Through Generational Housing

To further enhance the quality of co-housing, this project integrates the concept of generational housing. This approach establishes two interconnected layers of shared living: a broader co-housing community and a more intimate, multi-generational co-living household. By designing homes that accommodate three generations under one roof, the project fosters an intergenerational mix within the larger co-housing environment, promoting diversity, social cohesion, and mutual support among residents.

Incorporating a secondary user group, the older generation, requires careful consideration of both spatial and functional needs. Traditionally, co-housing communities consist of individual households, each accommodating a single family. However, with the introduction of multi-generational living, each home must now cater to two families, increasing the number of residents from four to six. (SBST, 2024). This means that the larger co-housing community will consist of co-living homes.
This shift necessitates additional living space to ensure convenience and privacy for all occupants. Therefor the home should be designed to cater to all users to ensure a suitable living environment. (Bolius, 2023).

Sub Conclusion

Co-housing presents a compelling alternative to traditional housing models, fostering strong social connections and shared resources while maintaining a degree of personal privacy. Rooted in Denmark's housing culture since the 1970s, this concept has evolved to encompass diverse living arrangements, including age-diverse and senior co-housing communities. By balancing communal interaction with private living spaces, co-housing offers an attractive solution for individuals seeking both social engagement and independence.

However, successful co-housing requires a willingness to embrace shared responsibilities, navigate social dynamics, and compromise on privacy. While this model enhances community ties, it may not suit everyone, as differences in lifestyle and expectations can pose challenges.

The integration of generational housing into co-housing communities further strengthens this approach by fostering intergenerational relationships and expanding support networks. By designing homes that accommodate multiple generations under one roof, the project enhances both the practicality and social sustainability of co-housing. Through thoughtful spatial planning and considerations, these communities can create inclusive environments that support diverse age groups while promoting long-term social and economic benefits.

Key Findings:

- Private housing units with shared community spaces, balancing privacy and social interaction
- Shared facilities (kitchens, gardens, workshops) encourage social engagement
- Generational housing combines co-housing with multi-generational living to support diversity and social cohesion
- Potential conflicts if disputes are not managed well

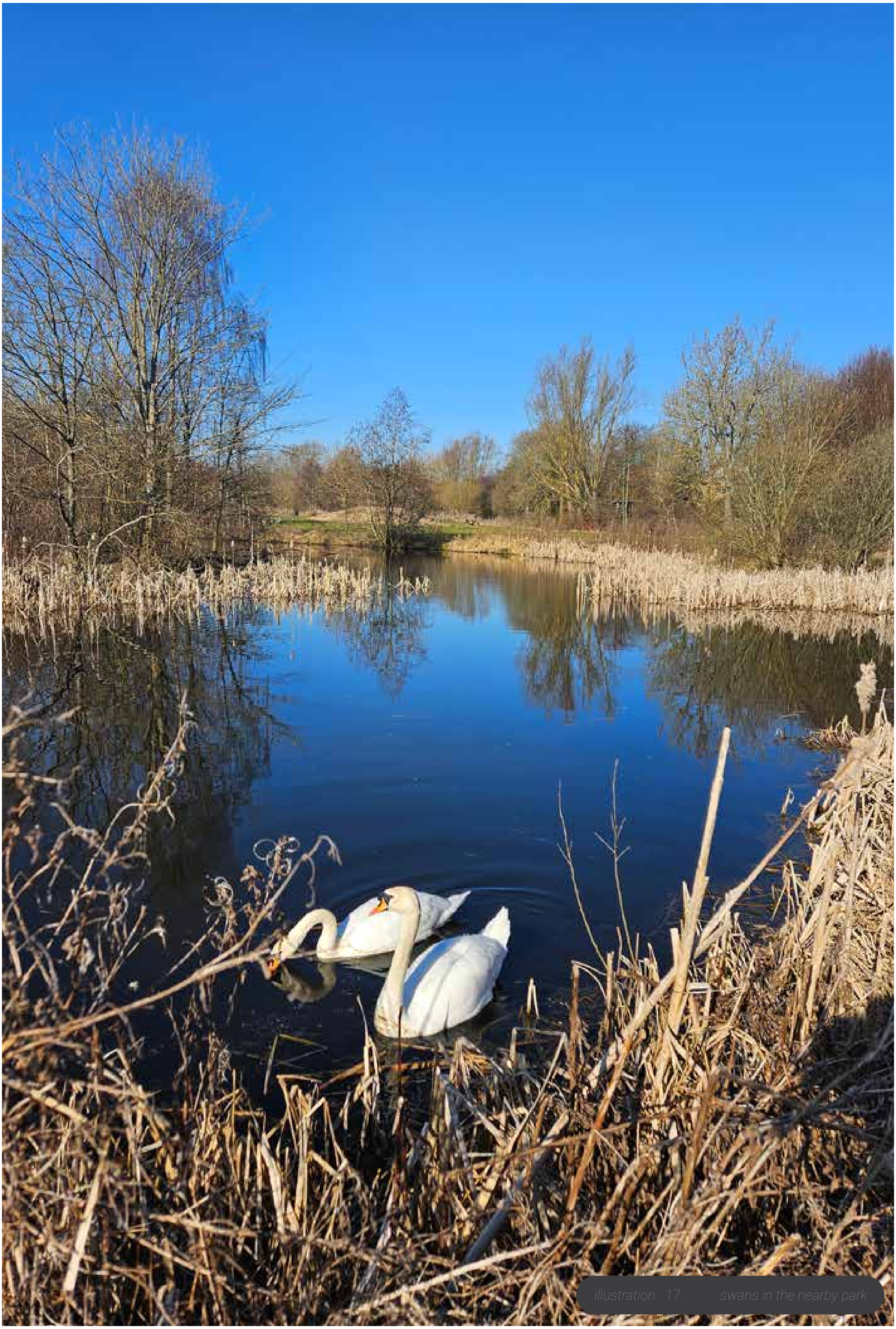


illustration 17. swans in the nearby park

Evolution of the Danish Co-Housing Communities

Since its emergence in the early 1970s, the typologies of co-housing communities have undergone significant transformation. Initially, these communities were primarily composed of low-rise housing centered around a shared common house. However, as the concept gained traction, new approaches to co-housing emerged. One notable shift was the repurposing of existing buildings, where former factories, schools, and farmhouses were transformed into communal living spaces, adapting old structures to accommodate modern co-housing needs (Jensen et al. 2022).

Despite these variations, low-rise housing remains the dominant typology, accounting for 69% of all co-living units, while 11% consist of free-standing houses and 20% of multi-story buildings. However, the architectural form of each community is deeply influenced by its social structure. The way residents interact, share facilities, and organize daily life plays a crucial role in shaping the spatial layout and density of the community (Jensen et al. 2022).

To gain a deeper understanding of how different typologies impact residents, this study will examine three case studies. These will be analyzed and compared based on their scale, materiality, and degree of privacy, providing insight into how architectural design influences communal living experiences.

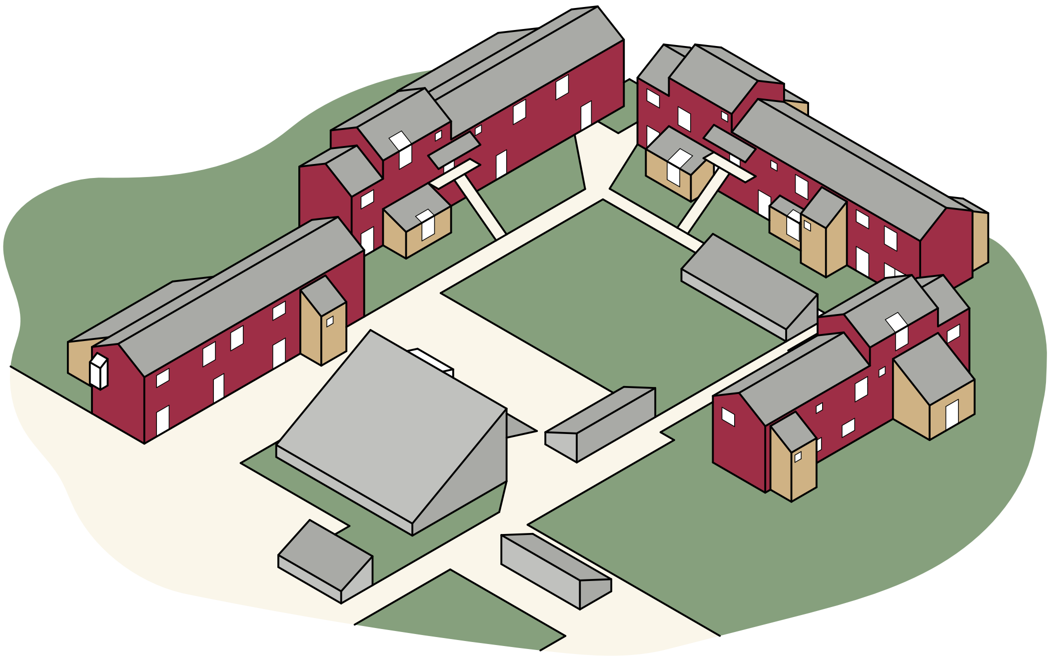


illustration 18. tinggården

Tinggården

Architect: Vandkunsten

Address: Tinggården 4681 Herfølge, Denmark

Year: 1978

Number of housing units: 78

Number of common houses: 7

Functions/facilities: Common houses, Flexible rooms.

Tinggården was developed as a result of a competition for alternative dwelling typologies, with the architects aiming to create a housing community centered around social interaction and user engagement (Vandkunsten, n.d.). The project consists of small row houses arranged in clusters, each with access to a shared common house. Constructed using prefabricated wood and brick elements, the buildings feature a narrow footprint, two-story pitched roofs, and a modular design that prioritizes flexibility.

With an average size of only 78 m² (Vandkunsten, n.d.), the family homes are designed to optimize space efficiency. To accommodate varying spatial needs, a flexible system was implemented, allowing certain rooms to be shared between adjacent houses. This design feature enables families requiring additional space to temporarily expand their living areas, fostering adaptability within the community.

Located on the outskirts of Herfølge, Tinggården is surrounded by a green landscape, reinforcing a connection to nature. The houses are oriented to provide each unit with a small front and backyard, delineated by fences and hedges. Meanwhile, the front façades open towards a network of roads that interconnect the clusters, reinforcing a sense of shared community and collective living.

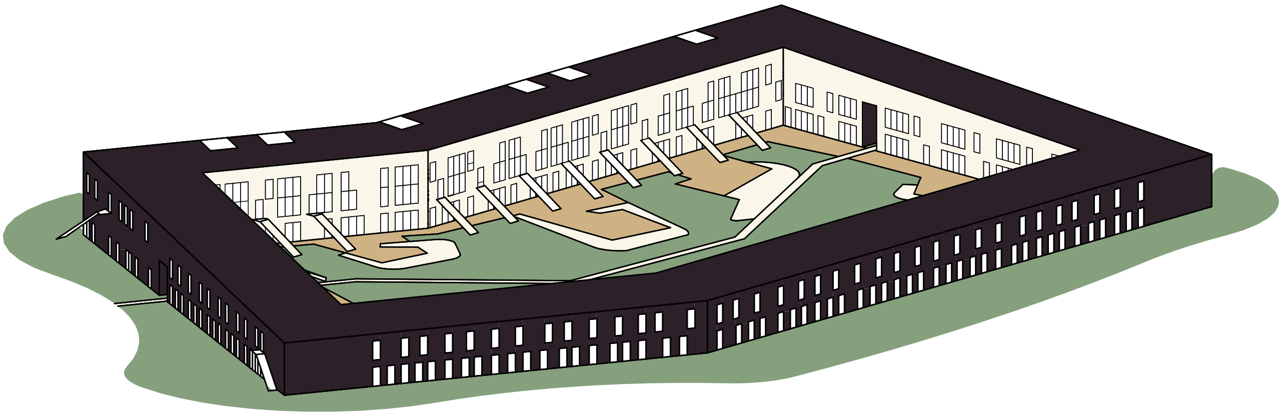


illustration 19. lange eng

Lange Eng

Architect: Dorte Mandrup

Address: Lange Eng, 2620 Albertslund, Denmark

Year: 2008

Number of housing units: 58

Number of common houses: 1

Functions/facilities: Dining hall, activity room.

In contrast to Tinggården's small clusters of row houses, Lange Eng is designed as a fully enclosed residential block centered around a large, shared courtyard. Each housing unit has its main entrance on the exterior side of the block, providing residents with a small private outdoor space adjacent to their homes. In contrast, the interior of the courtyard features a continuous wooden deck that connects all apartments, effectively dissolving physical boundaries between neighbors and fostering a strong sense of community (Dorte Mandrup, n.d.).

The architectural design employs a deliberate contrast between the exterior and interior facades. The outward-facing façades are clad in dark wooden panels, creating a solid and defined perimeter, while the inner courtyard is enclosed by translucent polycarbonate, lending an open and inviting atmosphere to the communal space (Dorte Mandrup, n.d.).

The apartments vary significantly in size, ranging from 71 m² to 128 m². Except for the smallest units, all apartments are designed as duplexes, providing expansive views of the courtyard. This design choice strengthens the communal dynamic by visually connecting residents to shared spaces, though it simultaneously reduces individual privacy within the home (Lange Eng, n.d.).

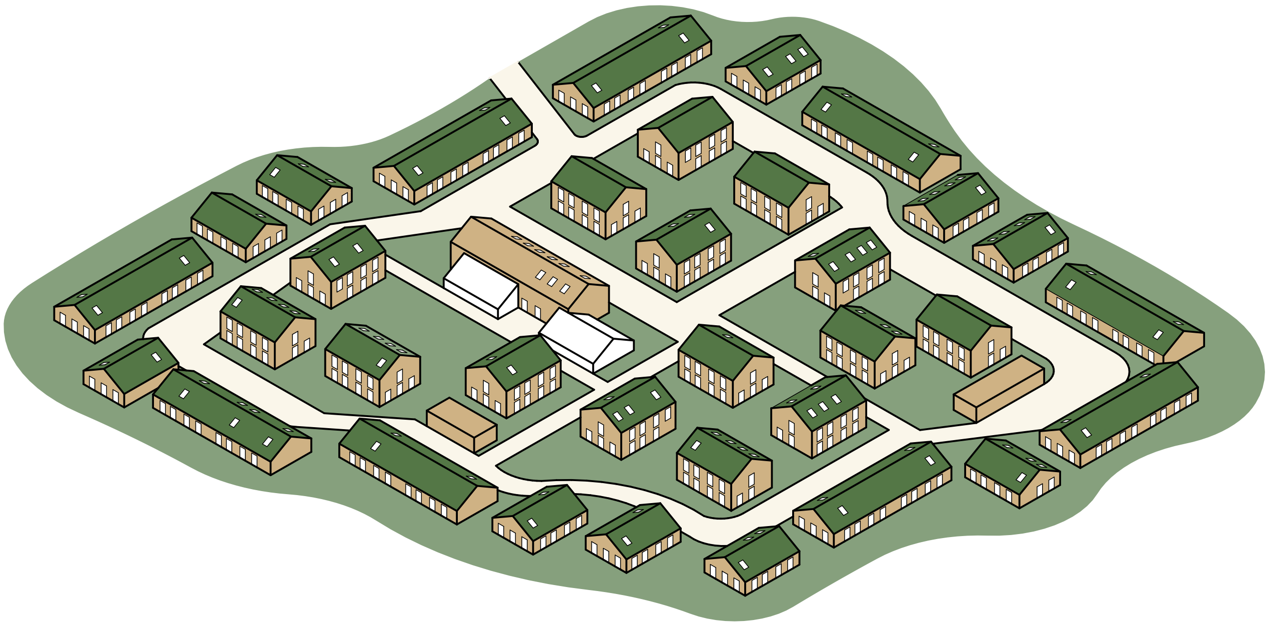


illustration 20. kløverbakken

Kløverbakken

Architect: Arken

Address: Kløverbakkevej 1, 62, 8300 Odder, Denmark

Year: 2022

Number of housing units: 58

Number of common houses: 1

Functions/facilities: Dining hall, Orangery, workshop

Kløverbakken represents a modern interpretation of a co-housing community, reflecting contemporary values with a strong emphasis on ecological sustainability. The community is designed with a low environmental footprint, incorporating wooden construction and sedum roofs as key strategies for reducing carbon emissions. These efforts have been recognized through multiple accolades, such as the title of "Wooden Construction of the Year" in 2023 (Tegnestuen Arken, n.d.).
The spatial organization prioritizes safety and community interaction. Instead of traditional asphalt roads, the shared pathways between the homes are covered in gravel, creating a pedestrian-friendly environment where children can move freely between their homes and the centrally located common house, which serves as the heart of the community (Kløverbakken, n.d.).

Architecturally, Kløverbakken integrates a diverse mix of free-standing houses, row houses, and multi-story buildings, allowing for a variety of housing options. The residences range in size from 85 m² to 125 m², making the community accessible to families of different compositions. Each home is allocated a small private outdoor area, but fences and hedges are not permitted, ensuring a seamless transition between private and shared spaces. This intentional openness fosters a strong sense of cohesion, visually and socially binding the community together (Kløverbakken, n.d.).

Sub Conclusion

Tinggården, Lange Eng, and Kløverbakken share a fundamental commitment to fostering communal living through thoughtful architectural design. All three communities prioritize social interaction, shared spaces, and a sense of collective belonging, yet they achieve these goals through distinct spatial and material strategies.

One key similarity across the three cases is their emphasis on integrating private and communal spaces. Each project balances individual living units with shared areas that encourage interaction, whether through Tinggården's clustered row houses, Lange Eng's enclosed courtyard, or Kløverbakken's seamless transition between private and public spaces. Additionally, all three projects promote sustainability, though Kløverbakken places the strongest emphasis on ecological responsibility through its wooden construction, sedum roofs, and car-free design.

However, the differences between the projects lie in their architectural typologies, spatial organization, and levels of privacy. Tinggården features small, flexible row houses, allowing residents to adapt their homes over time, while Lange Eng is a densely packed residential block with a strong visual connection to the shared courtyard, reducing privacy. Kløverbakken, in contrast, embraces a diverse mix of housing types, offering a balance between privacy and community engagement. Furthermore, while Tinggården and Lange Eng emphasize the built environment's role in fostering community, Kløverbakken integrates landscape and ecological strategies as key components of its design philosophy.

Ultimately, these three cases illustrate the evolution of co-housing typologies, demonstrating how communal living has shifted from experimental housing clusters to more diverse and sustainable models. Each project reflects its era's societal values, from Tinggården's focus on adaptable, user-driven spaces to Lange Eng's urban densification and Kløverbakken's emphasis on sustainability and environmental consciousness

Key Findings:

- Integration of private and shared spaces to encourage interaction

- The projects reflect evolving societal values

- All three communities prioritize social interaction and communal living through ditinct spatial strategies

- Tinggården emphasizes flexibility and adaptability, Lange Eng focuses on urban density and visual connection, and Kløverbakken highlights sustainability and open communal areas

illustration 21. pennant swaying in the wind

Design Criteria

For millennia, the Vitruvian Triad has been regarded as one of the earliest and most influential architectural theories (ArchInspires, 2022). While its core principles remain relevant, they may require adaptation to align with contemporary architectural challenges. According to Vitruvius, good architecture is defined by three fundamental principles: firmitas, utilitas, and venustas, translated into English as firmness, utility, and beauty (ArchInspires, 2022). These principles emphasize key aspects of building design:

- Firmitas ensure structural integrity, allowing buildings to withstand environmental forces, time, and daily use.

- Utilitas addresses functionality, ensuring that spaces effectively serve their intended purpose and meet the needs of occupants.

- Venustas focuses on aesthetic appeal, creating architecture that is visually and experientially pleasing.

Although these principles still inform architectural design today, they no longer fully encompass the complexities of modern buildings. Architecture has evolved significantly, yet Vitruvius' framework has remained unchanged.
Given contemporary advancements, an additional technical principle is necessary. Modern buildings integrate advanced energy systems, heating, ventilation, and smart technologies, effectively functioning as complex mechanical entities. To achieve a holistic and well-rounded design, these elements must be incorporated as a fundamental consideration.

As this thesis explores the sensory experience of architecture, the indoor environment plays a critical role in the design process. Consequently, the traditional Vitruvian Triad is modified to reflect contemporary needs, introducing a revised framework:
Mechanicus, Utilitas, and Venustas—technical performance, functionality, and aesthetics—ensuring a more comprehensive approach to architectural design.

Functional:

1. Establish common facilities that encourages interaction and collaboration, strengthening social bonds

2. Adaptable workspaces allowing for flexible workhours and childcare at the same time

3. The design should leverage prevailing winds for natural ventilation to reduce mechanical cooling

4. Homes should allow adaptability to accommodate changing family needs over time (e.g., modular rooms or shared spaces)

5. Utilize strategic spatial transitions to define boundaries without isolating residents, while balancing personal privacy and share spaces

Technical:

6. Design spaces that allow occupants to adjust environmental elements, such as lighting, temperature, and air movement, to enhance comfort

7. Climate Adaptation – Utilize passive solar design and shading to enhance indoor comfort and reduce energy use

8. Existing SUDS should be multifunctional allowing for recreational use during draughts

Aesthetic:

9. Utilize sensory design elements (textures, colors & shape) to promote connection and comfort

10. The design should allow people to age in place, focusing on ground-floor living

11. The new houses should consider existing materiality while allowing for contemporary solutions

12. The architecture should follow the sloped terrain to retain the site’s character

13. Multigenerational needs should be reflected in the design

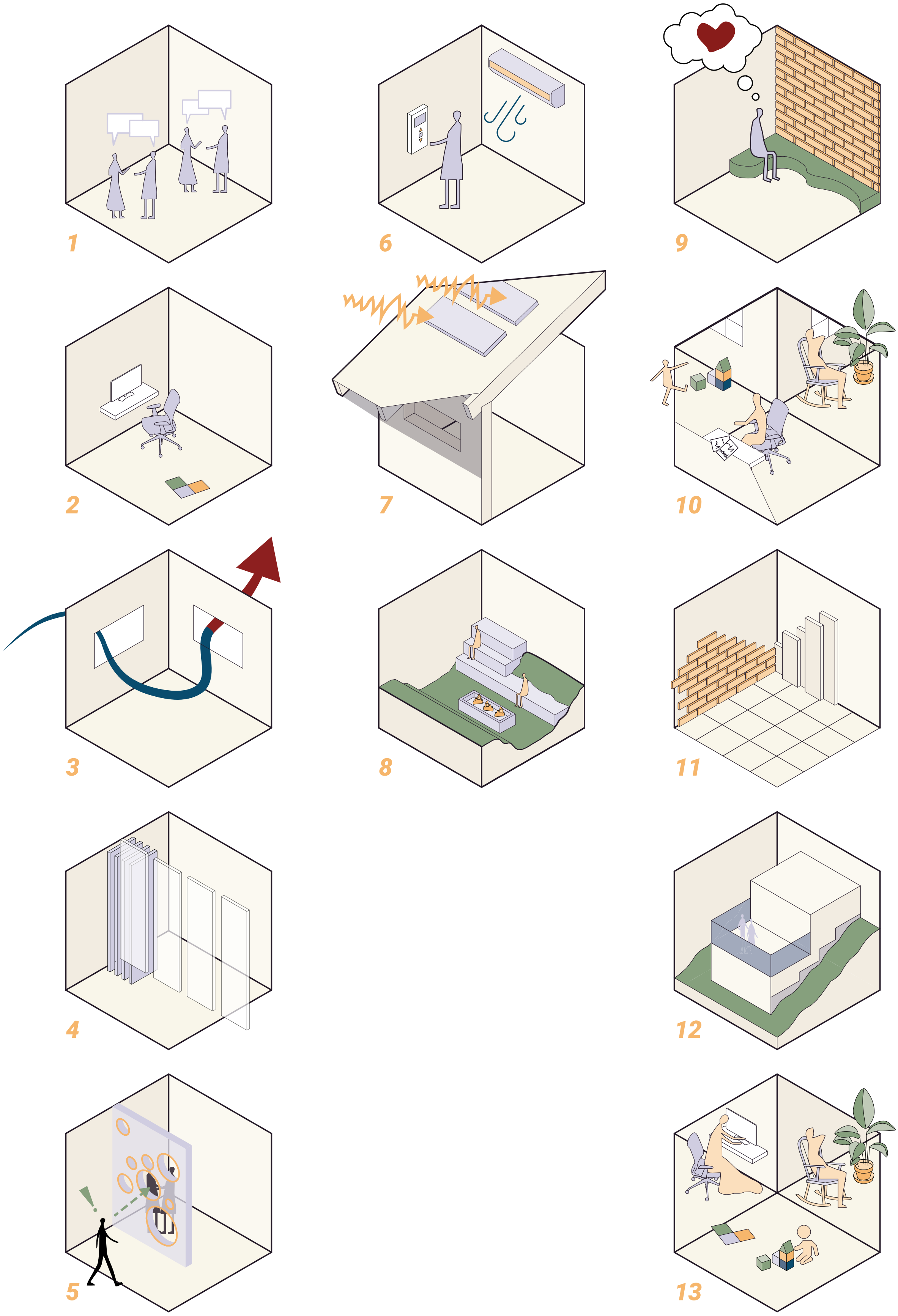


illustration 22. *design criteria*

illustration 23. pathway in the nearby park

Problem Statement

How can the human **perception** and **emotional experience** of space within the home be **enhanced** through **architectural and sensory elements**? Furthermore, how can these elements be strategically employed to design a larger **co-housing community** that supports both individuality and social interaction?

Design Process

The design process unfolds as an exploration of how architecture can evoke, frame, and support the human experience of space. Grounded in phenomenological thinking and inspired by the works of Peter Zumthor, Gaston Bachelard, and Yi-Fu TUan, this project investigates how atmosphere and materiality, intersect in the making of a home.

Rather than beginning with form or function, the process is guided by a sensory narrative: How does it feel to enter, to pause, to inhabit a space? How does light shape stillness? How does sound soften or sharpen spatial boundaries? These questions become tools—more than diagrams or programs—for shaping architecture that resonates at a personal and poetic level.

Early phases involve intuitive spatial sketches, material studies, and experiential mappings that prioritize human perception over architectural objecthood. Through iterative modeling—both physical and digital—the design evolves as a layered response to sensory thresholds, rhythms of daily life, and the emotional qualities of enclosure, openness, and transition.

The courtyard becomes a central motif: a spatial and atmospheric anchor. It operates as a vessel for light, air, and silence, fostering dwelling. The orientation of rooms, tactile surfaces, and framed views all contribute to a spatial sequence that aspires to be both grounded and transcendent—rooted in the everyday, yet attentive to the ineffable.

This chapter documents the unfolding of that process, not as a linear progression, but as a dialogue between material, body, and space.

illustration 24. creek in the nearby park

Planning the Dwelling

The concept of dividing the two stakeholders into two separate buildings (but still within close relation to each other) was explored. This would give the possibility to live closer together as one family but with the option of the grandparents retreating to their own quarters.

An early room diagram (appendix A) depicting the sizes of each room for each household was revisited. This made both the main house (nuclear family) and the annex (grandparents) smaller. The reduction in size was based on how much space was necessary to accommodate the furniture required for each case. These new sizes were then used to make the first floor plans.

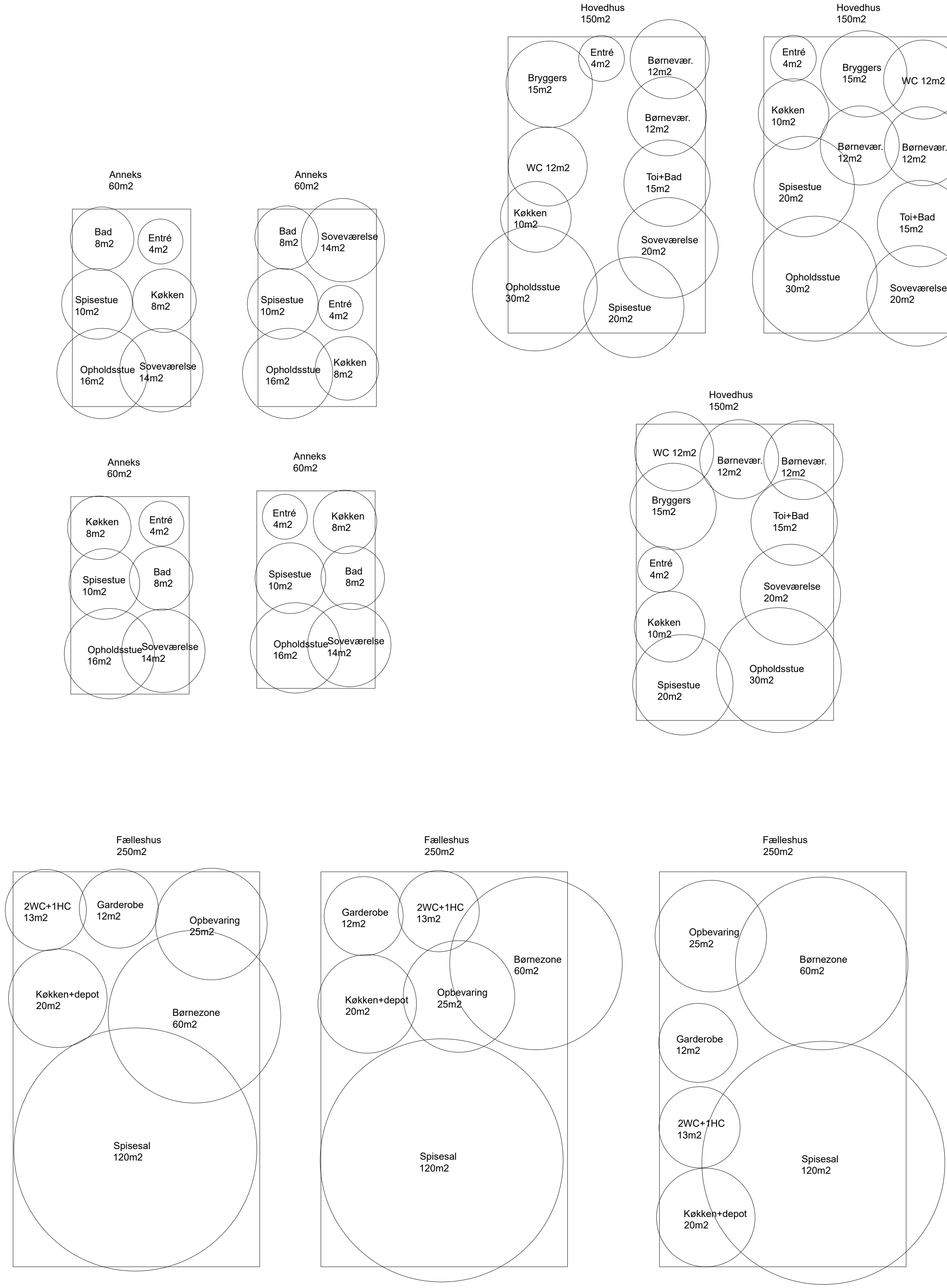


illustration 25. early placement of functions

Three sets of floor plans were made for the midway critique. The goal was to make a combination of the main house and the annex. The same rooms and roughly the same sizes would be used with an exception at the last one. The first case would be a single-storey building with a courtyard inside of the main house. The second case would be a two-storey building giving only the main house an upstairs area. The third case would be a combination of two annex, making it only suitable for the grandparents.

Common for all cases is that the utility room is made for both stakeholders and therefore leads to both houses. Furthermore, no windows were placed as the focus was solely on the room layout and the connection between them. The bedrooms for the parents are placed to the east allowing the early morning sun to enter, whereas the children' bedrooms are placed to the north for the ideal diffused working light. The kitchen is placed in close relation to the utility room and dining area for convenience.

Case 1 - Main House + Annex:

A courtyard within the main house became a big focus on the building and how each room would open up to hallway around it. The courtyard is an open green space that could be a private outdoor area for the house. All four sides would be glass giving the possibility to look into it from all sides but also to see through the entire courtyard and further into the house. It would also help to bring more sunlight into the center of the building for both lighting and heating. The entrance is based at the utility room giving both stakeholders the view directly into the courtyard as they enter the house.

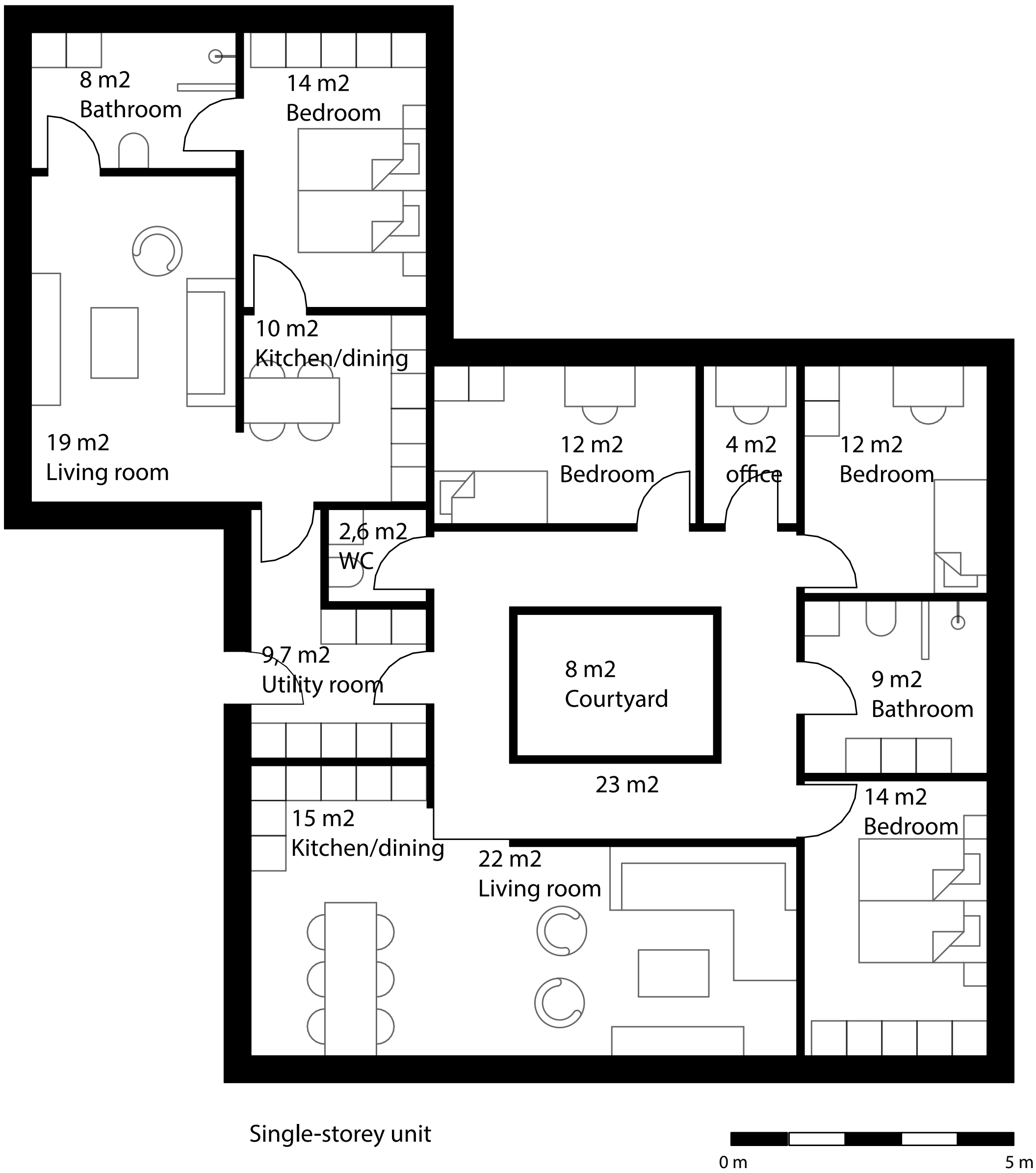
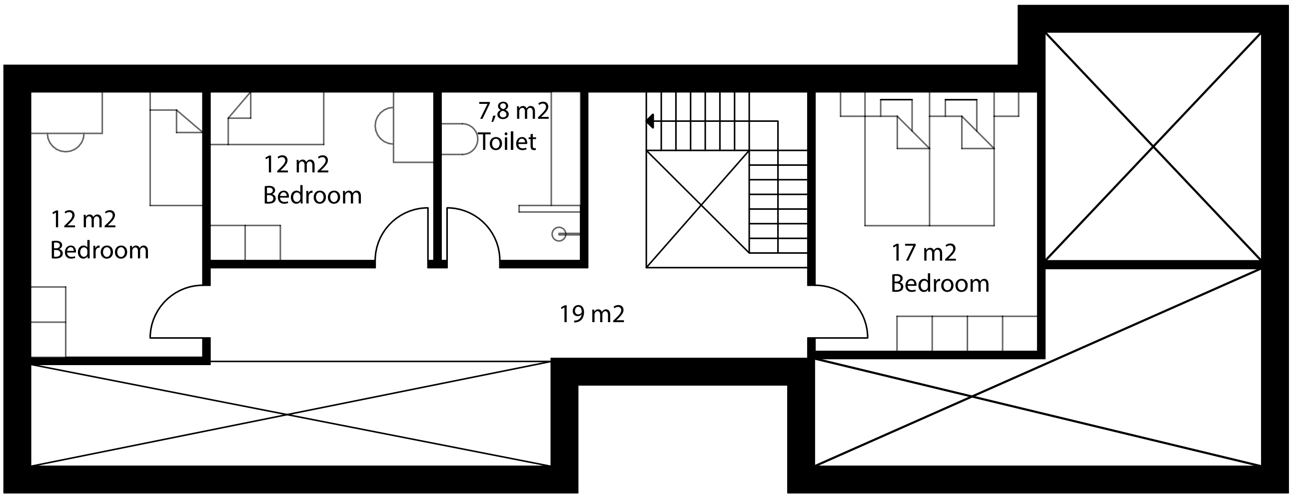


illustration 26. early plan drawing of the main house + annex

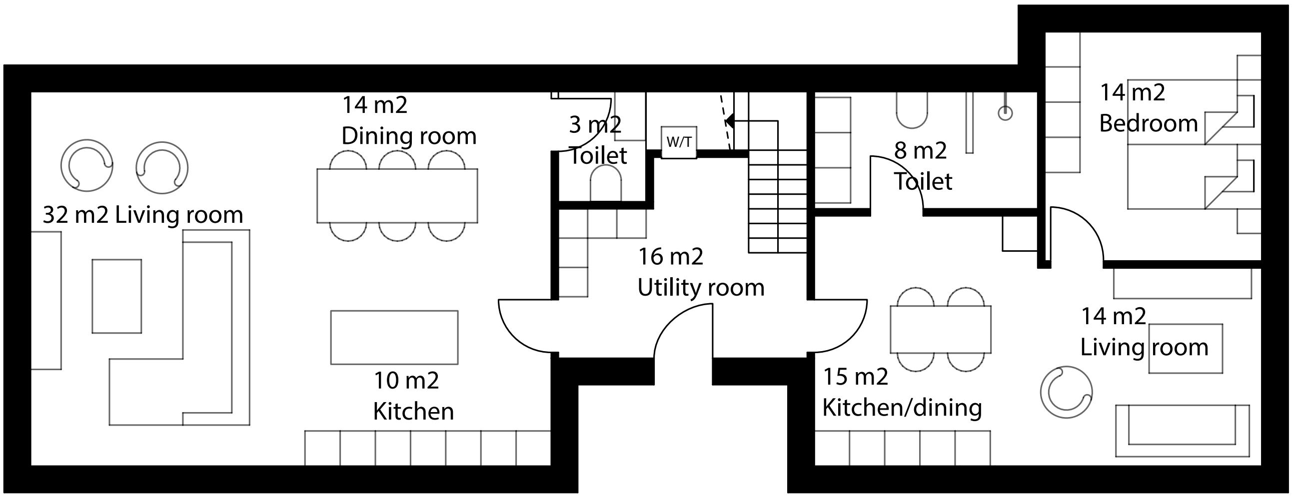
Case 2 - Two Storeys:

Set up as a long house with the flow moving from room to room or along a hallway. The long side is facing south to utilize the passive sun for heating. The main take on this was to create a space on the first floor that fits all of the private areas of the nuclear family home (bedrooms and bathroom). This will not be the case for the grandparents to ease them from moving upstairs. The height of the building was also explored how it could work as an architectual detail and a functional strategi. The height allowed the hallway on the first floor to have a direct view down to the kitchen. This could be used to create a connection between the two floors and for stacked ventilation. Furthermore, the idea was also to enhance the experience within the ground floor by raising the ceiling. Same goes for the annex, the second floor allowed the ceiling to be higher and therefore enriching the experience.



First floor

0 m 5 m



Ground floor

Two-storey unit

0 m 5 m

illustration 27. early plan drawing of the two-storey house

Case 3 - Double Annex:

The last case is a unit consisting of two annex's or "senior houses". The idea was to make some smaller units that only was suitable for the grandparents and that they should be placed close to the common house for convenience. Again, both users share and enter through the utility room. The layouts of both houses are quite similar with only the kitchen and bathroom swapping places. One of the focuses was to merge these small houses and give them the same qualities. For example, both of them have walls facing south and west in the living room and dining area.

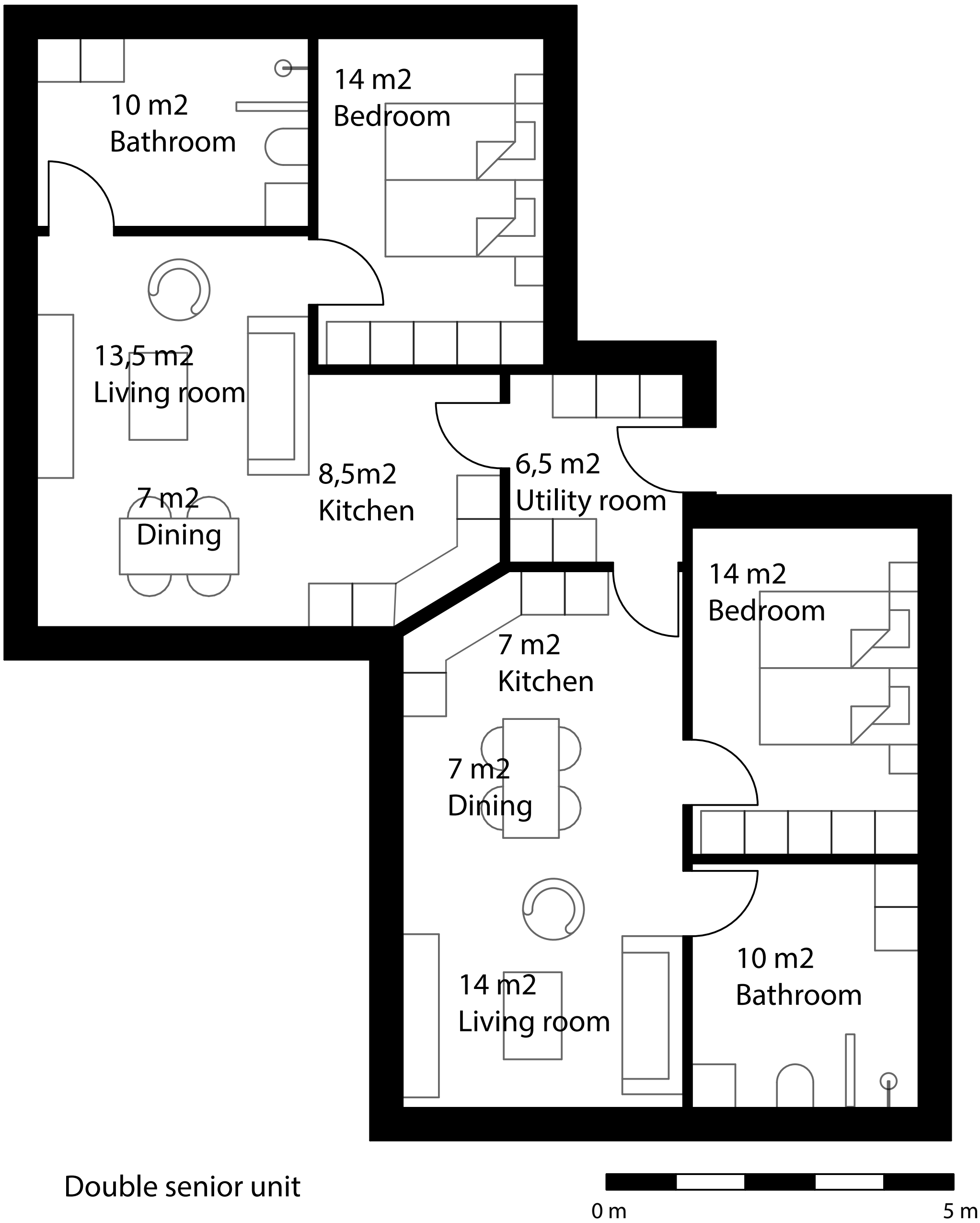


illustration 28. early plan drawing of a double annex

Reworking the Plans

After the midway critique and a supervision the aforementioned floorplans was reworked. The comments sought after a bigger focus on co-living and bringing the users closer together. A common feature for each case was that the only shared room was the utility room/entrance and the option to enter the other units from there. Another comment was on the future plans for incorporating strategies for enhancing the experience. It was important to remember not just the mood and setting within each individual room but also the movement between each room.

To explore the possibilities of co-living/-housing came the idea of extreme scenarios. A floorplan that fully embraced co-living and one that fully embraced privacy. And then lastly what lies in between them.

The concept of having a courtyard within the house to give each unit a private outdoor area was seen as a big quality and needed to be explored further. Therefore, case 1 will be used as a base floorplan for further development.

In the process of reworking the floorplans, all the functions within the dwelling was written on pieces of paper, and then placed accordingly to how certain scenarios were arranged according to levels of privacy and co-living.

Kam b = Child bedroom

Kam V = Parents’ bedroom

Kam G = Grandparent’ bedroom

Bad = Bathroom

WC = Toilet

Køk = Kitchen

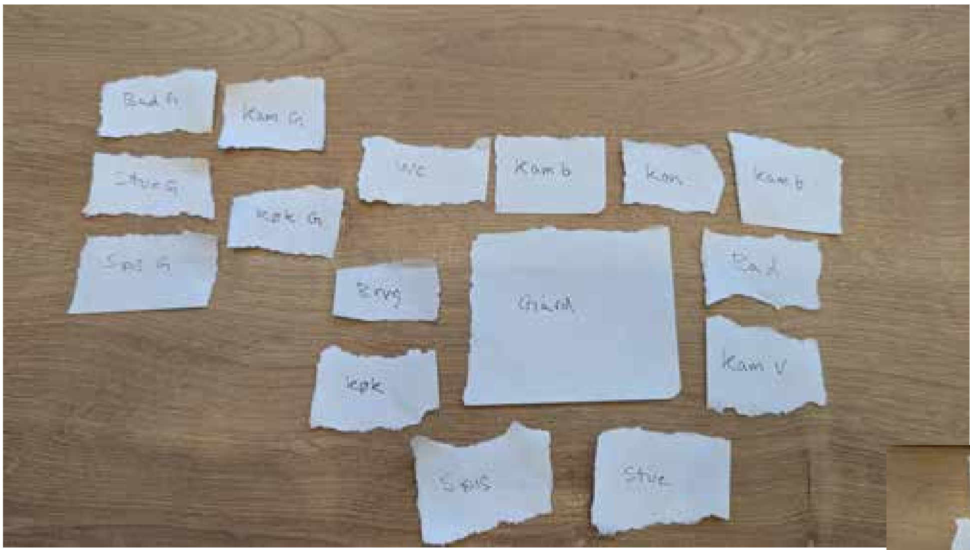
Spis = Dining area

Stue = Living room

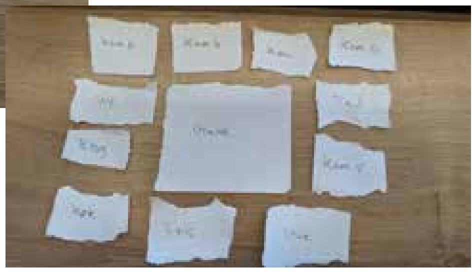
Kon = Office

Bryg = Utility room

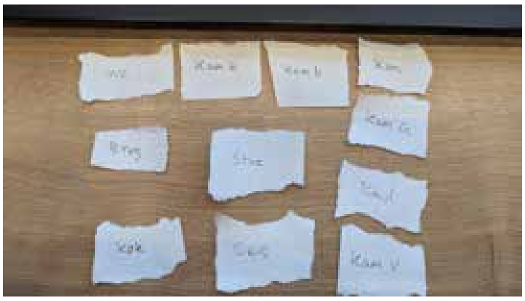
Gård = Courtyard



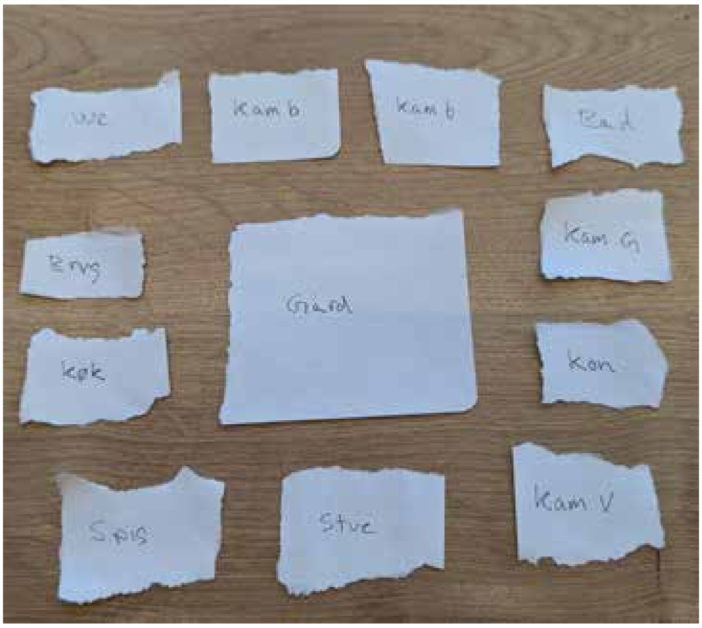
Layout presented at midway critique



The Idea is that all rooms are placed around the courtyard, binding everything together. This gives a clear view of the entire home and an idea of where the rest of the family are

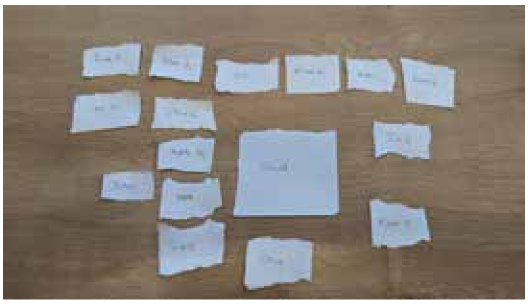


This is similar to the first floorplan with the absence of the courtyard. Here the living room, is the center of the home.

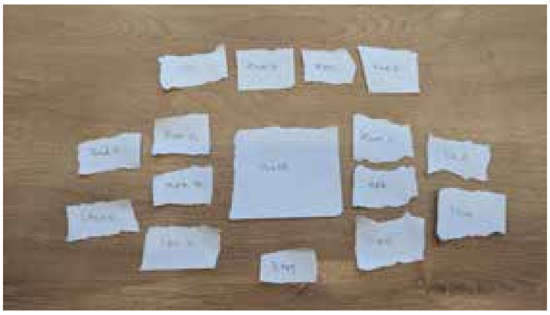


Courtyard as centre, toilets in corners to prevent view to them from the courtyard

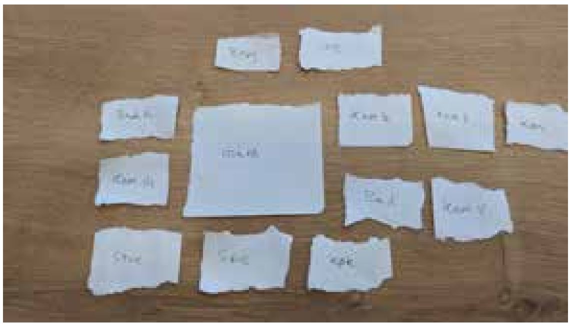
Here the idea was to bring the courtyard out of the house. Instead, the house itself creates a corner that frames the yard. The stakeholders' homes are separated and only share the utility room as an entrance and equal access to the yard.



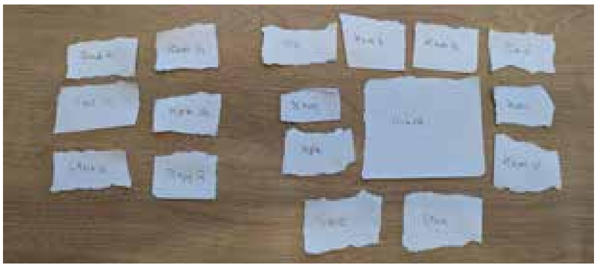
This is similar to the one showed at the midway critique, but the courtyard is larger allowing both stakeholders' kitchens and dining areas a view out to the courtyard.



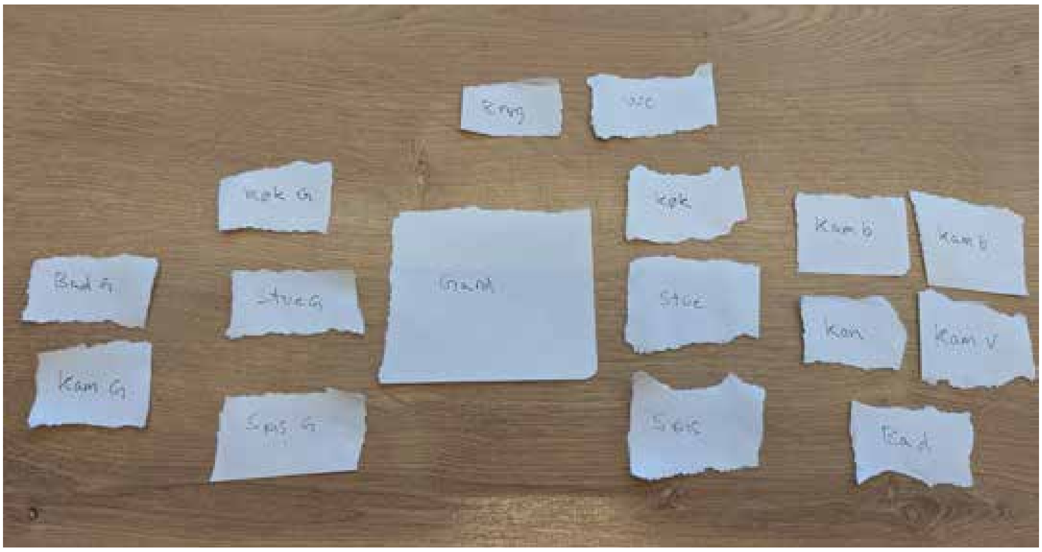
In this scenario both stakeholders have their own facilities but, the layout of the floorplan is mirrored across the yard, with the exception of the children's rooms and office which are placed to the north.



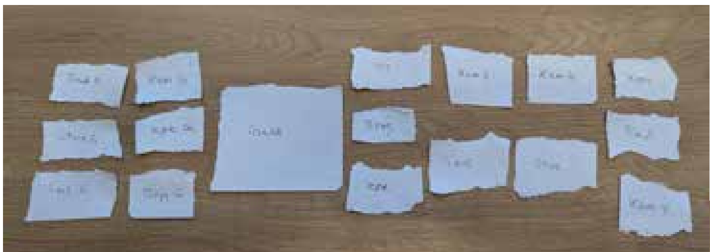
This case is divided into three parts. The middle are the shared areas for both stakeholders, but the living quarters are based in a zone for each type of stakeholders.



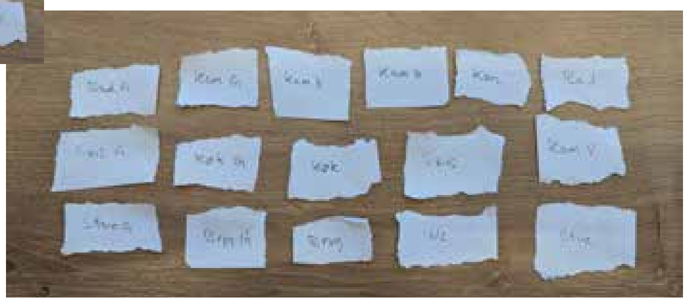
Here the house is split into two separate buildings. There is no physical connection between the two stakeholders.



Another solution separating the stakeholders while giving both an equal access to the courtyard. here the children's bedrooms are moved to the east instead of north.

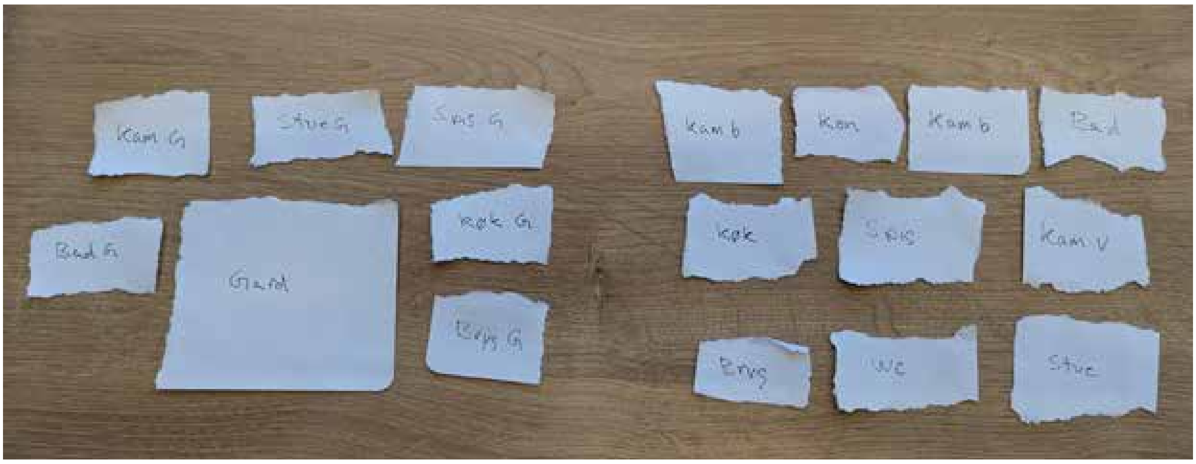


Similar to the previous layout but this time the buildings are connected with a shared garden/yard.

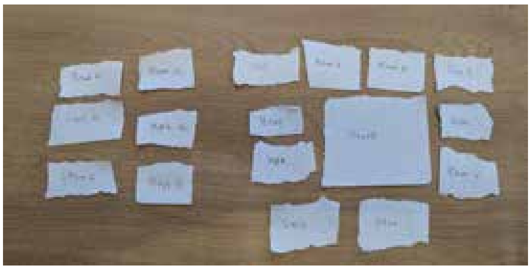


The only thing the stakeholders are sharing in this case is the wall between them.

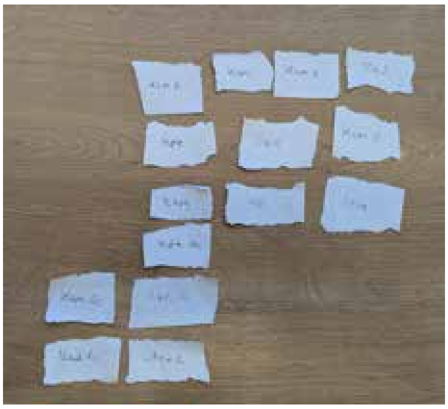
illustration 30. layouts with medium privacy



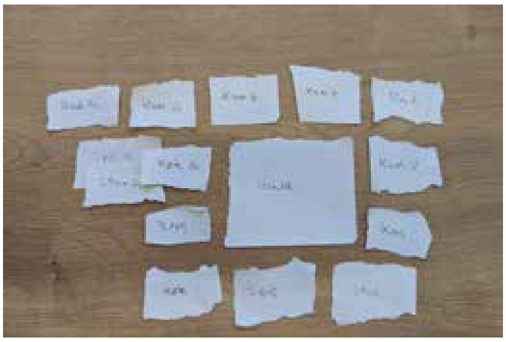
The houses remain detached from each other but, and the senior house has been giving the courtyard.



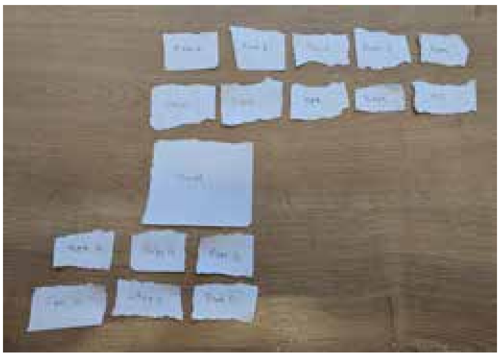
The nuclear family house is almost the same as the one at midway critique with the courtyard as a center for the home. But the senior building has been detached from the main house.



The two houses are pointing away from each other and only have the utility rooms as a connection.



Quite similar to the original floorplan but the senior building's kitchen, living room and dining area have been merged into one small room. This encourages the seniors to use the livingroom within the nuclear family's dwelling. However, it also gives them the possibility retire to their own quarters and relax.



Both layouts are made as long houses only connected with the courtyard.

illustration 32. sunshine on the repeated houses

Further Details

These concepts were moved to SketchUp, to get a better understanding of how the rooms relate to each other. Every room was given light furniture to help visualize the possible connections between neighboring rooms.

After moving to SketchUp and some initial work, four concepts was developed: Fully shared dwelling, two-storey dwelling, double annex and separated dwellings as well as a common house. These were the concepts we decided to iterate on and improve to fit various scenarios and family settings.

After working with the four concepts came to life, which was four different “houses” that can make up the co-housing community.

House 1 - Single-Family Dwelling

The process behind House 1 started out as a very small and compact dwelling, that had the dining room at the core. This early iteration can be split into two halves; to the east we have the sleeping quarters as well as the toilet and shower. To the west we have all the living quarters, such as a kitchen, living room and dining room.

This felt way too compact, and like it was missing something, which led to the next iteration of House 1. Here it was decided to incorporate a courtyard at the center of the dwelling, and place all the functions around it, besides the kitchen, which was placed within the courtyard. This time around, the master bedrooms were placed towards the east, while the children's rooms are towards north, and lastly the kitchen, dining room and living room towards the south.

Incorporating the courtyard made a lot of things work well, so that route was explored even further, leading to a new iteration, where the courtyard opens outwards to the south. This meant that the stakeholders could be given some more privacy, allowing each stakeholder to have access to their "own side". This also means that the bedrooms for the main stakeholders are kind of clumped together, which wasn't ideal.

Still hanging on to the courtyard, another iteration that uses the courtyard as a main feature, was made. This time, the master bedrooms are towards the south and east, while the children's rooms are towards the north, allowing for more privacy. The courtyard is accessed through a tunnel, which enhances the experience upon arrival of this green oasis.

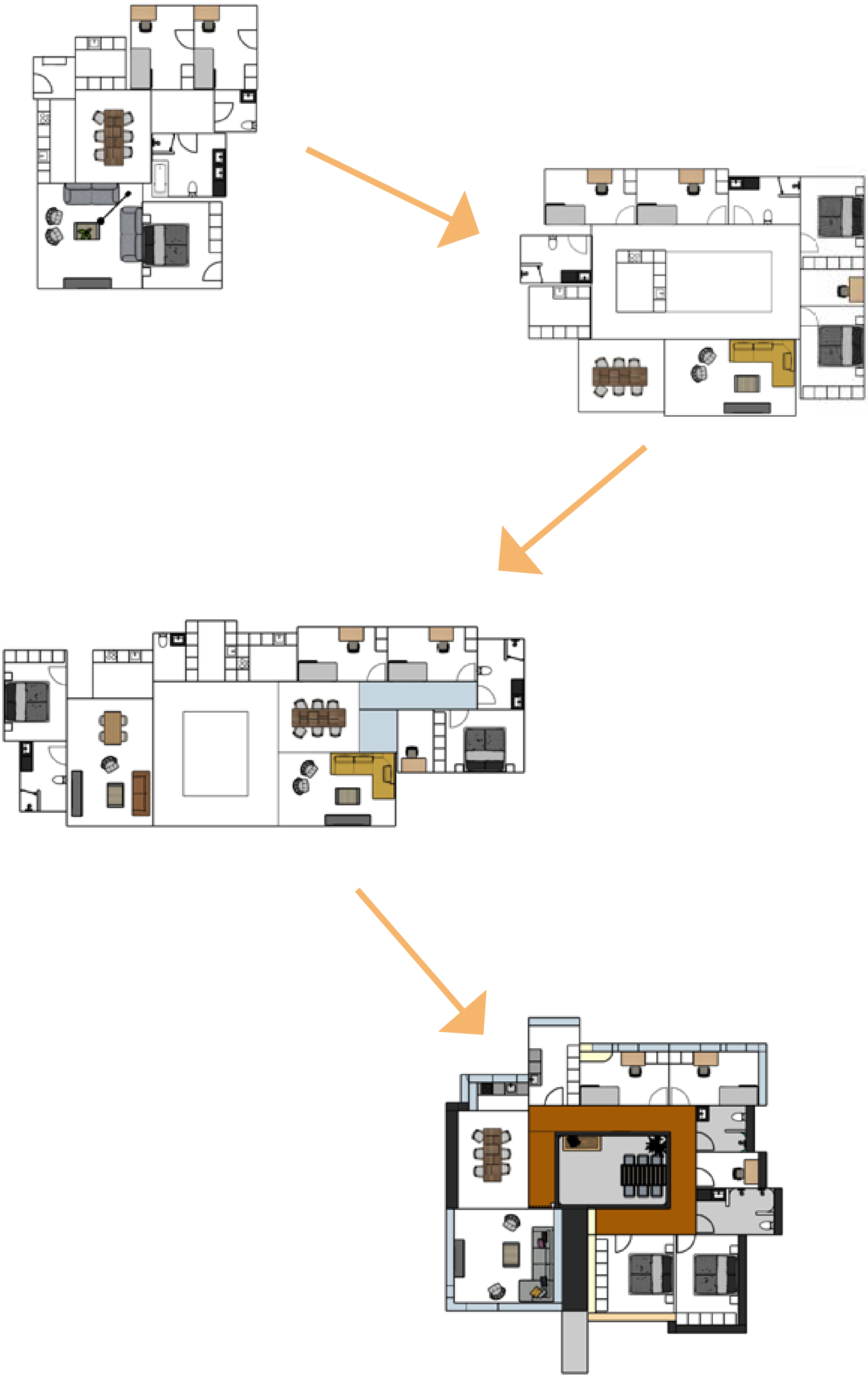


illustration 33. iterations of house 1

House 2 - Two-Family Dwelling

From working a lot with the floorplan in House 1, it was decided that, if possible, the courtyard should be a feature in all houses, which is why all the iterations here have it.

In the first iteration of House 2, there was some excess hallway, that led to dead ends, which proved that there was room for improvements. Besides the not so well-used hallway, there was very little separation between the master bedrooms and the children's bedrooms.

For the second iteration, an additional toilet/ shower was introduced, on both sides, as well as an office space. These extra rooms allowed for distance between the bedrooms, but still did not solve the issue with the hallway.

Having moved the rooms around quite a lot for the third iteration, it was possible to eliminate the excess hallway space, but at the same time increasing the size of the courtyard significantly. Here, the master bedrooms are all located to the north, to create a more private area of the dwelling.

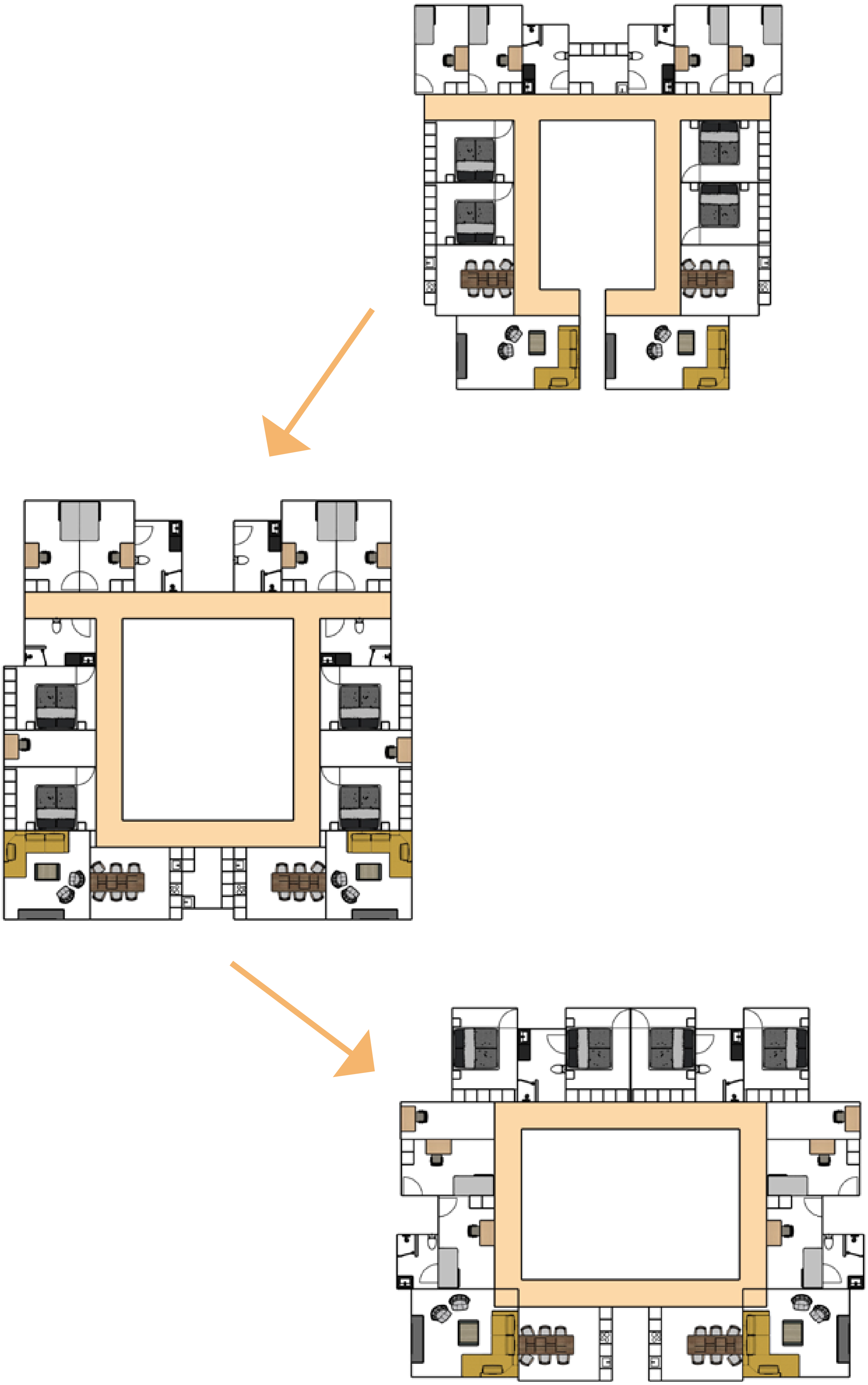


illustration 34. iterations of house 2

House 3 - Two-Storey Two-Family Dwelling

Working out the floorplan for House 3 was was proving difficult, if the courtyard was to be integrated. Having to allocate the same amount of functions as the two previous houses on two storeys, would mean the courtyard would become extremely small. In the beginning the plans were drawn as if the house should house six people, which did not work.

Later, experimenting was done with the courtyard, and along with some advice, a new floorplan was devised. This plan was designed to house twelve people (two families). This seemed to work a lot better as there were no longer too few functions to place around the courtyard, for it to work.

However, since the house has two storeys, there has to be a shared space for the stairs. In the beginning it was intended to be a feature, as seen in the last iteration, but it would probably take away from the intention behind the courtyard, and how the experience was intended.

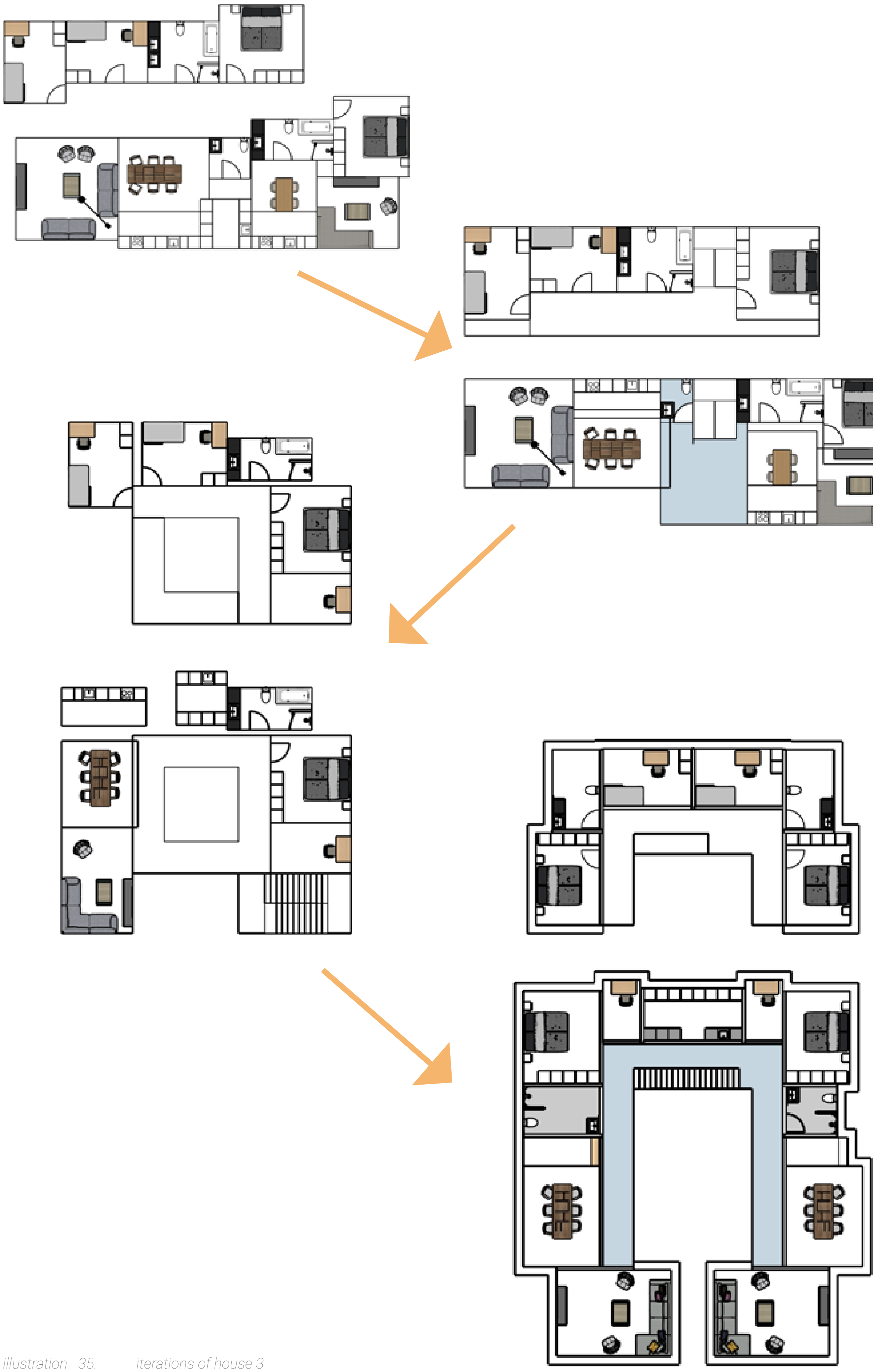


illustration 35. iterations of house 3

House 4 - Commonhouse

The plans for the commonhouse are initially based on the studies of other co-housing communities that had the following functions: dining area, kitchen, storage, play zone, entrance, and toilets. The next step was to look into the connections between these functions.

Trying to figure out the connection between the functions, the plans started out as almost split into four parts that just had to be there: kitchen, dining area, play area and storage. However, this did not feel right, so the layout was changed. The play area was made to be a more central part of the commonhouse, to focus more on the children, but also to ensure that it was not two separate rooms, but one combined room.

Afterwards a different approach was tested, and it was attempted to let the shape of the building control the placement of the functions within. The shape of the site was translated into a simplified shape, with more organic shapes, which was also to make it stand out from the three residential houses. The shape was intended to stand in contrast to indicate that this building is shared with everyone.

However, this approach ended up splitting the two rooms once again, and the kitchen being that open outwards, did not feel right.
The idea of the round shape defining the commonhouse was still appealing, so in the last iteration it was attempted to incorporate that.

This iteration has a larger focus on the dining area and the social aspect, while the kitchen and storage has almost been hidden, so not to be so much out in open. The kitchen layout also changed to be able to handle multiple people cooking and socializing while preparing food for the others. Within the kitchen, the counters are facing each other to support social interaction between the residents present in the kitchen.

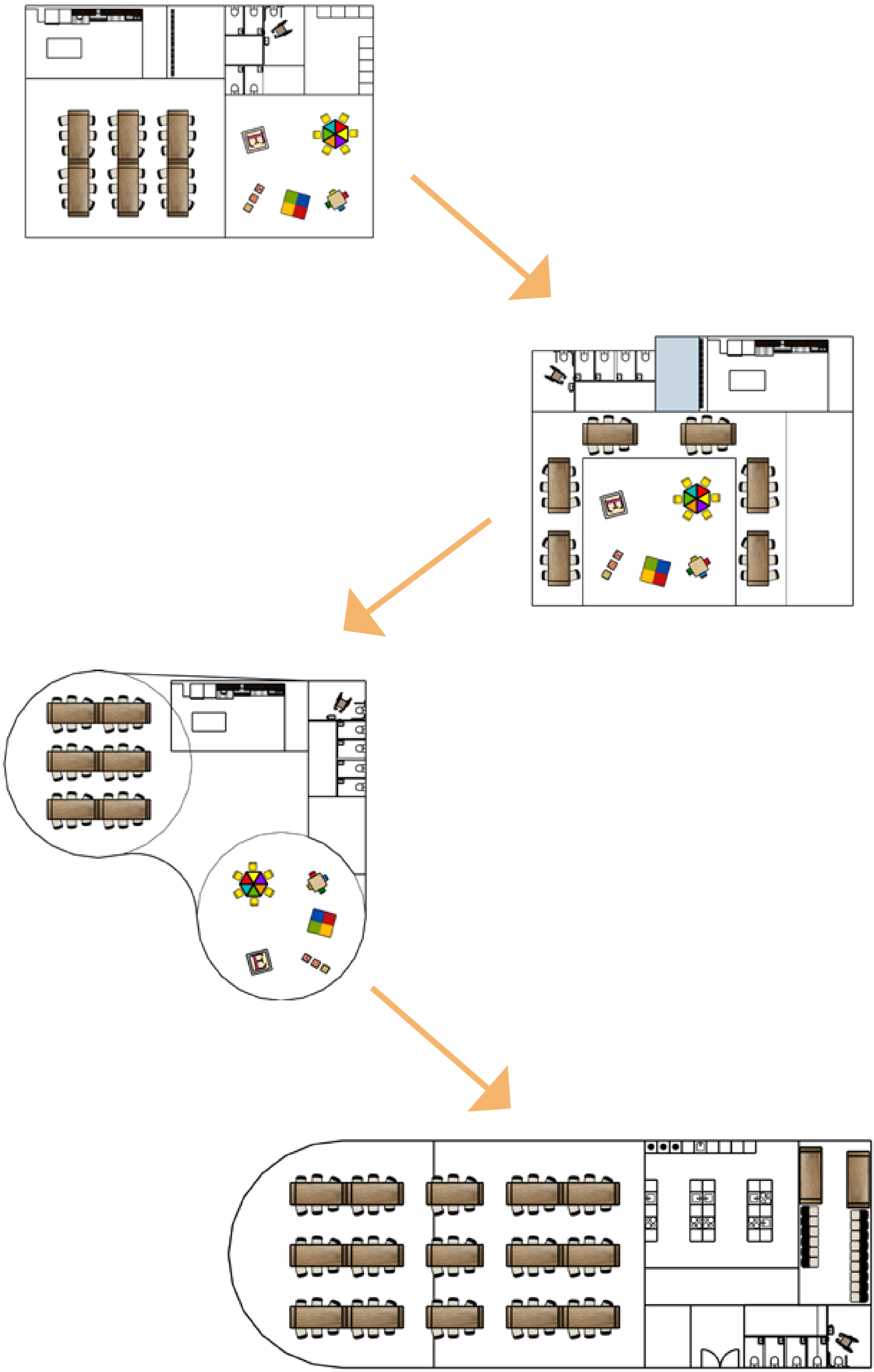


illustration 36. iterations of house 4

Interior Detailing

This project centers on the lived experience of interior architecture, with particular attention to how space is sensed rather than merely seen. To investigate key spatial qualities, such as proportions, ceiling height, spatial flow, materiality, and views, the use of a virtual reality (VR) headset was implemented as an essential design tool. By immersing oneself in the digital model, it became possible to explore and evaluate the building from a first-person perspective, thereby achieving a more authentic and embodied understanding of the spatial experience than traditional 2D drawings or screen-based models allow.

Virtual reality enabled full-scale navigation through the design, offering immediate sensory feedback on decisions related to spatial configuration. Every major aspect of each room, such as size, ceiling height, surface colors, material finishes, and the placement and dimensions of windows, was assessed and refined within the VR environment. This method proved especially valuable for perceiving subtle design differences, such as the spatial impact of a ceiling lowered by 20 cm rather than 10 cm.

Furthermore, VR allowed for the testing of spatial transitions between rooms. The flow from one space to another was experienced directly, highlighting how the perception of one room influenced the emotional and sensory reception of the next. This sequential exploration supported a holistic approach to interior design, where memory, contrast, and continuity became central parameters in shaping the architectural experience.

illustration 37. iterations of house 4

House 1 - Single-Family Dwelling

Once the decision was made to focus on the interior spaces, the process took on a structured and reflective approach. Set viewpoints were established throughout the house to create a consistent basis for comparison. By capturing images from these fixed positions, subtle changes could be evaluated side by side.

This iterative method was used across key spatial zones: the courtyard, hallway, kitchen, dining area, living room, bathrooms and transitional zones. All investigations were first carried out in House 1, which served as the primary testing ground for spatial experience. Once the intended mood and atmosphere were achieved, the spatial strategies and principles developed here were translated to House 2 and House 3. In this way, the experience-led design approach was maintained consistently throughout the project.

sharp corners

white ceiling

rounded corners

illustration 38. courtyard corners

neutral wood ceiling

illustration 39. ceiling color

normal window sill

extended window sill

illustration 40. niche design

sharp corners

one rounded corner

two rounded corners

illustration 41. shower cabin corners

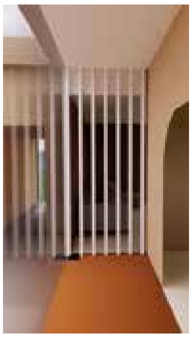
big arch

small arch

medium arch

illustration 42. doorway arch

small spacing



large spacing

medium spacing

illustration 43. lamella wall spacing

upwards curve

smooth floor

left turning curve

planks along the hallway

left to right, overhead curve

illustration 44. kitchen border

planks across the hallway

illustration 45. hallway floor

minimal amount of posts, above
and below horizontal post

equally space posts on the wall,
above and below

different spacing above and below
the vertical post

illustration 46. hallway glass wall

no visible ceiling beams

few visible ceiling beams

many visible ceiling beams

illustration 47. hallway beams

House 4 - Commonhouse

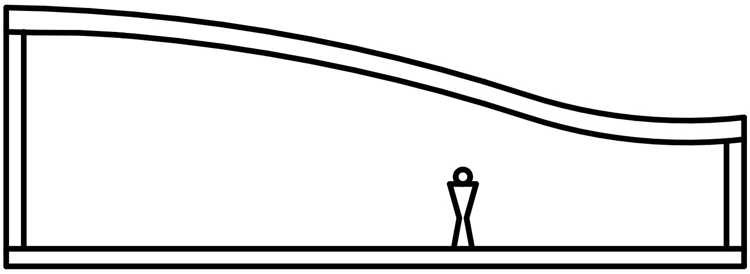
As part of shaping the architectural language of the common house, a series of sectional studies were carried out to investigate how spatial form influences experience.

The longitudinal sections, on illustration 49, explore how the building gradually opens itself to the surroundings through changes in height and curvature. Some variations rise softly in one direction, while others create symmetrical or slower transitions, each offering a distinct spatial gesture and rhythm.

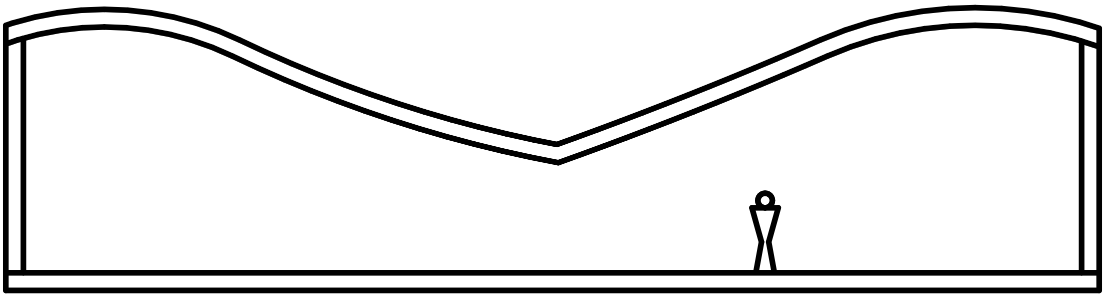
The transverse sections, on illustration 50, focus on ceiling geometry and the degree of structural visibility. From soft curves and hidden rafters to sharp lines and exposed construction, these tests aim to understand how ceiling form and wall height affect light, atmosphere, and sense of scale.

Together, the studies inform a balance between openness, enclosure, and the tactile experience of space

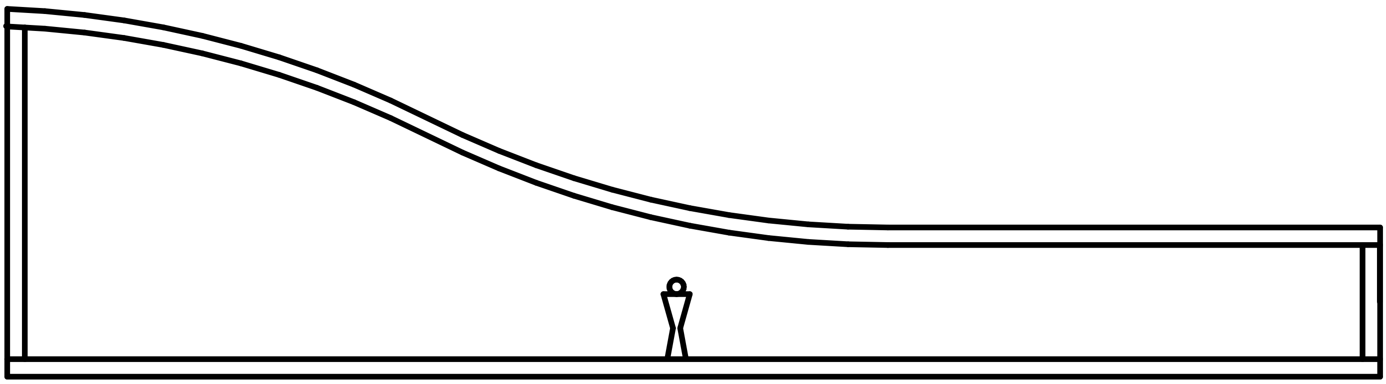
illustration 48. water reservoir



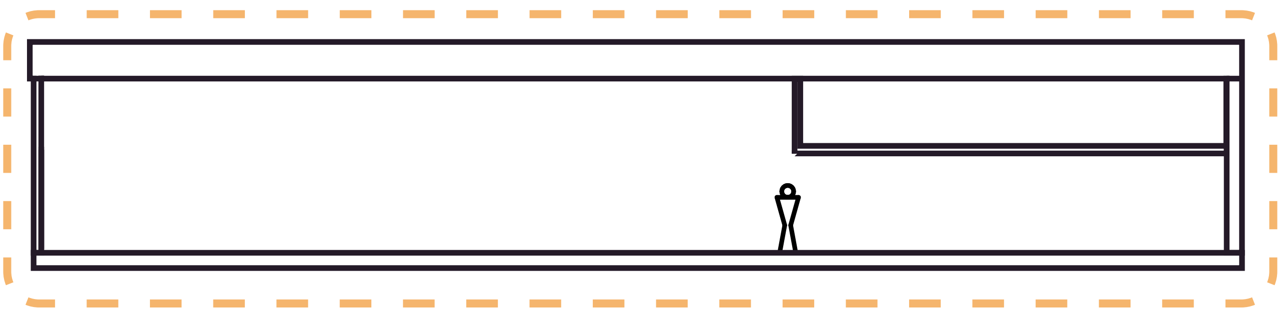
soft transition in height, one-sided



soft transition in heigh, two-sided

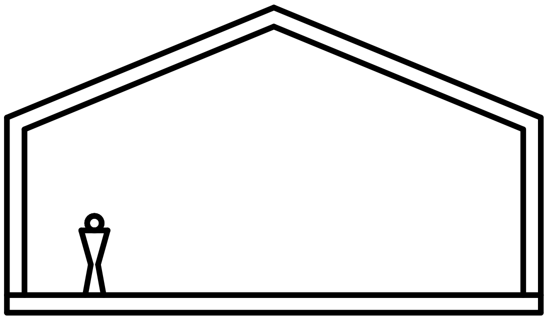


slower soft transition in height, one-sided

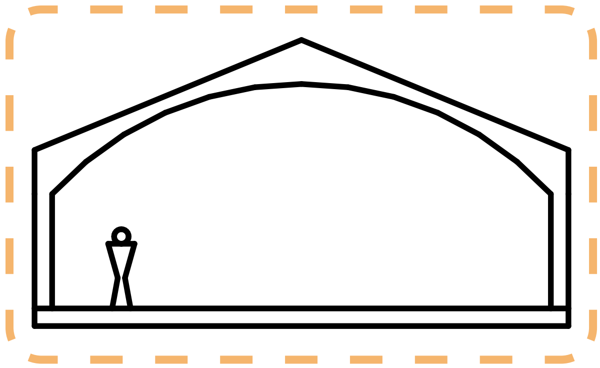


instant sharp transition in height

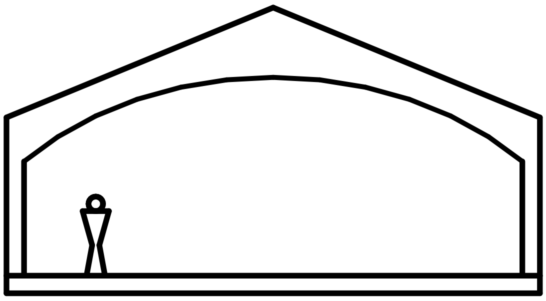
illustration 49. longitudinal section shape in the commonhouse



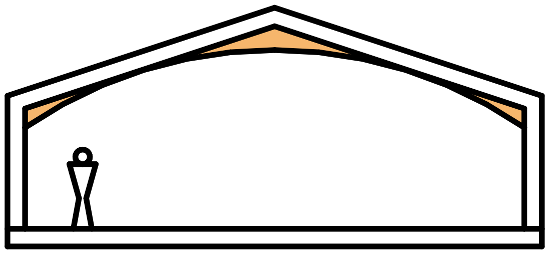
regular ceiling, sharp corners



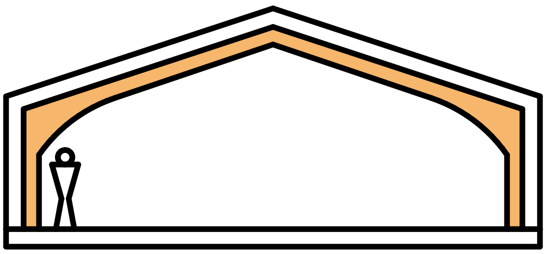
regular ceiling, round corners, higher walls



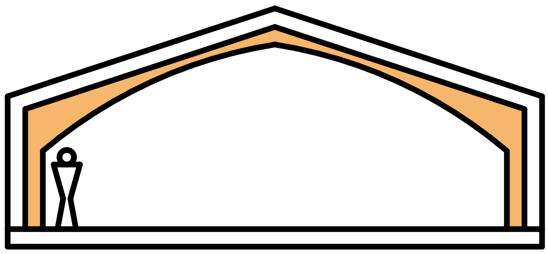
regular ceiling, round corners, regular wall height



slightly visible rafters, high walls



visible rafters, normal wall height, soft transition



visible rafters, normal wall height, sharp transition

illustration 50. cross-section shape in the commonhouse

Design Presentation

The design proposal for *Lokeshøj Fællesskab* is situated on a gently sloping site in Svenstrup, Denmark, and explores how architectural form, materiality, and spatial atmosphere shape the experience of dwelling. The site is developed with a series of modestly scaled buildings, three types of private dwellings and one common house, arranged to balance openness, privacy, and spatial flow.

The built volume occupies approximately 14,6% of the total site area, allowing for generous green space, soft transitions between buildings, and visual connection across the site. Each unit is carefully positioned to maximise daylight, spatial variety, and access to both shared and private outdoor zones.

Together, the buildings form a coherent and atmospheric framework for everyday life, designed not only to be inhabited, but to be sensed and remembered.

illustration 51. master plan 1:2000

illustration 52. living room

illustration 53. children's room

illustration 54. master bedroom

illustration 55. living room

House 1 - Single-Family Dwelling

House 1 is a compact home designed for a single family, organized around a central courtyard that acts as an experiential core. The plan wraps around this outdoor area, creating strong visual connections between rooms while maintaining privacy and a sense of enclosure.

The courtyard brings light into the interior and becomes a quiet focal point, offering a moment of stillness within the home. Living areas are placed to the south to benefit from natural light, while bedrooms are positioned along the north and east facades to ensure calmer, more sheltered spaces.

Materials are chosen for warmth and comfort, supporting an atmosphere of calm domesticity. House 1 is not driven by formal complexity, but by the desire to shape everyday life through proportion and quiet spatial clarity.

illustration 56. *floor plan 1:100*

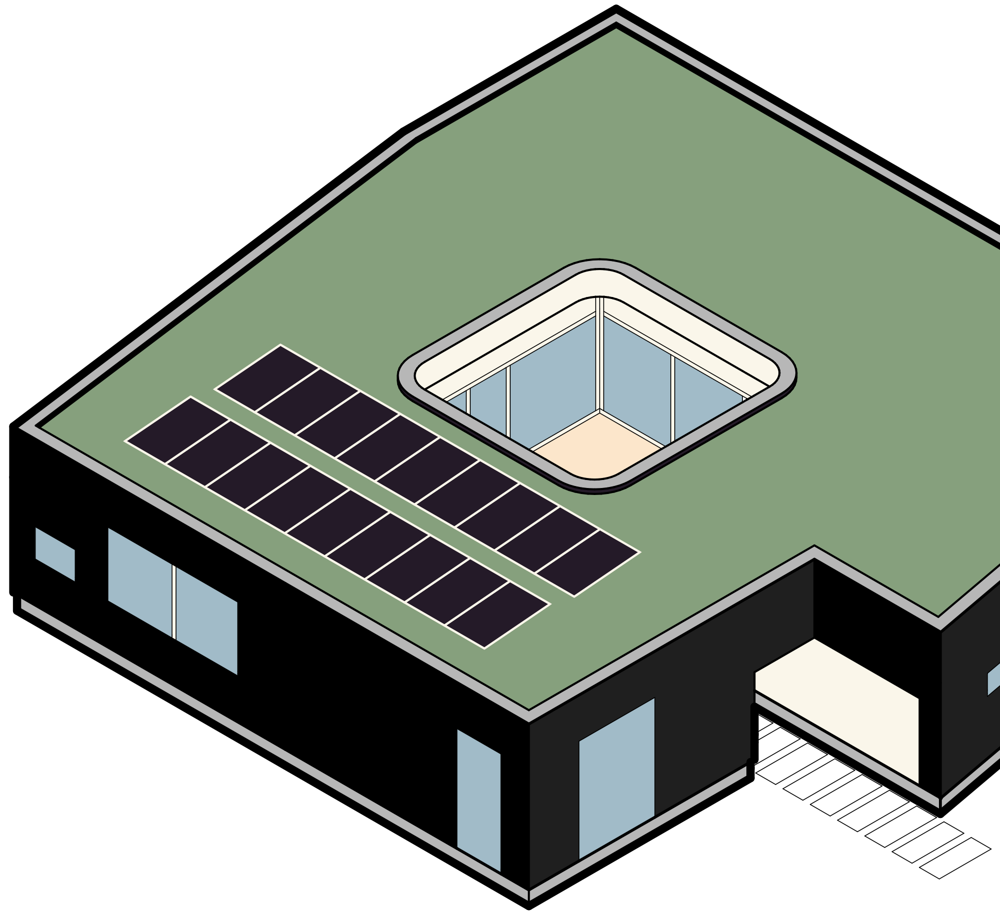


illustration 57. house 1 isometric

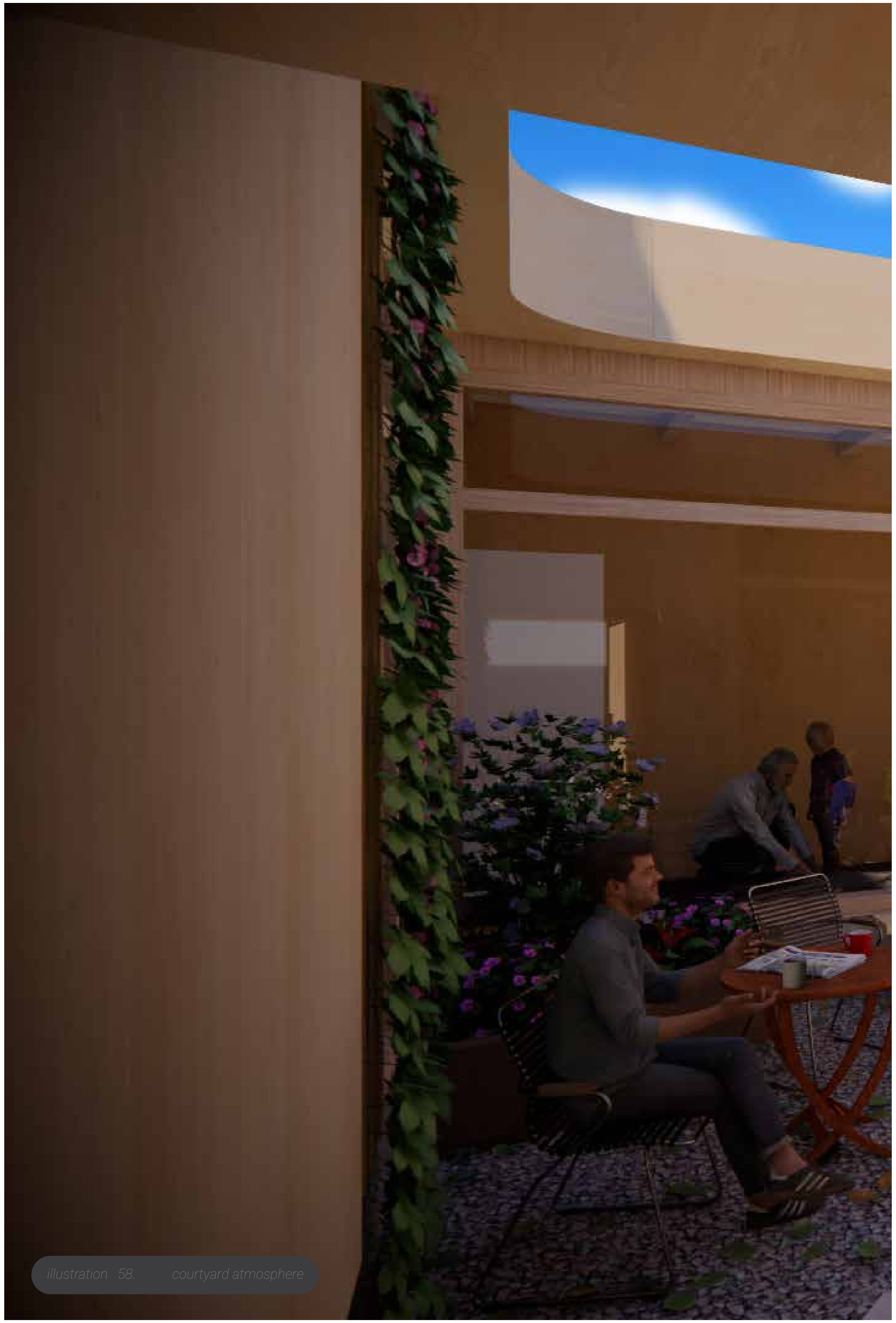


illustration 58. courtyard atmosphere

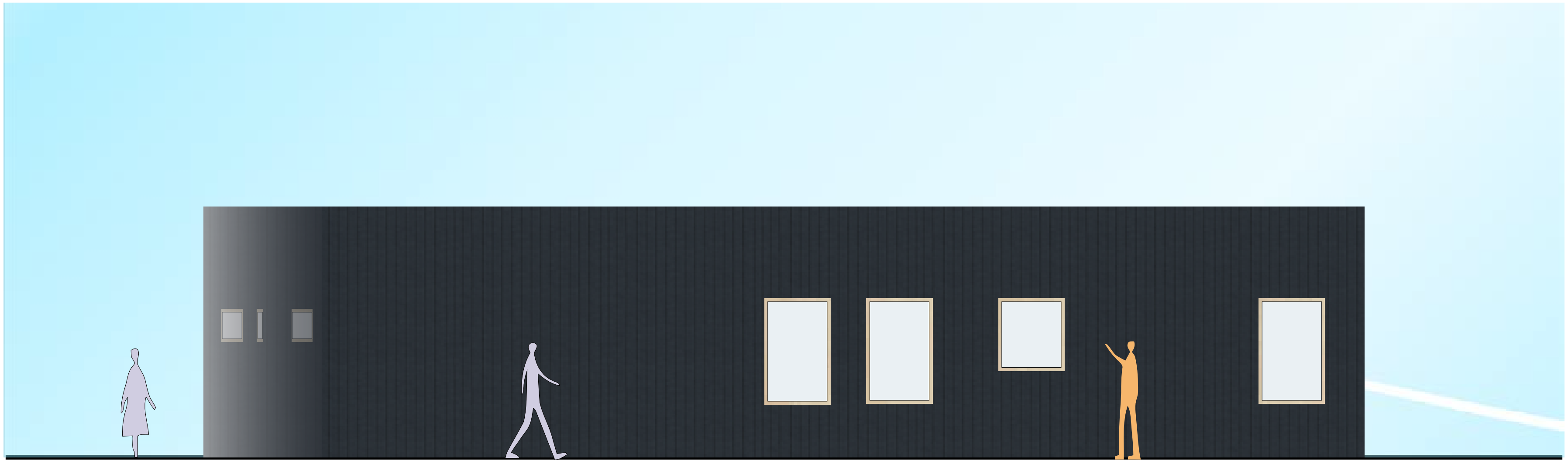


illustration 59. north elevation 1:100

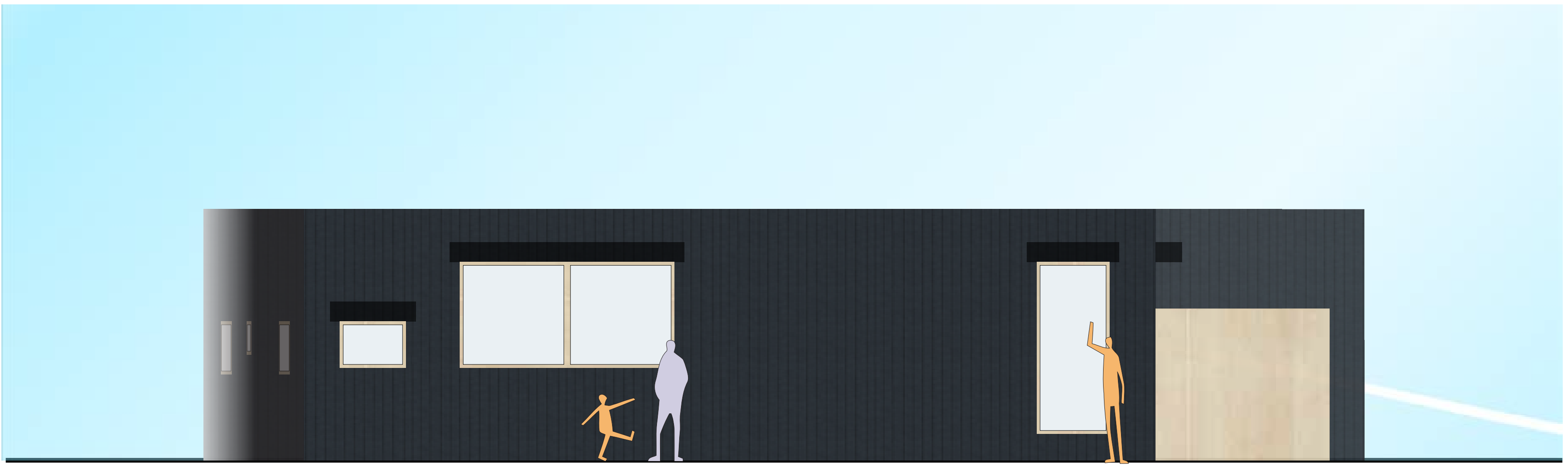


illustration 60. south elevation 1:100

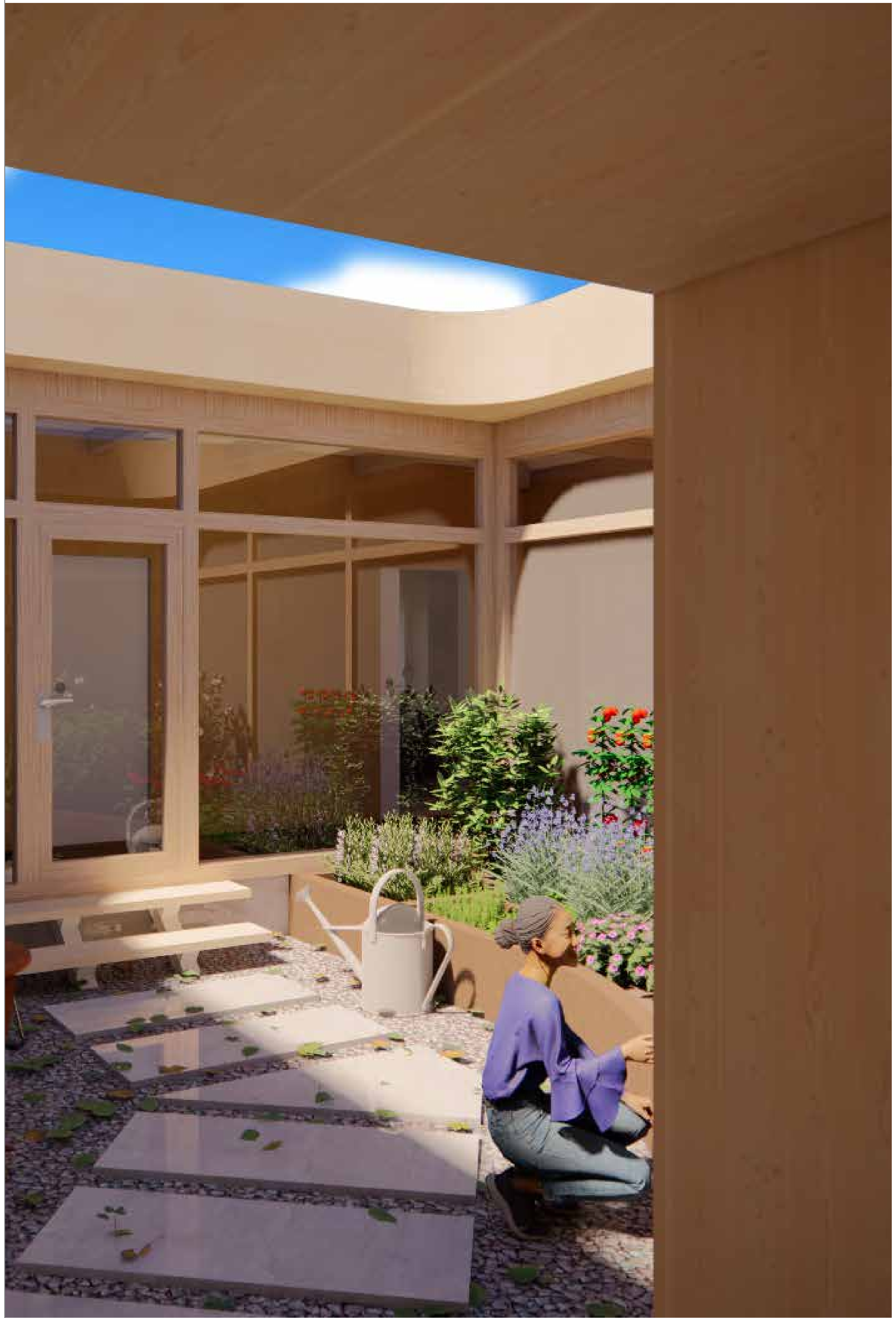
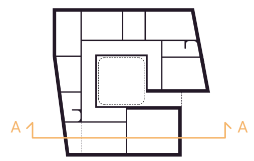


illustration 61. section a 1:100



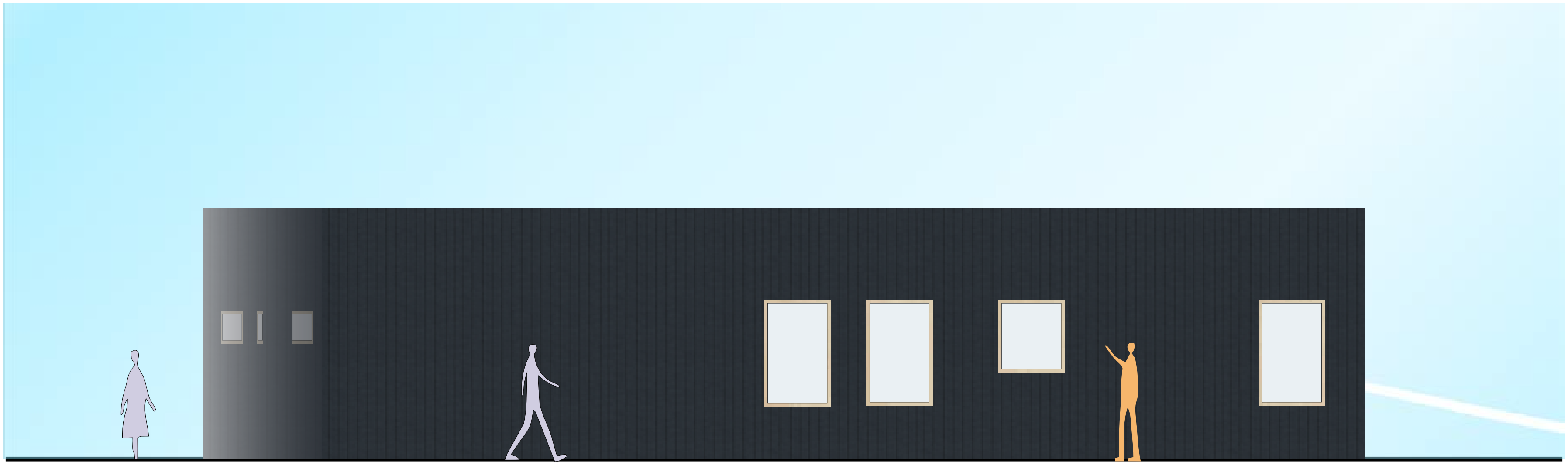


illustration 62. east elevation 1:100

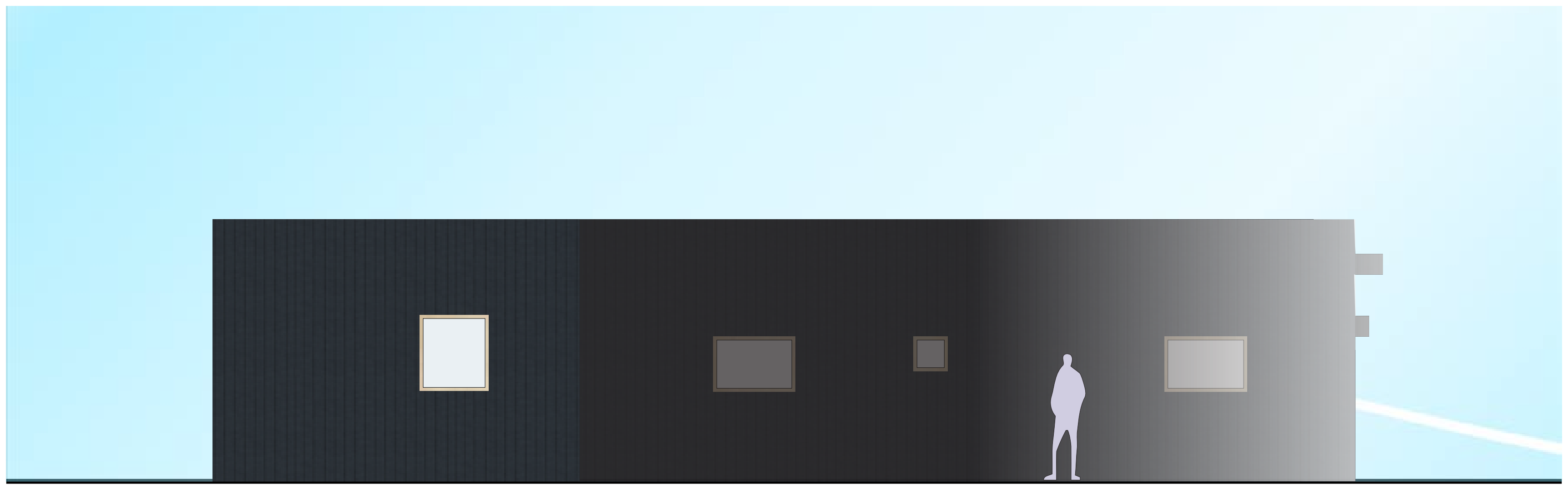


illustration 63. west elevation 1:100

illustration 64. relaxing in the living room

illustration 65. brunch in the dining room

House 2 - Two-Family Dwelling

House 2 builds on the spatial principles of House 1 and adapts them for two families living side by side. At the heart of the layout is a central courtyard, which acts as a shared spatial anchor, bringing in light and creating a quiet place of connection.

Each dwelling is arranged to allow for a sense of belonging and comfort. Bedrooms are positioned along the outer edges to ensure privacy and calm. Kitchens and living spaces are oriented towards the south to benefit from the sunlight. This arrangement allows both homes to benefit from daylight and outdoor access without overlapping circulation.

House 2 offers a solution for multi-family living, while providing a sense of belonging. Material choices are shared across both units to give the building a cohesive identity.

illustration 66. floor plan house 2 1:100

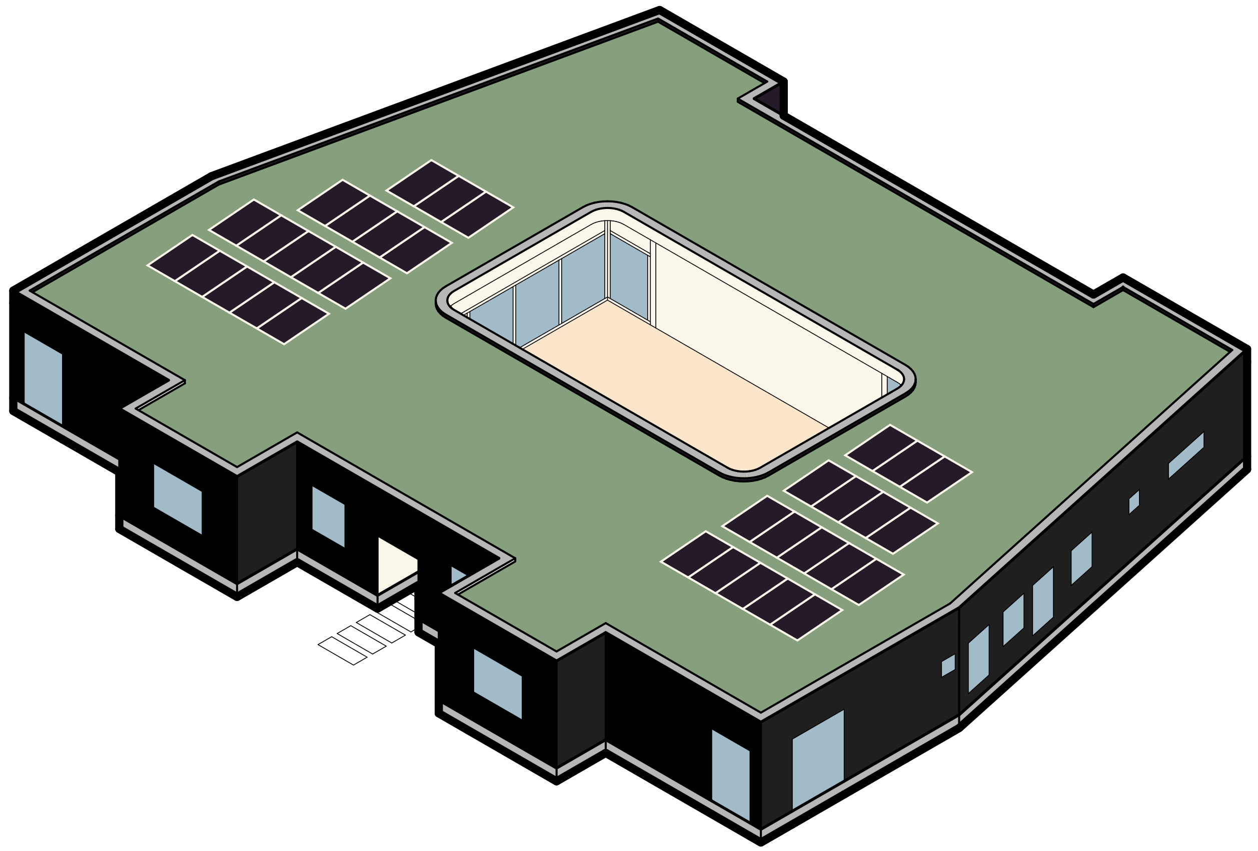


illustration 67. house 2 isometric

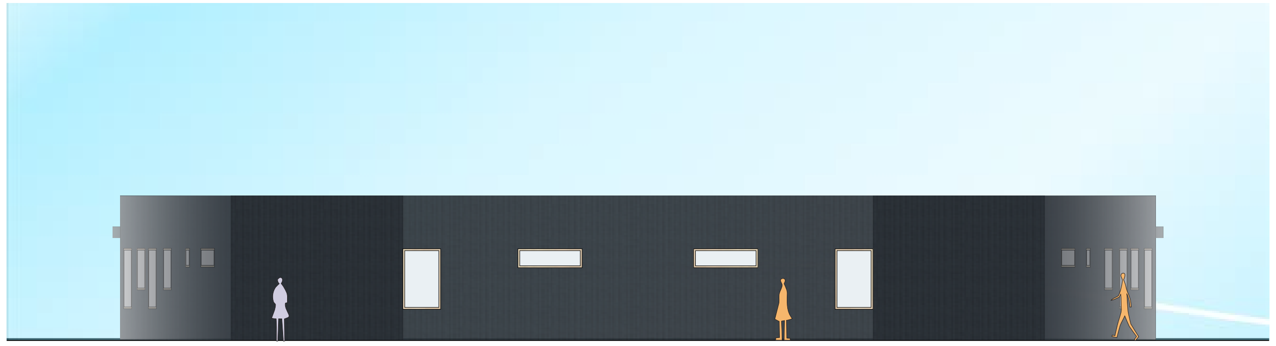


illustration 68. north elevation 1:200

illustration 69. south elevation 1:200

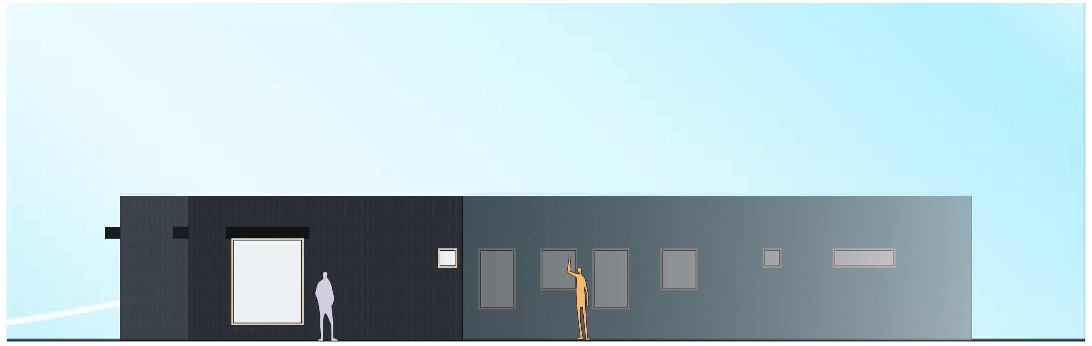


illustration 70. east elevation 1:200

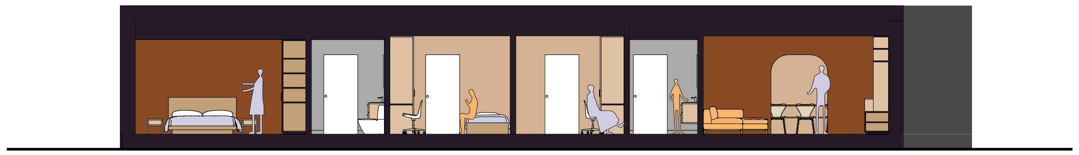


illustration 72. section a 1:200

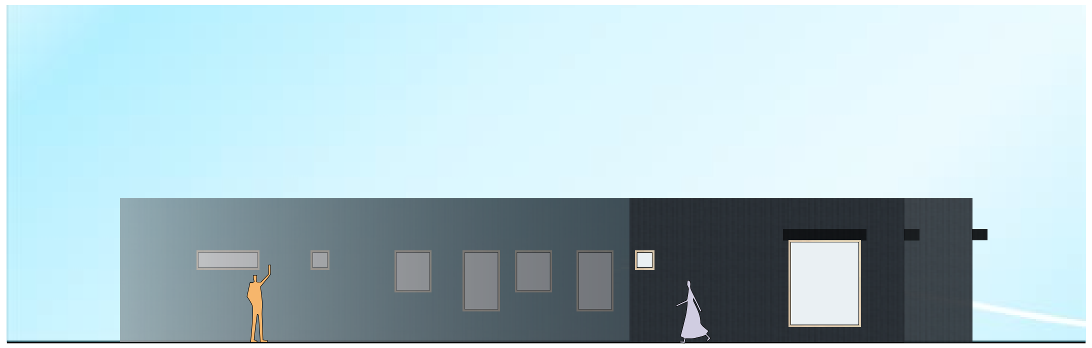


illustration 71. west elevation 1:200

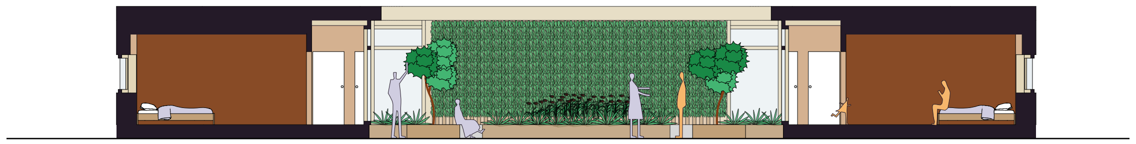
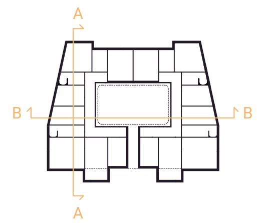


illustration 73. section b 1:200



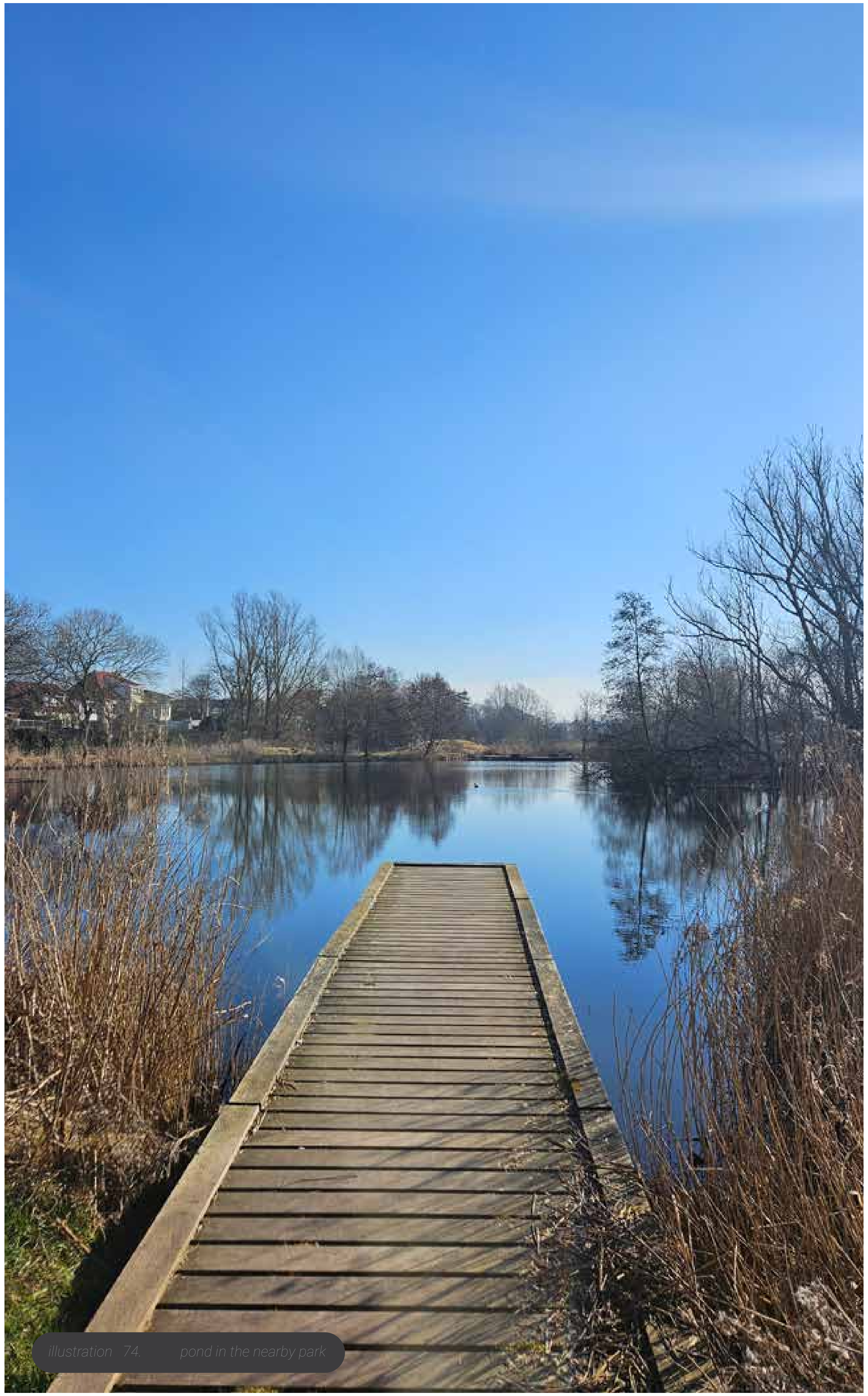


illustration 74 pond in the nearby park

House 3 - Two-Storey Two-Family Dwelling

House 3 introduces a vertical strategy for two-family living, distributed across two levels. While each family has their own unit, the design emphasizes continuity and shared atmosphere through a central courtyard that extends its influence across both floors.

The two families enter through the same entrance, leading to a shared utility room, also housing the staircase. This space is more than just a circulation element—it is a shared space between the families, where social interactions unfold. The double-height spaces and varying ceiling height change the experience of each room, giving each part of the house its own spatial identity.

The layout separates private and communal areas vertically: quieter rooms are placed above, while shared functions stay close to the garden and courtyard. Materials and details are consistent throughout, creating a calm, coherent atmosphere.

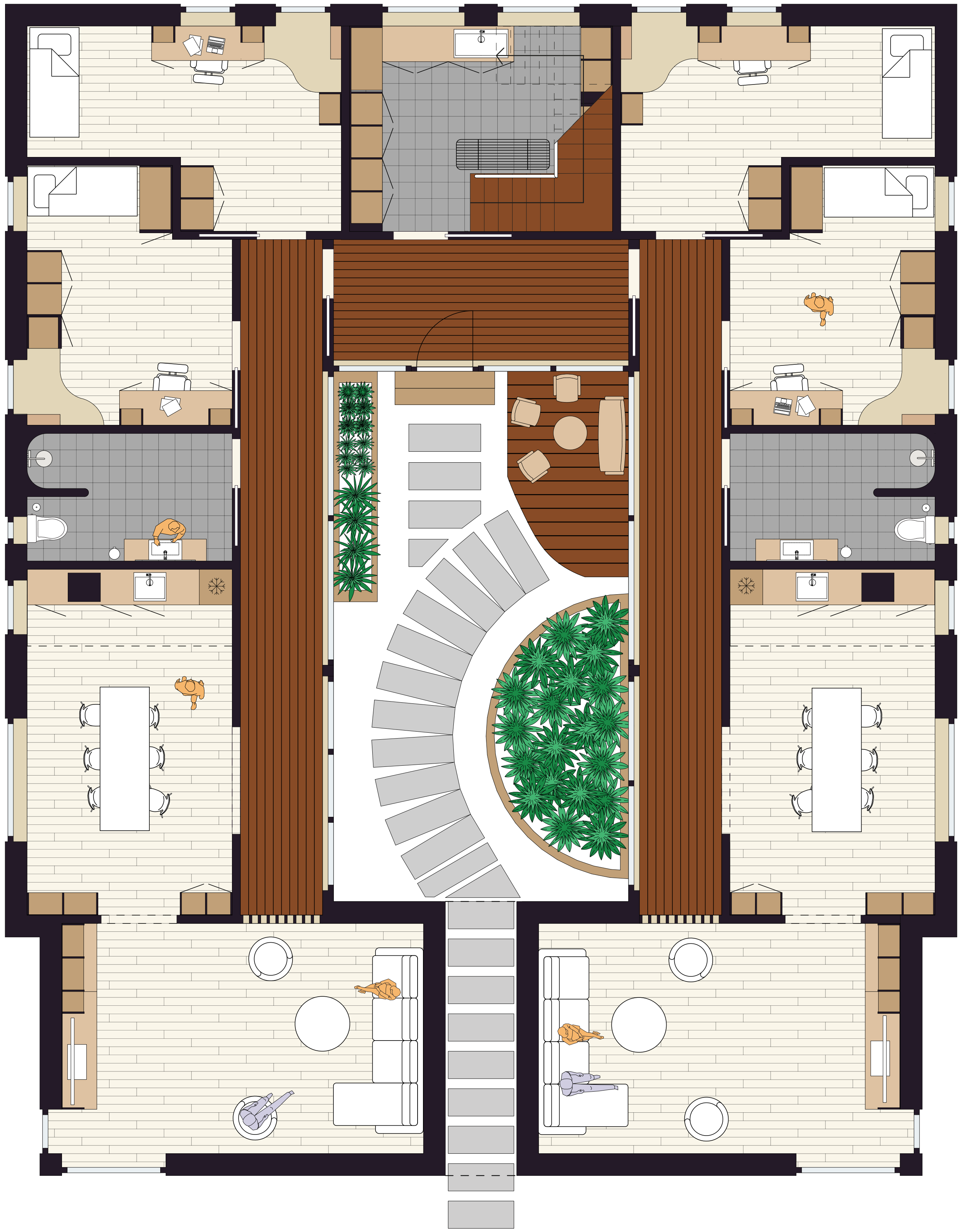


illustration 75. floor plan house 3 1:100 - ground floor

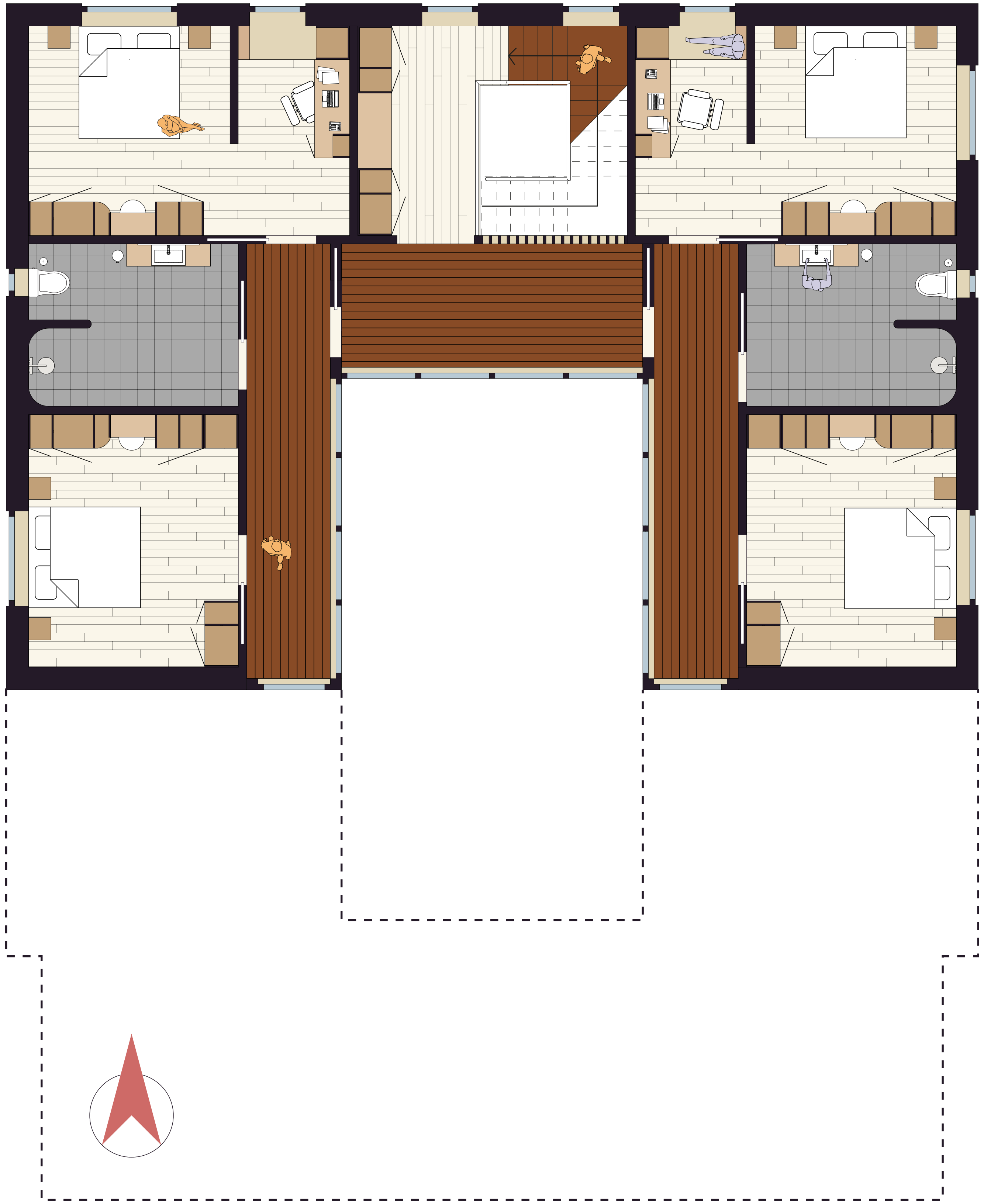


illustration 76. floor plan house 3 1:100 - first floor

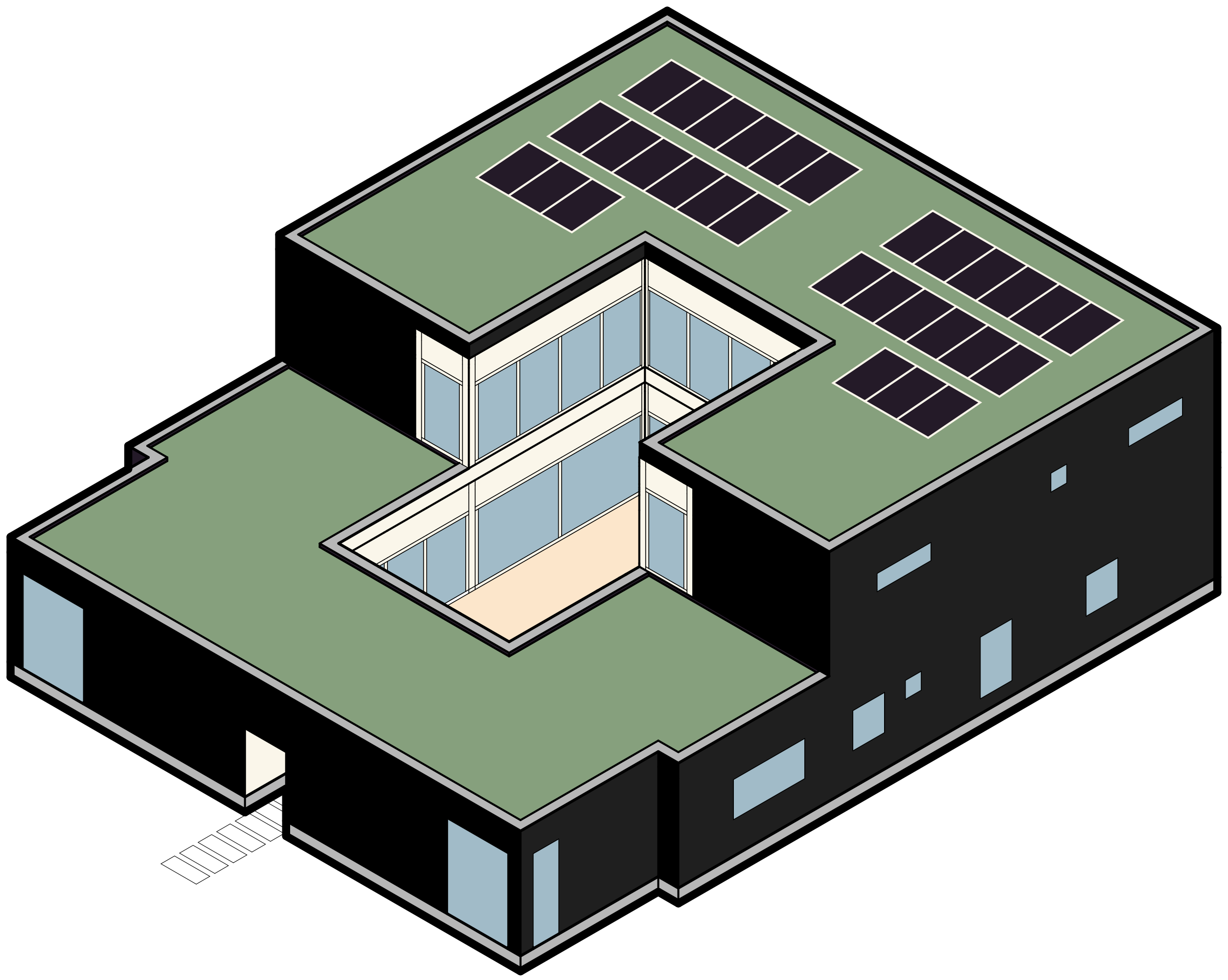


illustration 77. house 3 isometric

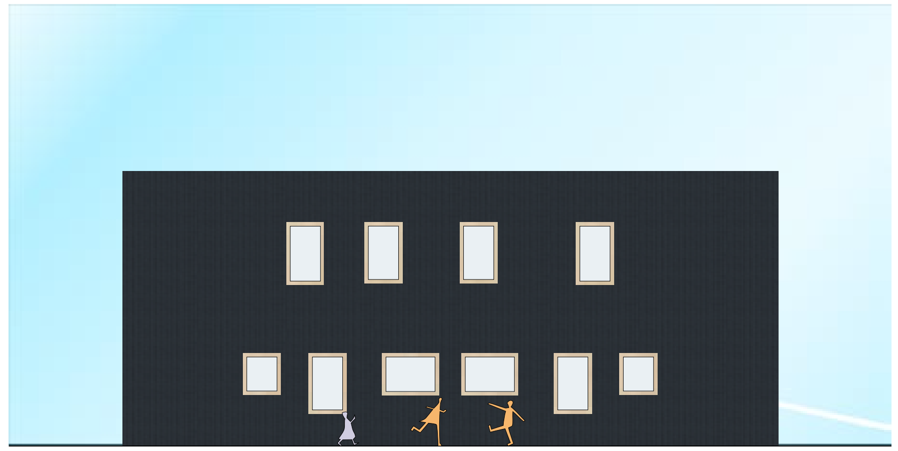


illustration 78. north elevation 1:200

illustration 79. south elevation 1:200

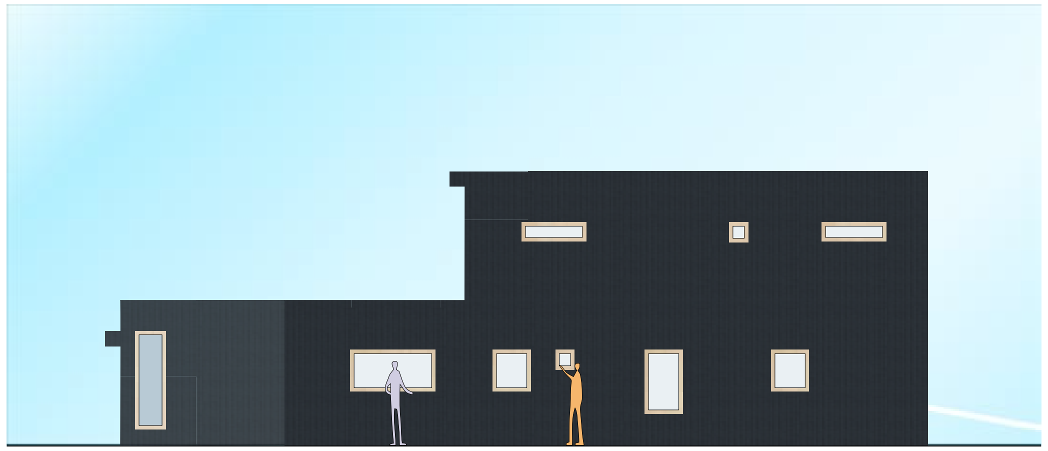


illustration 80. east elevation 1:200

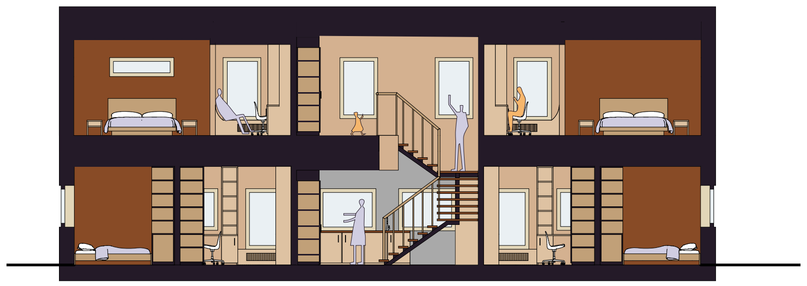


illustration 82. section a 1:200

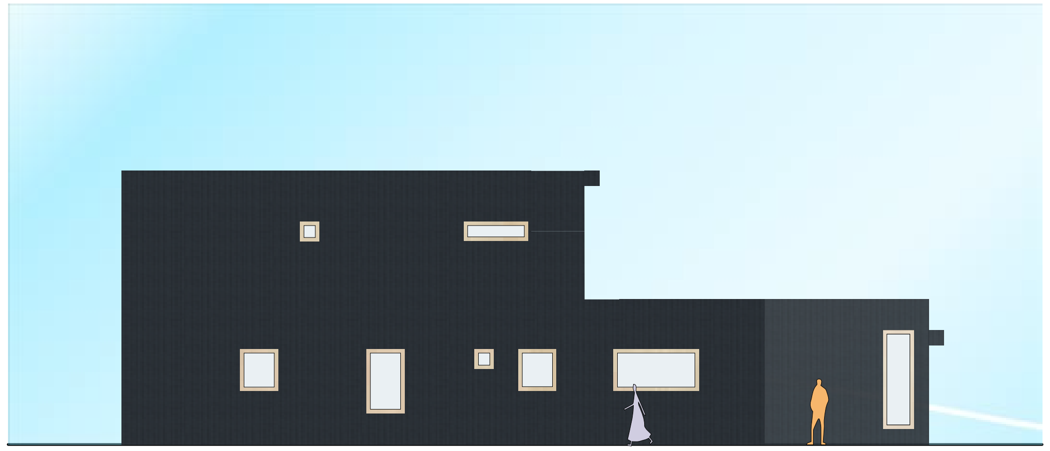
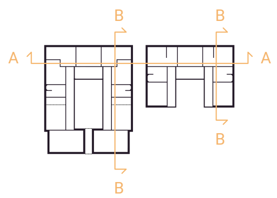


illustration 81. west elevation 1:200

illustration 83. section b 1:200



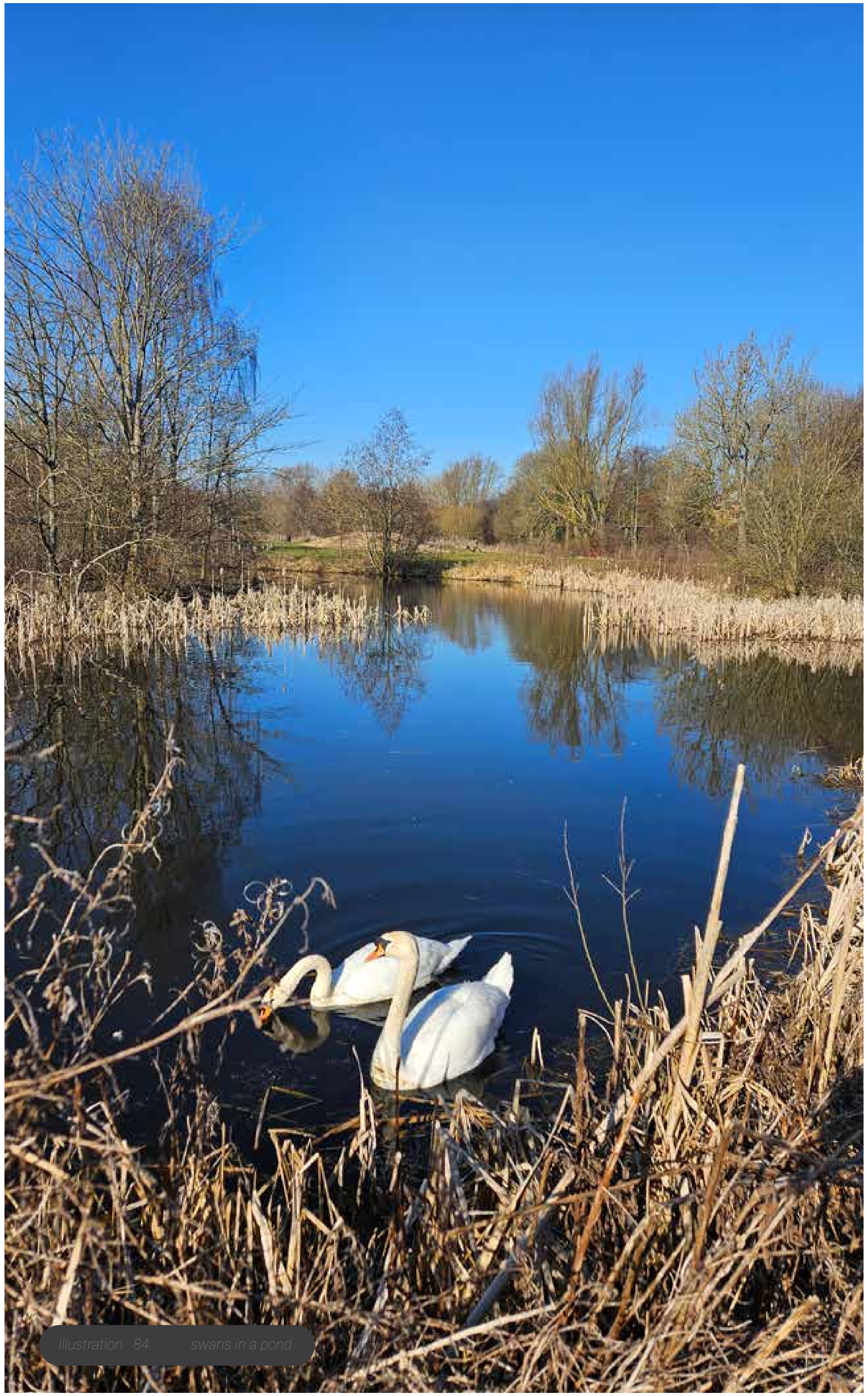


illustration 84 swans in a pond

House 4 - Commonhouse

House 4 functions as the social center for the community, bringing together key communal activities such as shared dining, informal gatherings, indoor play, and creative workshops under a single roof. Architecturally, the building draws inspiration from the traditional Danish longhouse typology yet reinterpreting it through a softened and more expressive formal language. This is achieved through a rounded gable and a gently curved ceiling, both of which contribute to a distinct spatial character and a heightened sense of identity.

The design emphasizes openness and social accessibility. A prominent southwest-facing glass facade provides strong visual and physical connections to the surrounding community. Large sliding doors are integrated into the glazed wall, allowing the building to open fully to the exterior during warmer months, thereby extending the communal life out into the landscape. This transparency not only invites daylight deep into the building but also fosters spontaneous interaction among residents by making communal activity visibly present.

Programmatically, the common house includes essential amenities such as toilet facilities, a generous communal kitchen, a storage room, and a flexible dining hall. While the primary function of the hall is communal dining, the space is intentionally designed for adaptability. A modular indoor play area is integrated into the hall and can be packed away when needed, allowing the room to host a wide variety of social functions.

By consolidating these diverse activities within a shared architectural space, House 4 reinforces the principles of co-living and supports everyday interaction, shared responsibility, and collective identity within the community.

illustration 85. floor plan house 4 1:100

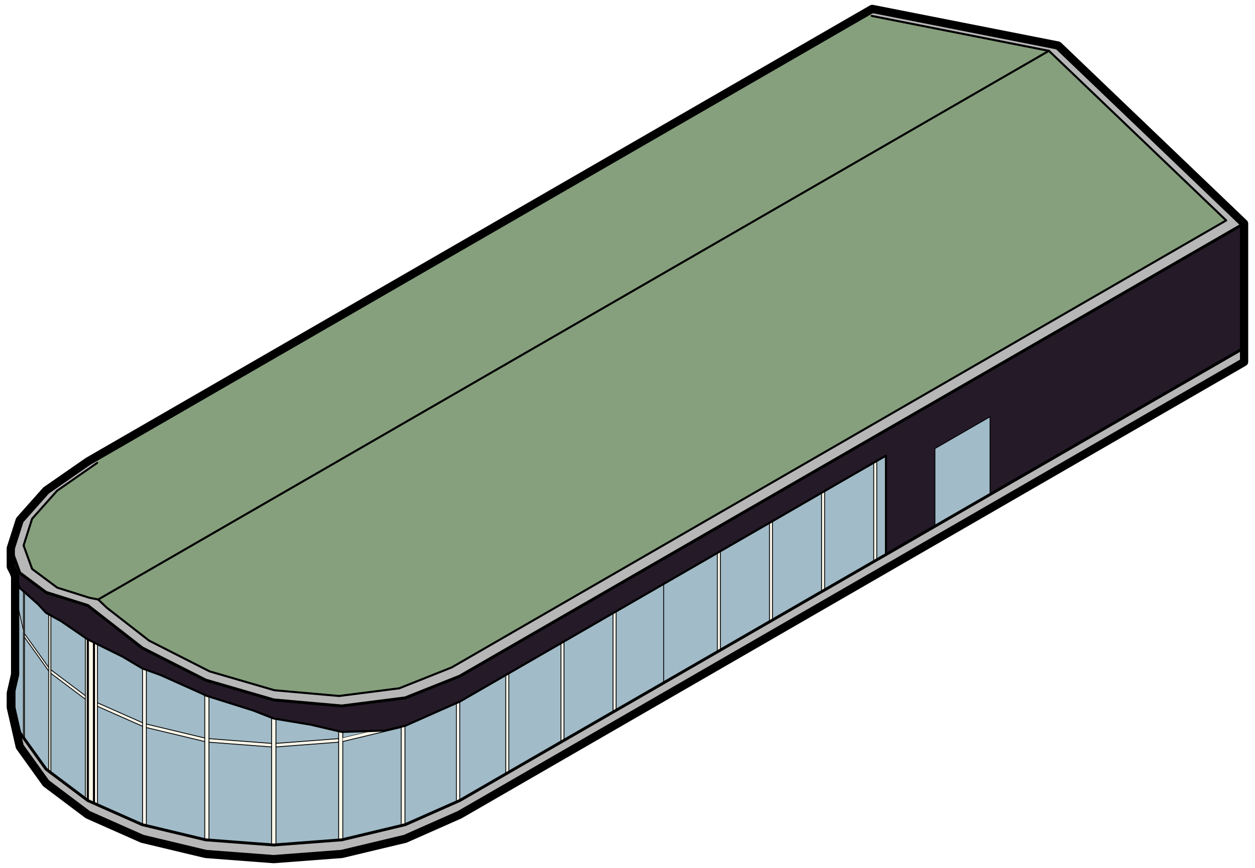


illustration 86. house 4 isometric

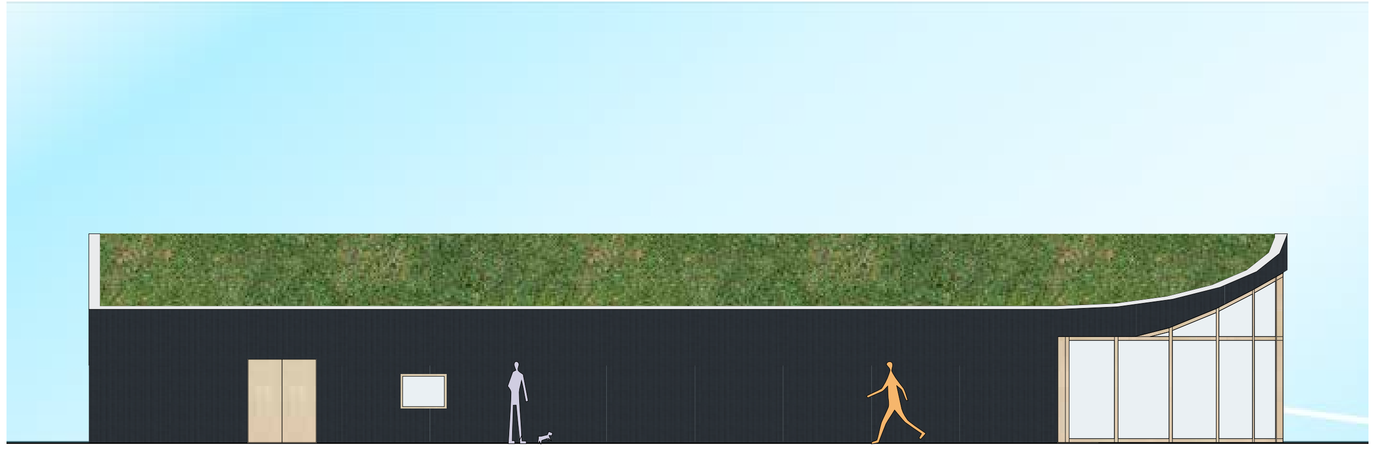


illustration 87. north elevation 1:200

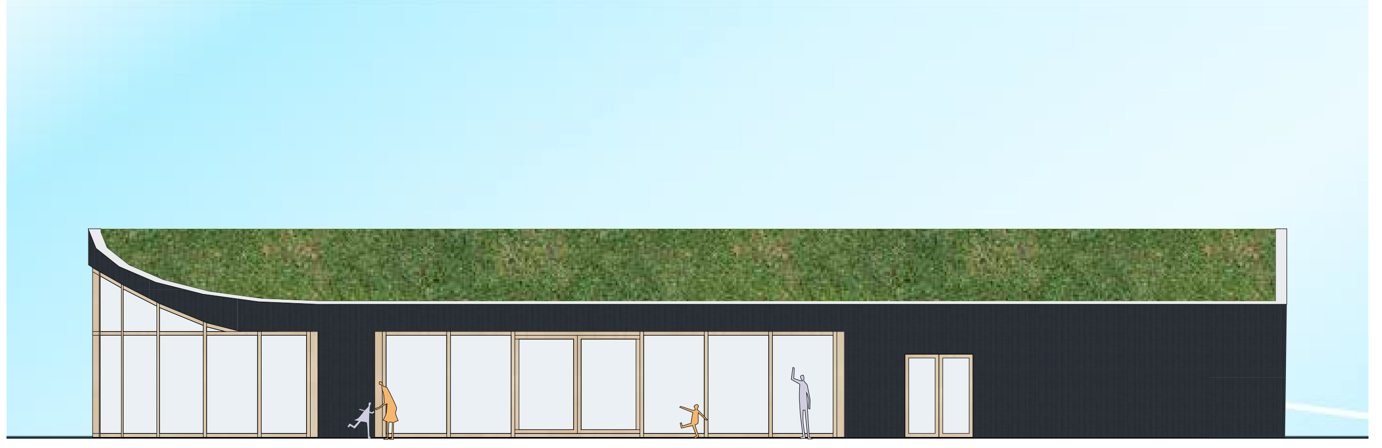


illustration 88. south elevation 1:200

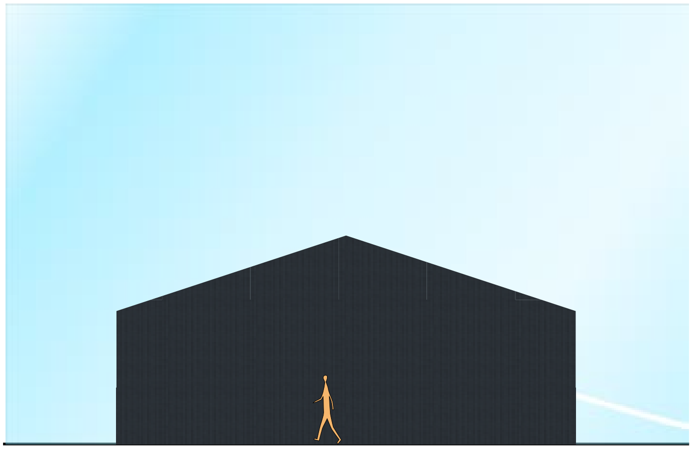


illustration 89. east elevation 1:200

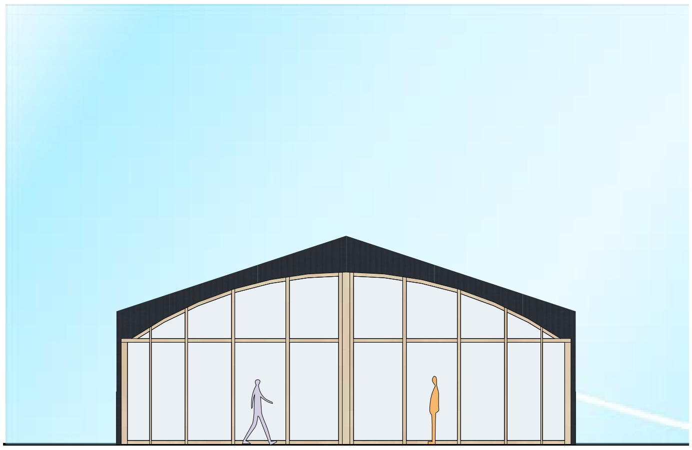


illustration 90. west elevation 1:200

illustration 91. house 4 dining area

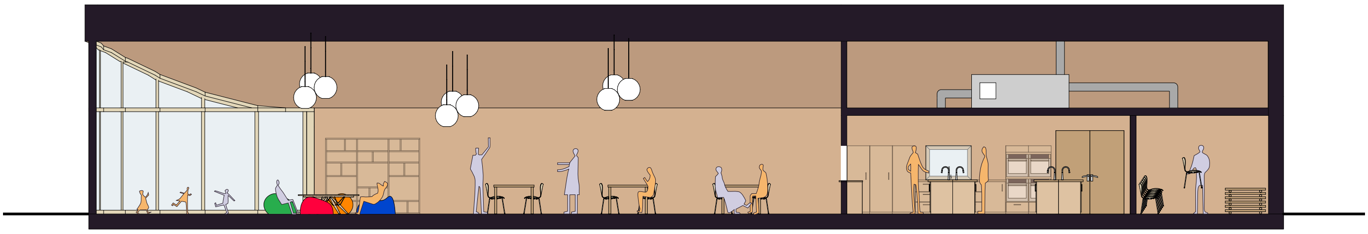


illustration 92. section a 1:200

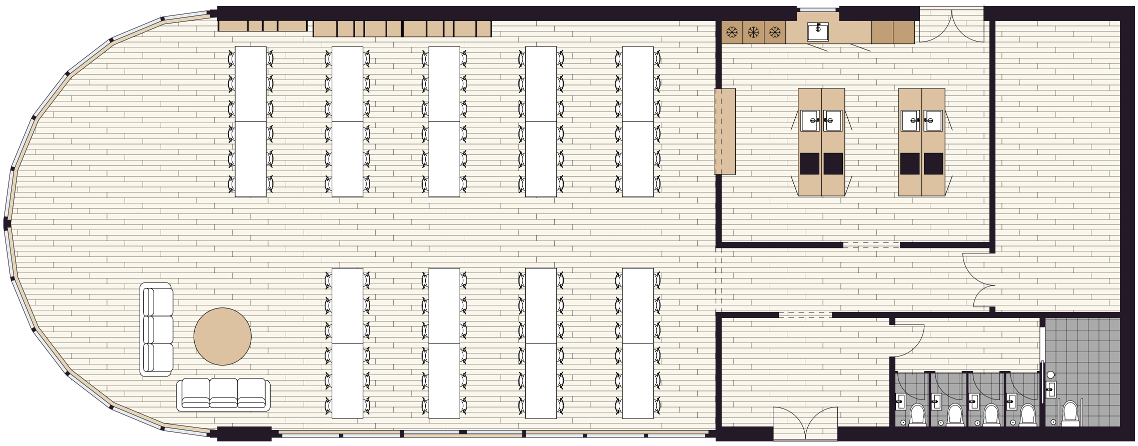


illustration 93. all families gathered at once

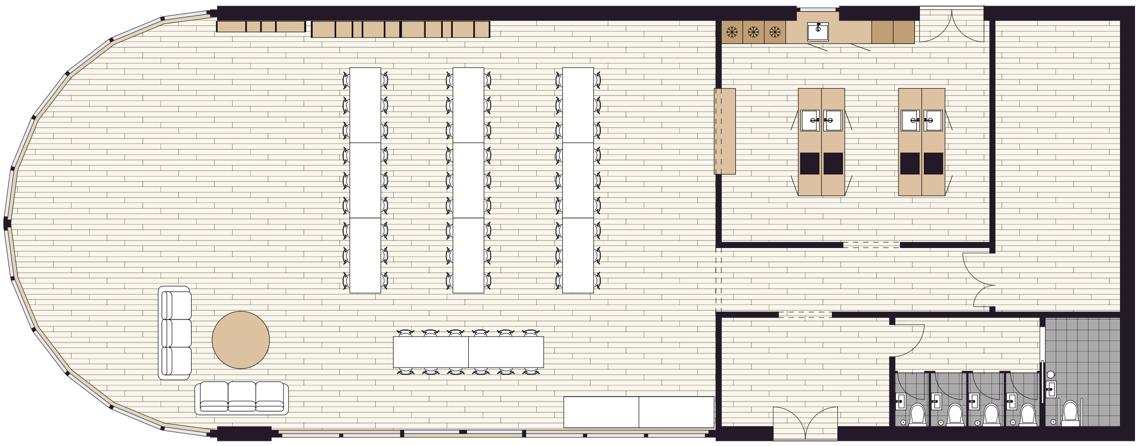


illustration 94. birthday party

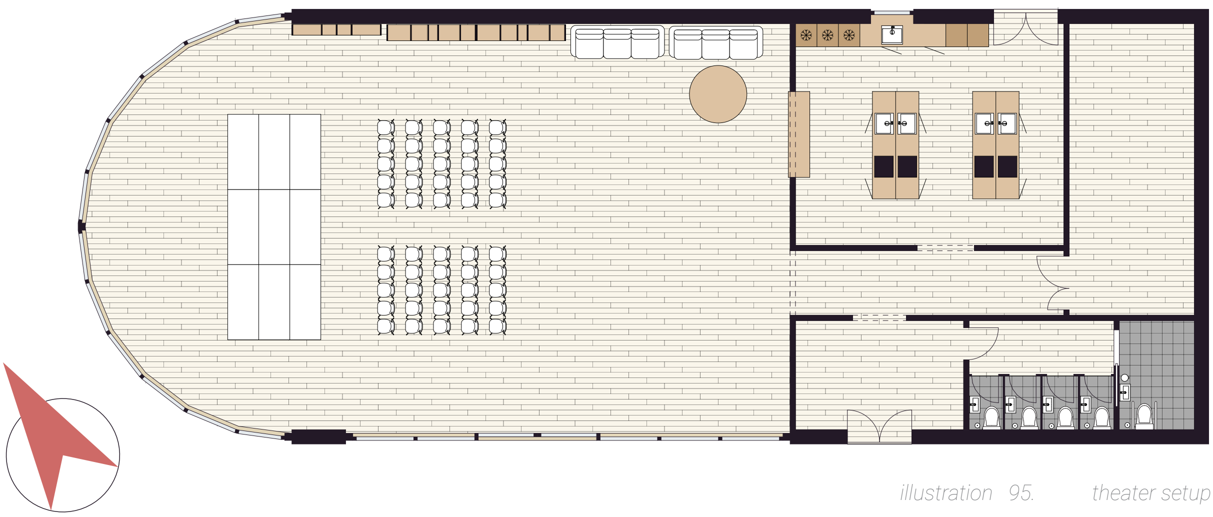


illustration 95. theater setup

Materials

In this project, a diverse palette of natural materials has been carefully composed to express atmosphere, transitions, and the rhythm of domestic life. Each material contributes not only through its physical properties, but through its tone, texture, and placement within the spatial sequence of the home.

Throughout the project a variety of timber has been used, such as; ash, beech, caramel oak, birch, oak, and re-used structural timber, each selected for its distinct character. Plywood in ash, beech, caramel oak, and birch defines surfaces across cabinetry, walls, and ceilings. These light-toned woods evoke openness, clarity, and activity, guiding the experience of spaces designed for engagement and movement.

Floor planks in thermo ash and regular ash extend this language underfoot, bringing warmth and tactility to circulation areas and rooms of gathering. Their grain and color soften the experience of passage, adding emotional weight to daily routines.

Darker, more textured materials define moments of retreat, as they introduce weight and stillness, anchoring quiet zones and grounding the lighter surroundings. These tones suggest a lowering of tempo, a cue for pause, rest, and reflection.

The charred pine cladding is used exclusively on the exterior, marking a clear boundary between inside and out. Its deep, scorched blackness provides a striking contrast to the pale birch plywood found within. This interplay creates a threshold condition: as one moves from the charred, tactile outer shell into the soft, luminous inner lining, the material contrast heightens the sense of arrival and enclosure. The house thus reveals itself through a tactile shift; from rough to smooth, dark to light.

Warm woods (thermo ash, caramel oak, oak, and re-used timber) thread throughout the house, bridging transitions and grounding the material palette. Their tones add richness and familiarity, contributing to an atmosphere of warmth and continuity.

Above, a vegetated roof introduces a living layer of green, merging the home with its landscape. It softens the architectural profile and seasonal variation, tying the built to the organic.

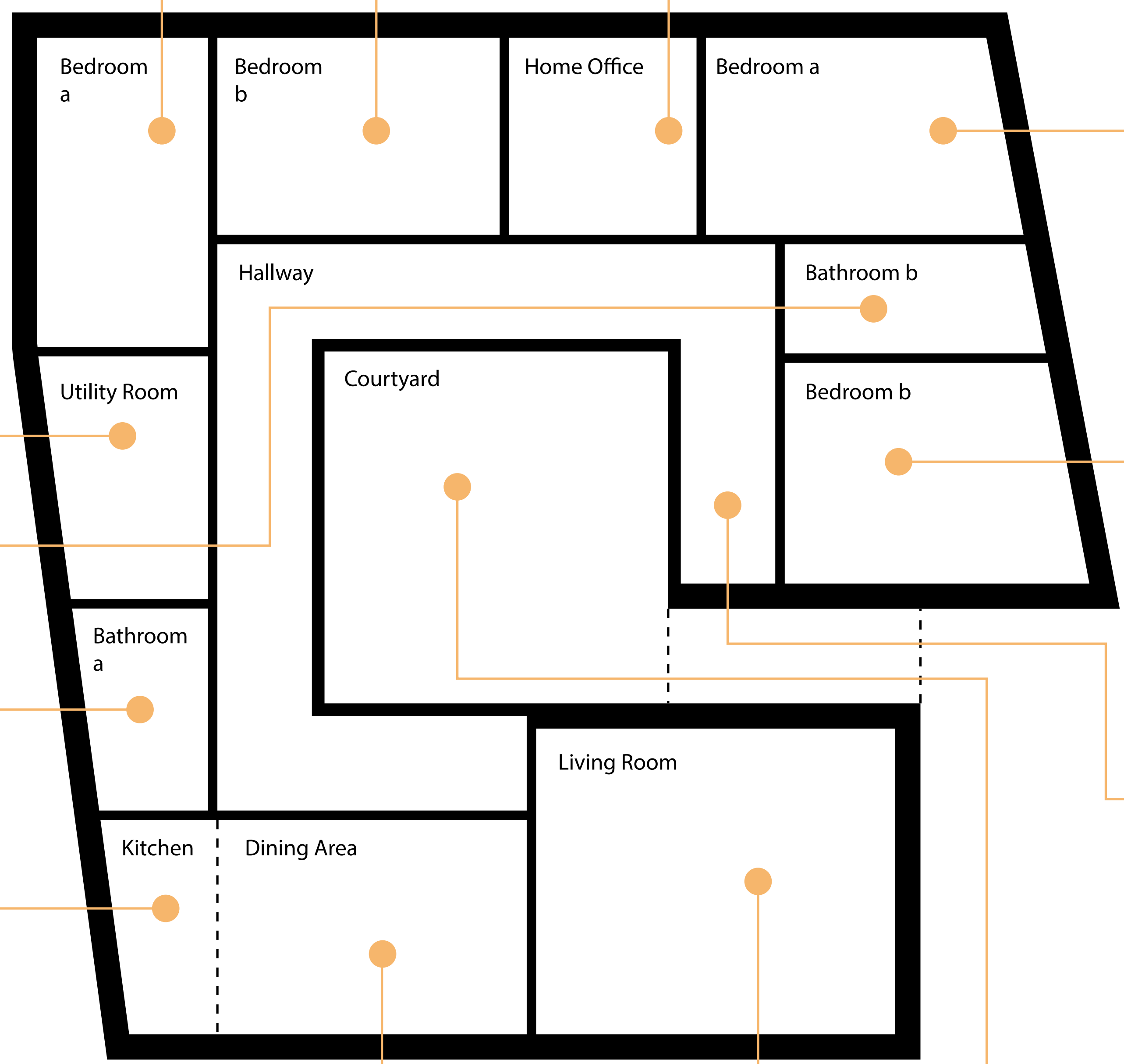
Together, these materials do more than clothe the architecture: they shape how space is perceived and inhabited. Light and dark, warm and cool, rough and refined, they choreograph experience and bring the architecture to life.

Bedroom a & b

Area:
a: 13,3 m²
b: 14 m²

Ceiling height:
2,6 meters

Atmosphere:
relaxing, immersion



Home Office

Area:
7,4 m²

Ceiling height:
2,4 meters

Atmosphere:
immersion, inspiring

Utility Room

Area:
9,4 m²

Ceiling height:
2,5 meters

Atmosphere:
practical

Bedroom a & b

Area:
a: 16,7 m²
b: 15,8 m²

Ceiling height:
2,5 meters

Atmosphere:.
relaxing

Bathroom a & b

Area:
a: 6,2m²
b: 6,9 m²

Ceiling height:
2,5 meters

Atmosphere:
practical, slightly unpleasant

Hallway

Area:
35,4 m²

Ceiling height:
3 meters

Atmosphere:
uplifting, calming

Kitchen

Area:
5,5 m²

Ceiling height:
2,5 meters

Atmosphere:
practical

Dining Area

Area:
16,7 m²

Ceiling height:
2,9 meters

Atmosphere:
home, practical

Living Room

Area:
28,4 m²

Ceiling height:
2,6 meters

Atmosphere:
Cozy, warmth, embracing

Courtyard

Area:
30,7 m²

Ceiling height:
the sky

Atmosphere:
calming, welcoming

illustration 96. overview of materials used indoors and in courtyard

illustration 97. materials used

Technical Performance

Following the completion of the architectural design, the development of energy calculations was initiated to assess the building's performance. The Be18 software was chosen for this purpose, as it is a widely recognized industry tool capable of evaluating the energy performance of the building envelope. The objective was twofold: to ensure compliance with the Danish Building Regulations (BR18) and to support the design of a comfortable indoor environment through passive strategies.

Initial Assessment

The first iteration of the model revealed several performance deficiencies. According to the calculations, the building exhibited high heating demands and significant occurrences of indoor overheating, suggesting poor performance across both winter and summer conditions. In addition, the building exceeded the recommended transmission heat loss limit of 21.1 W/m²K for a building of this type, indicating inefficiencies in the thermal envelope. Furthermore, the total energy demand surpassed the BR18 threshold of 35.7 kWh/m²/year, confirming the need for both design and material adjustments.

Design Refinement and Passive Strategies

In response to the initial findings, several passive design strategies were implemented, alongside more accurate detailing of the building model. The first improvement addressed solar gain. As the inner courtyard features substantial glazing, shading effects were added to reflect actual conditions more realistically. This adjustment successfully reduced overheating but simultaneously increased heating demands, as passive solar heating was limited. Consequently, the total energy demand rose slightly.

To counterbalance this, the south-facing windows were revised in size and number to optimize winter solar gain. Overhangs were then introduced to mitigate excessive solar exposure during summer: 40 cm overhangs were added above south-facing windows, 20 cm above a east-facing window, and 30 cm on all inner courtyard facades. This measure effectively eliminated overheating without compromising natural light.

Envelope Optimization

To further reduce heating demands, the thermal envelope was upgraded. The insulation material was changed from hemp (λ = 0.039 W/mK) to high-performance Kingspan (λ = 0.023 W/mK) across the walls, roof, and foundation. In addition, the suspended timber ground floor was replaced with a traditional concrete slab, increasing the building's thermal mass and raising the heat capacity from 27 Wh/K·m² to 33 Wh/K·m². This helped stabilize indoor temperatures and improve overall thermal comfort.

Final Performance

After all interventions, the building achieved compliance with BR18's energy requirements, while maintaining the original architectural concept. Although the introduction of overhangs slightly reduced sky views from within the courtyard, this was counteracted by the enlargement of window openings, which provided broader horizontal views and improved daylight conditions. The final design was also evaluated in ClimateStudio to verify indoor thermal comfort, confirming that no significant overheating occurs in rooms facing south.

Key Results – First Iteration:

- Transmission loss: 5.0 kW / 29.0 W/m²

- Total energy demand: 51.6 kWh/m²/year

Contribution to total energy demand:

- Heating: 61.1 kWh/m²/year

- Indoor overheating: 10.9 kWh/m²/year

Key Results – Final Iteration:

- Transmission loss: 4.5 kW / 25.8 W/m²

- Total energy demand: 30.1 kWh/m²/year

Contribution to total energy demand:

- Heating: 49.5 kWh/m²/year

- Indoor overheating: 0.0 kWh/m²/year

External Wall and Foundation Detail Intersection

1. Sealing strip
2. DPC (Damp-proof course)
3. Concrete
4. Plastered base
5. Soil
6. Vapour barrier
7. Wooden floorboards
8. Timber
9. Kingspan insulation
10. Concrete
11. Kingspan insulation

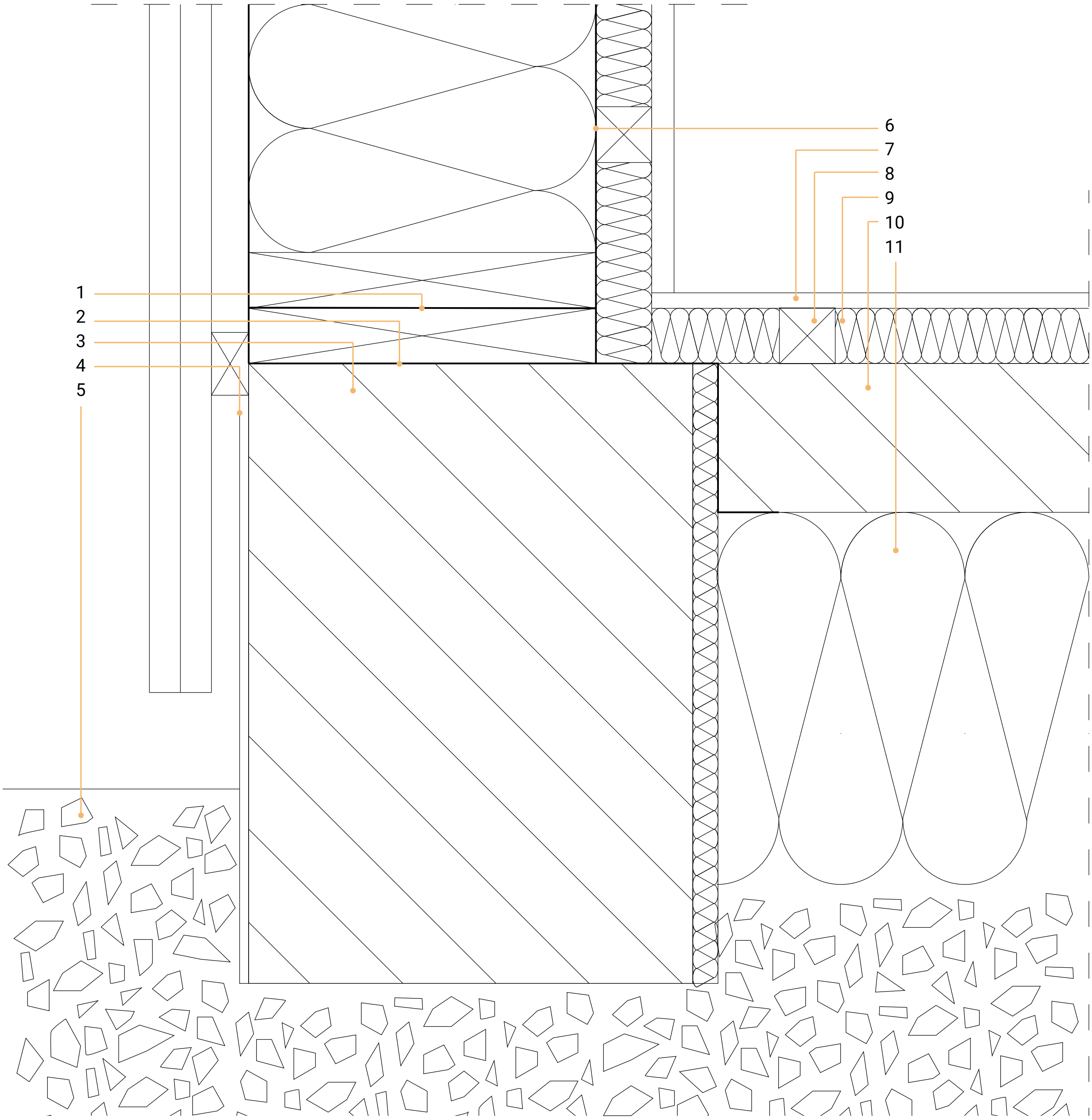


illustration 98. section detail 1:5 - foundation

External Wall and Window Detail

1. Window sill flashing
2. Wooden facade cladding
3. Timber
4. Air cavity
5. Wind barrier
6. Timber
7. Silicone foam
8. Silicone sealant
9. Wooden window sill support
10. Polyurethane foam
11. Windowsill
12. Internal wall cladding
13. Timber
14. Timber
15. Kingspan insulation
16. Kingspan insulation
17. Vapour barrier

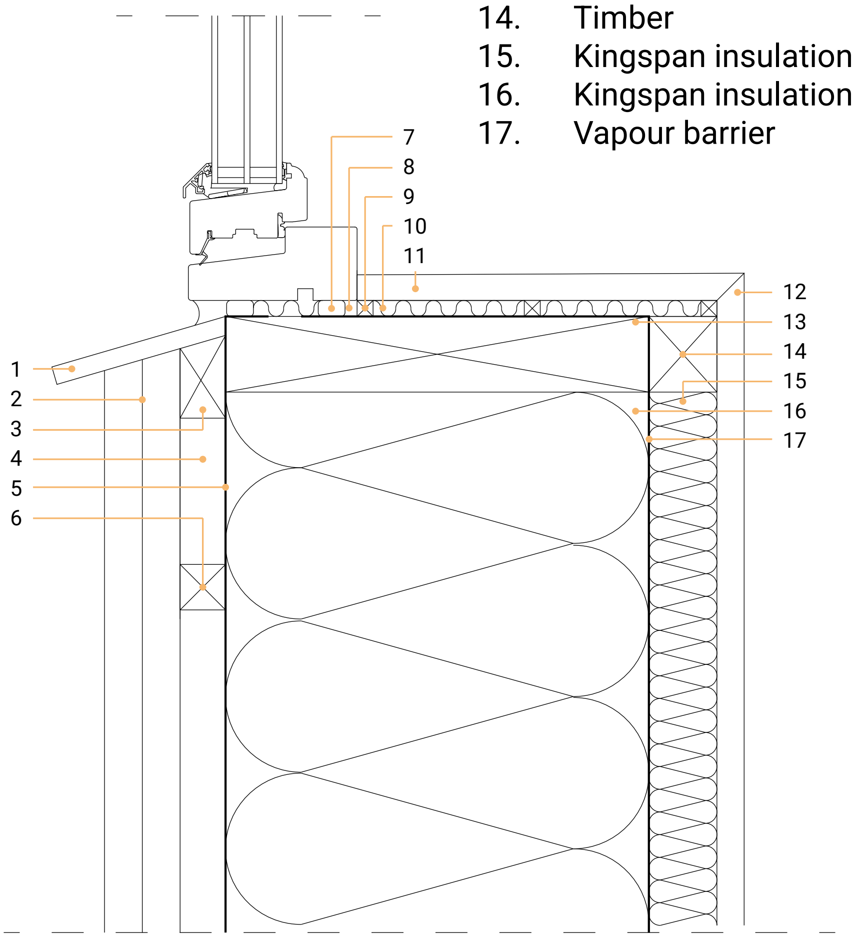


illustration 99. section detail 1:5 - wall

Roof and Suspended Ceiling

1. Metal sheet
2. Cembrit board
3. Soil
4. Vapour barrier
5. OSB board
6. Kingspan insulation
7. Timber
8. Kingspan insulation
9. Wooden board
10. Wooden ceiling board

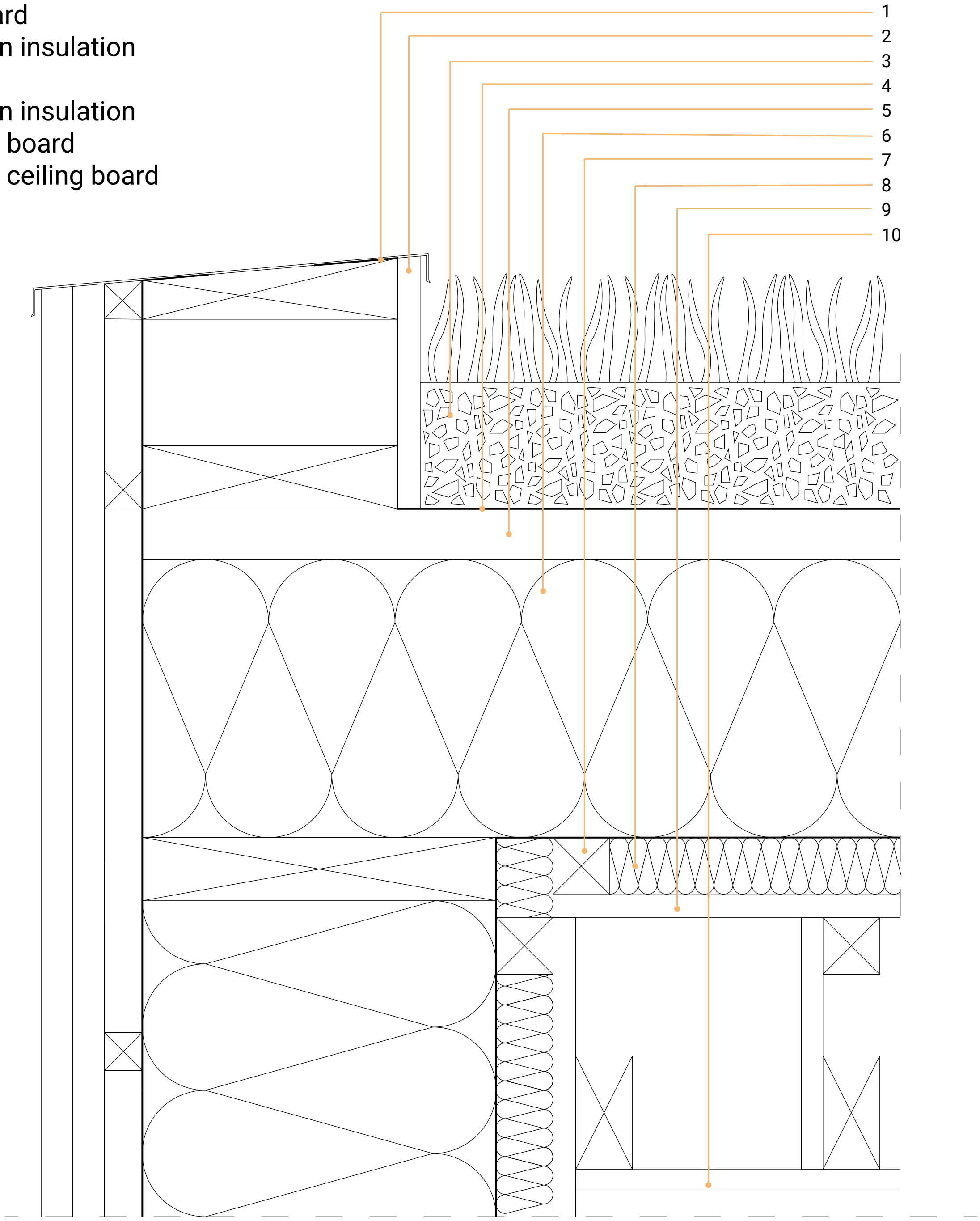


illustration 100. section detail 1:5 - roof

Epilogue

Conclusion

The goal of this project was to investigate which tools and parameters can be used to enhance the human experience of space within the home. This led to an architectural approach that diverges from traditional design methodologies, prioritizing emotional and sensory perception over purely functional or conventional solutions. While practicality has not been disregarded, the project instead explores how spatial decisions can be rooted in how spaces feel rather than how they are typically expected to function.

Almost everything in our surroundings influences how we perceive space, whether we register it consciously or not. This means that every element carries weight in shaping our experience of the built environment and should therefore be carefully considered. To guide the design process, key parameters were identified, including materiality, movement, and spatial memory. These were selected both for their theoretical foundation and their potential to be translated into spatial strategies.

Movement is expressed through physical elements, for example, floorboards in the hallway are oriented in the direction of travel, subtly guiding inhabitants from one space to the next. Variation in materiality is explored throughout the homes by using several species of wood. These differ in tone and texture and are strategically distributed according to activity levels: darker woods are used in low-activity spaces such as bedrooms, while lighter woods are placed in more active rooms, such as kitchens and dining areas, creating a subtle yet readable material rhythm.

This focus on the experiential quality of space has been integrated into the architectural program of a multigenerational co-housing community, where these spatial principles are explored and tested in a real-world context.

Lokeshøj Fællesskab is a co-housing community that offers dwellings for multigenerational families. This settlement aspires not only to accommodate everyday life but to inspire it—fostering meaningful intergenerational interaction, mutual care, and a shared sense of belonging. While the co-housing component may not be the most technically developed aspect of the project, it remains an important part of the architectural vision. It represents a deliberate attempt to create a spatial framework that supports community, adaptability, and emotional well-being through everyday architecture.

In conclusion, this project demonstrates that sensory design strategies, grounded in theory and applied with intention, can meaningfully improve the quality of life within a home. By balancing these experiential considerations with regulatory demands and real-world feasibility, the result is a design that is not only buildable but also deeply human in its ambition.

Reflection

Limited Use of Analog Tools

During the course of the project, the design process was predominantly carried out using digital tools, while the use of sketches, hand drawings, and physical models was minimal. One contributing factor was the absence of a permanent grouproom, which made it difficult to store and work with physical materials such as drawings and context models. As a result, much of the early-phase work took place in temporary and less suitable environments, which further limited opportunities for analog experimentation.

Although these logistical challenges influenced the process, greater effort could have been made to incorporate physical media through alternative strategies. The lack of analog methods may have constrained the tactile and spatial exploration of form and context, which physical sketches and models often support. This highlights the importance of actively integrating both digital and analog approaches in future projects, regardless of practical limitations.

Lack of user involvement

The lack of involvement of the stakeholders, particular those living in co-housing communities, represents a missed opportunity in the design process. Conducting interviews with them could have provided valuable insights into specific needs, preferences, and everyday routines. This input might have significantly influenced both the spatial organisation and the architectural expression of the houses. Furthermore, it could have strengthened the focus on the co-housing aspect, which remained underdeveloped. In the absence of this user-centred perspective, several design decisions were based on general assumptions and established practice rather than being tailored to the unique characteristics of the intended user group.

Some of the design decisions in this project were based on how spaces were experienced through VR. However, only the project authors have evaluated the design in VR, which limits the validity of the feedback. Involving additional participants could have provided an objective assessment and helped determine whether the theoretical framework applied in the project translated effectively into spatial experiences. Designers has a tendency to be inherently biased, as their understanding of the underlying theoretical concepts likely influence their perception of the spaces.

Energy Calculations

Although the final proposal for House 1 complies with the BR18 requirements regarding total energy demand, several aspects of the building's energy performance could have been further optimized. In particular, the heating demand and transmission heat loss were relatively high for a newly constructed building. Greater focus on energy optimization during the design process could have contributed to reducing these values. Quick tests and calculations indicate that decreasing the windows within the courtyard would lower both heating demand and transmission losses. However, these strategies were not fully investigated or integrated into the final design, representing an area with clear potential for improvement.

Impact of Energy Requirements on Design

As the energy calculations progressed, it became necessary to implement significant alterations to the design of the house. To meet the required energy performance, particularly in terms of thermal capacity and insulation at the foundation level, the original design featuring a suspended timber ground floor was replaced with a traditional concrete slab. This change conflicted with one of the project's design criteria, namely that "the architecture should follow the sloped terrain to retain the site's character." The decision illustrates the tension between architectural intent and technical performance requirements, and highlights the challenges of designing a housing unit that fits throughout the entire site despite a complex topography.

Imbalance Between Interior and Exterior Focus

Throughout the design process, considerable emphasis was placed on the interior spatial experience of the housing units. While this focus contributed to a refined and well-considered indoor environment, it came at the expense of the exterior expression and the placement of the buildings within the site. The original intention was to design the house from the inside out; however, this approach resulted in an exterior that appears underdeveloped and somewhat lacking in identity. A more balanced consideration of both interior and exterior elements could have led to a more coherent and complete architectural expression.

Moreover, this interior-oriented focus led to a limited exploration of the project's urban and contextual dimensions. The siting of the co-housing units, as well as their relationship to one another and to the sloped terrain, was not sufficiently investigated or resolved. This lack of contextual integration has contributed to a design that, despite its internal strengths, lacks a distinctive connection to place and community.

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Appendix

THESIS TITLE PAGE

This form must be submitted for all theses written in programs under the Study Board of Architecture and Design, and it should be placed at the beginning of the appendix section of the assignment.

A printed copy of the form must be submitted along with the printed copy of the thesis.

The information given in this form must also be available in PURE.

(All fields must be filled out)

Program: **Architecture** ☐	**Industrial Design** ☐	**Urban Design** ☐
This thesis was written by (full name):		
Title of the thesis:		
Supervisor´s name:		
Submission date/year:		
Is the project confidential?	**Yes** ☐	**No** ☐
External collaboration*	**Yes** ☐	**No** ☐
External collaboration partner (name of company/organization):		
Contact at external collaboration partner (title, name og email):		

Appendix A - Room programme

Hovedhus	150	Optimized	m2	Forbindelse	Beskrivelse
Opholdsstue	30	25		Direkte til spisestue	Et sted hvor man kan opholde og samles som familie. Fungerer som husets hjerte.
spisestue	20	26		Direkte til køkken og opholdsstue og WC	Sammenhængende med køkkenet, hvor der er nem adgang og familien kan samles til måltiderne
badeværelse	15	10.4		I nær forbindelse til soveværelse og børneværelser	Det private toilet/bad forbeholdt familien.
WC	12	4		Direkte til spisestue, nær forbindelse til opholdsstue	Toilet der tilbydes til gæster og andre besøgende
køkken	10	7.2		Direkte til spisestue og bryggers	Praktisk indretning hvor der er plads til køle-/fryseskab, ovn og vask. Rummet flyder sammen med spisestuen.
entre	4	4		Direkte til bryggers	En forbindelse til fordøren med plads til et par jakker og sko og byde sine gæster indenfor.
bryggers	15	6		Direkter til køkken og entre	Plads til kummefryser og vasketårn. Et sted hvor det våde og beskitte tøj kan smides og hjemmets opbevarings rum
soveværelse	20	16		Nær forbindelse til wc+bad	plads til en stor seng med tilgang på begge sider og et stor tøjskab.
børne værelse 1	12	12		Nær forbindelse til wc	barnets ejet soveværelse hvor han/hun har plads til at indrette det efter deres ønsker og behov. Et sted til fordybelse af lektier
børne værelse 2	12	12		Nær forbindelse til wc	
Hovedhus ialt	150	122.6	m2		

Anneks	60	Optimized	m2	Forbindelse	Beskrivelse
Opholdsstue	16	14		Direkte til spisestue	Mindre intim stue hvor to personer komfortabelt kan opholde sig
spisestue	10	8		Direkte til køkken og opholdsstue og WC	Lille og praktisk spisestue der flyder sammen med køkkenet
badeværelse	8	8		Direkte til soveværelse og spisestue	husets eneste badeværelse så det vil blive opretholdet mere da det også er til gæster
køkken	8	5.7		Direkte til spisestue og entré	Praktisk lille køkken der flyder sammen med spisestuen og skaber et større rum hvor måltiderne kan nydes
entre	4	4		Direkte til køkken	En forbindelse til fordøren med plads til et par jakker og sko og byde sine gæster indenfor.
soveværelse	14	14		Direkte til badeværelse og opholdstuen	plads til en stor seng med tilgang på begge sider og et stor tøjskab.
Anneks ialt	60	53.7	m2		

Fælleshus	250	Optimized	m2	Forbindelse	Beskrivelse
spisesal	120			Direkte til børnezone, køkken og garderobe, nær forbindelse til WC'er	Hyggeligt samlingspunkt for beboerne. Stort åbent rum hvor der er plads til alle beboerne fra klynger inklusiv børn.
køkken+depot	20		15+5	Direkte til spisesal	Stort fælles køkken der kan bruges til at tilberede og anrette maden til alle tilstedeværende. Depotet skal bruges til fælles opbevaring af delte fødevarer og lignende.

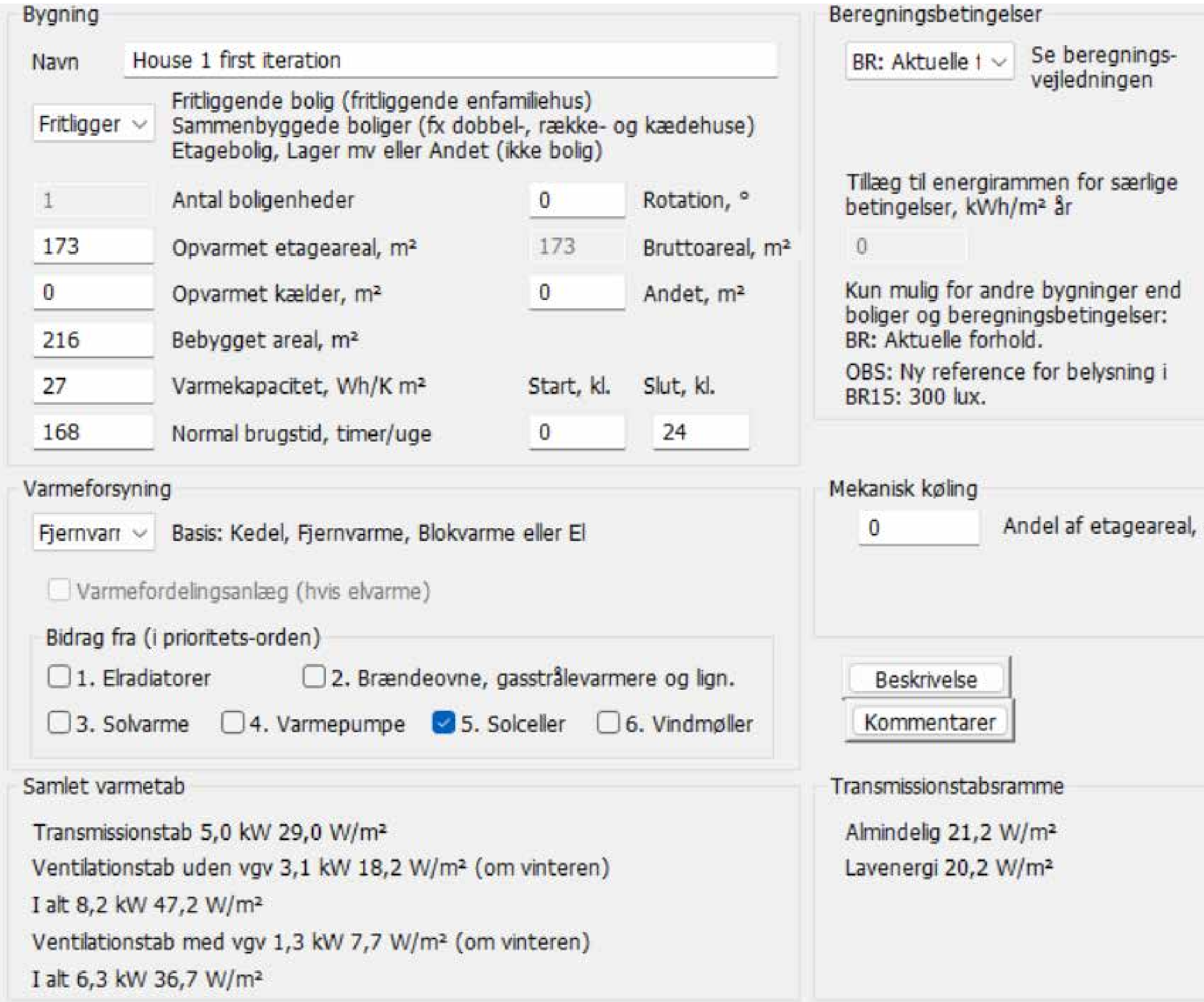
Belysning (Naturligt/Kunstig)	Lux	Rumhøjde	Stemning/Atmosfære	Oplevelse	Ventilation (Naturlig/Mekanisk)
Naturlig	200		hyggelig/rumlig/varm		Naturlig
Naturlig	200		hjemlig/praktisk		Naturlig
Kunstig	300		praktisk/behageligt		Mekanisk
Kunstig	300		praktisk		Naturlig
Naturlig/Kunstig	500		praktisk		Naturlig
Naturlig	200		velkommende		Naturlig
Naturlig/Kunstig	500		praktisk		Mekanisk
Naturlig/Kunstig	200		beroligende		Naturlig
Naturlig/Kunstig	200		beroligende/forbybelse		Naturlig
Naturlig/Kunstig	200		beroligende/forbybelse		Naturlig

Belysning (Naturligt/Kunstig)	Lux	Rumhøjde	Stemning/Atmosfære	Oplevelse	Ventilation (Naturlig/Mekanisk)
Naturlig	200		hyggelig/rumlig/varm		Naturlig
Naturlig	200		hjemlig/praktisk		Naturlig
Kunstig	300		praktisk/behageligt		Mekanisk
Naturlig/Kunstig	500		praktisk		Naturlig
Naturlig	200		velkommende		Naturlig
Naturlig/Kunstig	200		beroligende		Naturlig

Belysning (Naturligt/Kunstig)	Lux	Rumhøjde	Stemning/Atmosfære	Oplevelse	Ventilation (Naturlig/Mekanisk)
Naturlig/Kunstig	300		hyggelig/rumlig/varm		Naturlig
Naturlig/Kunstig	500		praktisk		Mekanisk

Appendix B - Be18 calculations process

First iteration, transmission loss



First iteration, heating demands

	MWh	Januar	Februar	Marts	April	Maj	Juni	Juli	August	September	Oktober	November	December	I alt
	Varmebehov													
1	Trans.- og vent.tab	3,12	2,86	3,35	2,02	1,37	0,90	0,38	0,34	0,85	1,65	2,60	3,12	22,56
2	Vent. VF (total)	0,10	0,09	0,11	0,03	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,10	0,50
3	Vent. VGV nedreg.	0,00	0,00	0,00	0,00	-0,02	-0,04	-0,08	-0,08	-0,05	0,00	0,00	0,00	-0,27
4	Varmetab	3,03	2,76	3,24	1,99	1,39	0,95	0,44	0,43	0,90	1,65	2,53	3,03	22,33
5	Solindfald	0,36	0,69	1,42	1,90	2,14	1,97	2,16	2,03	1,65	1,13	0,47	0,29	16,20
6	Internt tilskud	0,64	0,58	0,64	0,62	0,64	0,62	0,64	0,64	0,62	0,64	0,62	0,64	7,58
7	Fra rør og VVB konst	0,09	0,08	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	1,06
8	Samlet tilskud	1,10	1,36	2,16	2,61	2,87	2,68	2,89	2,76	2,36	1,86	1,18	1,02	24,82
9	Rel. tilskud -	0,36	0,49	0,67	1,31	2,06	2,83	6,55	6,43	2,62	1,13	0,47	0,34	
10	Del af rumopv	1,00	1,00	1,00	0,63	0,00	0,00	0,00	0,00	0,00	0,66	1,00	1,00	
11	Variabl. varmetisk.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	Tot. tilskud	1,10	1,36	2,16	2,61	2,87	2,68	2,89	2,76	2,36	1,86	1,18	1,02	24,82
13	Rel. tilskud -	0,36	0,49	0,67	1,31	2,06	2,83	6,55	6,43	2,62	1,13	0,47	0,34	
14	Udnyt. faktor	0,94	0,90	0,84	0,61	0,44	0,33	0,15	0,15	0,36	0,67	0,91	0,95	
15	Varmebehov	1,99	1,54	1,44	0,26	0,00	0,00	0,00	0,00	0,00	0,29	1,46	2,05	9,02
16	Vent. VF (centralvarme)	0,10	0,09	0,11	0,03	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,10	0,50
17	I alt	2,09	1,63	1,55	0,28	0,00	0,00	0,00	0,00	0,00	0,29	1,53	2,15	9,53

First iteration, key numbers

Nøgletal, kWh/m² år

Renoveringsklasse 2

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
82,7	0,0	82,7
Samlet energibehov		51,6

Renoveringsklasse 1

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
62,0	0,0	62,0
Samlet energibehov		51,6

Energiramme BR 2018

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
35,8	0,0	35,8
Samlet energibehov		51,6

Energiramme lavenergi

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
27,0	0,0	27,0
Samlet energibehov		51,6

Bidrag til energibehovet

Varme	61,1
El til bygningsdrift	-5,9
Overtemp. i rum	10,9

Netto behov

Rumopvarmning	55,1
Varmt brugsvand	15,1
Køling	0,0

Udvalgte elbehov

Belysning	0,0
Opvarmning af rum	0,0
Opvarmning af vbv	4,6
Varmepumpe	0,0
Ventilatorer	2,4
Pumper	0,0
Køling	0,0
Totalt elforbrug	37,9

Varmetab fra installationer

Rumopvarmning	6,1
Varmt brugsvand	2,0

Ydelse fra særlige kilder

Solvarme	0,0
Varmepumpe	0,0
Solceller	14,4
Vindmøller	0,0

Final proposal, transmission loss

Bygning

Navn: house 1 final proposal

Fritligger

- Fritliggende bolig (fritliggende enfamiliehus)
- Sammenbyggede boliger (fx dobbel-, række- og kædehuse)
- Etagebolig, Lager mv eller Andet (ikke bolig)

1	Antal boligenheder	0	Rotation, °
176	Opvarmet etageareal, m²	176	Bruttoareal, m²
0	Opvarmet kælder, m²	0	Andet, m²
216	Bebygget areal, m²		
33	Varmekapacitet, Wh/K m²	Start, kl.	Slut, kl.
168	Normal brugstid, timer/uge	0	24

Beregningsbetingelser

BR: Aktuelle f — Se beregnings-vejledningen

Tillæg til energirammen for særlige betingelser, kWh/m² år: 0

Kun mulig for andre bygninger end boliger og beregningsbetingelser: BR: Aktuelle forhold.

OBS: Ny reference for belysning i BR15: 300 lux.

Varmeforsyning

Fjernvarr — Basis: Kedel, Fjernvarme, Blokvarme eller El

[ ] Varmefordelingsanlæg (hvis elvarme)

Bidrag fra (i prioritets-orden)

[ ] 1. Elradiatorer [ ] 2. Brændeovne, gasstrålevarmere og lign.

[ ] 3. Solvarme [ ] 4. Varmepumpe [x] 5. Solceller [ ] 6. Vindmøller

Mekanisk køling

0 — Andel af etageareal, -

Beskrivelse

Kommentarer

Samlet varmetab

Transmissionstab 4,5 kW 25,8 W/m²

Ventilationstab uden vgv 3,1 kW 17,8 W/m² (om vinteren)

I alt 7,7 kW 43,6 W/m²

Ventilationstab med vgv 1,1 kW 6,3 W/m² (om vinteren)

I alt 5,7 kW 32,1 W/m²

Transmissionstabsramme

Almindelig 21,1 W/m²

Lavenergi 20,1 W/m²

Final proposal, heating demands

	MWh	Januar	Februar	Marts	April	Maj	Juni	Juli	August	September	Oktober	November	December	I alt
	Varmebehov													
+1	Trans.- og vent.tab	2.61	2.39	2.80	1.69	1.15	0.76	0.30	0.29	0.71	1.38	2.18	2.61	18.87
2	Vent. VF (total)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Vent. VGV nedreg.	-0.00	-0.00	0.00	-0.04	-0.06	-0.07	-0.09	-0.09	-0.07	-0.05	-0.02	-0.00	-0.51
4	Varmetab	2.62	2.39	2.80	1.72	1.21	0.83	0.39	0.38	0.79	1.43	2.19	2.62	19.38
5	Solindfald	0.18	0.36	0.80	1.09	1.26	1.18	1.29	1.17	0.93	0.59	0.23	0.15	9.23
6	Internt tilskud	0.65	0.59	0.65	0.63	0.65	0.63	0.65	0.65	0.63	0.65	0.63	0.65	7.71
7	Fra rør og VVB konst.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	Samlet tilskud	0.84	0.95	1.45	1.72	1.91	1.81	1.95	1.82	1.56	1.25	0.87	0.80	16.94
9	Rel. tilskud, -	0.32	0.40	0.52	1.00	1.58	2.19	4.95	4.79	1.98	0.87	0.40	0.31	
10	Del af rumopv.	1.00	1.00	1.00	1.00	0.05	0.00	0.00	0.00	0.00	0.90	1.00	1.00	
11	Variabl. varmetilsk.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Tot. tilskud	0.84	0.95	1.45	1.72	1.91	1.81	1.95	1.82	1.56	1.25	0.87	0.80	16.94
13	Rel. tilskud, -	0.32	0.40	0.52	1.00	1.58	2.19	4.95	4.79	1.98	0.87	0.40	0.31	
14	Udnyt. faktor	0.98	0.97	0.93	0.76	0.57	0.43	0.20	0.21	0.47	0.81	0.97	0.98	
15	Varmebehov	1.80	1.47	1.44	0.42	0.01	0.00	0.00	0.00	0.00	0.38	1.36	1.83	8.70
16	Vent. VF (centralvarme)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	I alt	1.80	1.47	1.45	0.42	0.01	0.00	0.00	0.00	0.00	0.38	1.36	1.83	8.71

Final proposal, key numbers

Nøgletal, kWh/m² år

Renoveringsklasse 2

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
82,5	0,0	82,5
Samlet energibehov		30,1

Renoveringsklasse 1

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
61,9	0,0	61,9
Samlet energibehov		30,1

Energiramme BR 2018

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
35,7	0,0	35,7
Samlet energibehov		30,1

Energiramme lavenergi

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
27,0	0,0	27,0
Samlet energibehov		30,1

Bidrag til energibehovet

Varme	49,5
El til bygningsdrift	-6,3
Overtemp. i rum	0,0

Netto behov

Rumopvarmning	49,5
Varmt brugsvand	15,0
Køling	0,0

Udvalgte elbehov

Belysning	0,0
Opvarmning af rum	0,0
Opvarmning af vbv	4,5
Varmepumpe	0,0
Ventilatorer	2,3
Pumper	0,0
Køling	0,0
Totalt elforbrug	37,5

Varmetab fra installationer

Rumopvarmning	0,0
Varmt brugsvand	1,9

Ydelse fra særlige kilder

Solvarme	0,0
Varmepumpe	0,0
Solceller	13,5
Vindmøller	0,0