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Envelopes and exteriority

Local specificity and extended exterior as design criteria for architectural envelopes

Abstract
This article discusses the relationship of architecture to its surrounding environment. The objective of the article is i) to reposition the relationship of architecture and its surrounding exterior by expanding the understanding of architectural envelopes, and ii) to systematically define exterior space as design input. The notion of the envelope encompasses a spatial recognition defined by interactions between interior and exterior environments that affects an inhabitant's experience of architectural space. This research is organised in three sections: a) a literature review to systematically examine the terminologies of this research, b) selected case studies that consider exteriority as a design criterion, and c) research through design inquiry to combine a systematic approach with design thinking. The study applies both conceptual and method-oriented approaches to develop an integrated design approach focused on the climatic and atmospheric performances of architectural envelopes.

Keywords*:* Architectural envelopes, performance-oriented design, extended setting, extended threshold, in-between spaces

Introduction

This article examines the relationship between built forms and their surrounding environment with the aim of developing an integrative design approach to locally specific architectural envelopes through an extended threshold between the interior and the exterior. This is systematically approached using a number of case and design studies. Conceptual approaches are extracted from the case study diagrams that can act as a design guideline. The diagrammatic guideline constitutes generalised principles from locally specific designs. However, the intention is not to derive universal design principles that can be applied at any location. Instead, the goal is to derive principles that need to be re-contextualised and adapted to the specific settings they are positioned at. Therefore, these principles cannot be applied irrespective of the specific exterior environment of architecture.

A significant driver today in the disconnect between architecture and its settings in the industrialised parts of the world results from an exclusive focus on energy efficiency and modulated interior climates, which

> …tend to create an overall drive towards optimization, that is, towards the reduction of building to the maximizing of economic criteria and to the adoption of normative plans and construction methods reducing architecture to the provision of an aesthetic skin – the packaging, in fact, of nothing more than a large commodity in order to facilitate its marketing.
>
> (Frampton, 2007, p. 376).

In contemporary architectural practices there exist a great variety of approaches to designing the relationship between architecture and its setting. These include, among others, a continuation of vernacular architecture in various parts of the world that continue building structures such as courtyard houses; various forms of regionalist approaches that are – to a

lesser or greater extent – informed by vernacular examples; as well as contemporary designs that propose the addition of new technologies and solutions. In parallel, there exists a common trend that emphasises a separation of architecture from its setting by way of increasingly generic architecture and lack of consideration of local specificity. The architecture of the latter mainly results in a singularity of the architectural form that is ignorant of its context. Although varied in intentions and approaches, the resulting architecture of this type is designed to separate and be separated, resulting in "provisions of an aesthetic skin" (2007, p. 376). or operative boundaries of insulation that lead to blank envelopes (Moussavi, 2005). Rem Koolhaas's essay on *Bigness* (Koolhaas & Mau, 1995, pp. 494–517) is a primary example of affirmation of what might be termed the object-orientation of architecture. Koolhaas does so by positioning architecture as an object independent and often wilfully ignorant of its surrounding urban context, and as a creator of an emerging context through size and individuality. Contemporary urban fabrics increasingly adhere to Koolhaas's concept of Bigness with a distinct idiosyncratic diversity of unrelated architectural objects and their deliberate disconnect from context. The provocation of "fuck context" posits that Bigness, through its very independence of context, survives by "not [taking] inspiration from givens too often squeezed for the last drop of meaning". Instead, it finds its independence by "its own raison d'être" (1995, p. 515).

This article is a continuation of an ongoing research that is focused on developing an alternative notion of the architectural envelope (Saeidi Derakhshi, 2017) as a critique of the common practice of building skins or façades that represent a strict boundary condition. One cannot sensibly deny that the built form impacts its surroundings and interacts with them, thus "presenting itself as though [they] were coextensive" (Leatherbarrow, 2009, p. 39). This investigation aims to reposition the performance of architectural envelopes within the scope of local specificity and architectural experience. This is to examine the role of surrounding local conditions as an integrated criterion in designing envelopes with the purpose of creating atmospheric experiences. The investigation redefines the notion of architectural envelopes, focusing on spatial organisation as the factor for creating an extended threshold that is habitable, and with features of the exterior environment as its key design criteria (Figure 1).

The question that arises is how to define a performance-oriented approach in which the material and spatial constituents of the architectural envelope condition and are conditioned by the exterior environment. The notion of *performative envelopes* refers to envelopes that accommodate experiential effects through their constructs, allowing for interactions between architecture and its surroundings. To meet this objective, the investigations are pursued through two types of studies: case studies that focus on how specific aspects of exteriority have been designed or addressed in selected architectural projects and design experiments in a workshop conducted by the author in the context of an architectural master-level studio. The workshop aimed to explore methods that enabled assessing various performative and conceptual aims of the design projects. What evolved from these efforts is an attempt to reposition exteriority as a critical design criterion that encompasses the interrelations of architecture with its surrounding environments, generating a spatial extension of both the interior and the exterior. This article uses the term "exteriority" to refer to the exterior space outside an enclosure in its generic sense and "exterior environment" to represent the immediate surroundings of the built form.

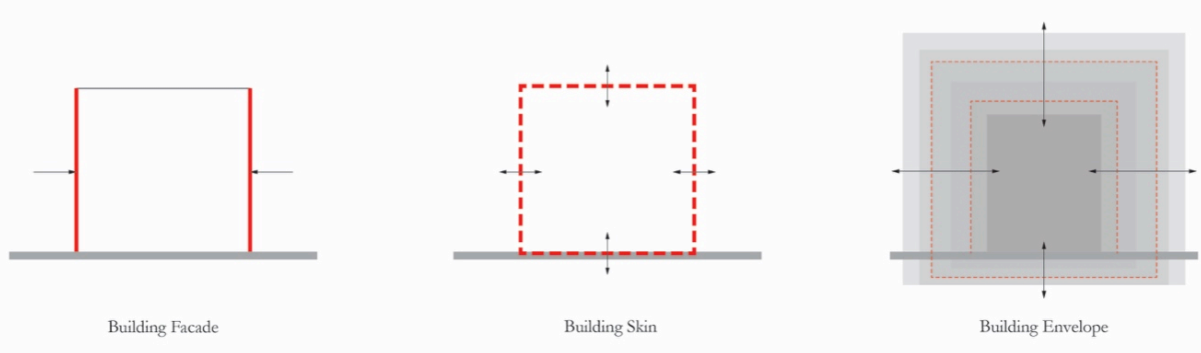

Figure 1. Diagram representation of this research's definition of building façade, building skin, and building envelope – produced by Sareh Saeidi, Spring 2018.

Literature review

The inattentive use of various definitions in the architectural discipline in referring to the outer boundary of the built form often obscures a clear distinction between the notions used and their inherent differences and characteristics. This is the case with the notion of exteriority. Although architectural forms are considered to be both space occupiers as well as space definers (Rowe & Koetter, 1984, p. 79), the discussions of architectural spaces are mainly focused on interior and, sometimes, transitional spaces. Although varying in approaches and focuses, this is apparent in the discourse of many modern and contemporary theorists and architects who discuss architecture mainly in terms of interior spaces, giving less attention to the exterior beyond the exterior expression. Le Corbusier refers to the exterior as a result of the interior, considering the process of architectural design as a plan that proceeds from the inside out (Corbusier, 2007, p. 216). In explaining his viewpoint, he refers to the similarity of a building to a soap bubble that is "perfect and harmonious if the air is evenly distributed and properly ordered from the inside" (2007, p. 216). The primacy of the interior thus overshadows both the role of the exterior in creating effects and conditions for the interior, as well as its potential in accommodating the spatial extension to the interior spaces. There are also other modern architects and theorists who attempt to establish a spatial realisation of architecture, defining it beyond the boundary of the outer wall. Two examples of these design approaches are "breaking the box" by Frank Lloyd Wright (Wright, 2010) and the approaches of Loos (Risselada, 2008) and Mies van der Rohe (Frampton, 2001), who pursued spatial continuity. Concepts such as "breaking the box", which opened up the corners of the intersecting walls to allow the interior to merge with its ambient surroundings, employ walls as means of spatial extension. As a result, architectural design provides a milieu for the built space that is "not only the building's immediate vicinity, but also the greater region surrounding the site" – an extended topography (Leatherbarrow, 2009, p. 145 on Frank Lloyd Wright's projects). Leatherbarrow uses the term *extended topography* to discusses *Raumplan* as an approach utilised for designing interior settings, but also in regard to the exterior. He analyses Adolf Loos's projects to expound on *Raumplan* as a mode of interpreting the relationship and connections between the building's interior and exterior, and enclosed and open spaces, as complementary in creating a unified whole. In his view, no room or collection of rooms in this unified whole is seen "in itself" but is understood or conceived with in respect to one another (Leatherbarrow, 2009, pp. 152–157). Some discourses have taken this discussion further by raising the point that architecture needs to "have an interactive relationship with nature" (Frampton, 2007, p. 383). Nature here doesn't only represent "the topography and site, but also climate and light […] to which built form is necessarily susceptible to a degree" (2007, p. 383). It can be argued that here architecture becomes more than the sum of its parts by incorporating the given context through creating a spatial extension of both its interior and exterior environments. Using Leatherbarrow's

extended topography as inspiration, this research uses the term *extended settings* to refer to design strategies through which the vicinity of the building exterior serves as a complementary extension of the interior spaces, as well as a space that demands attention in its own right.

This research distinguishes between three main approaches in creating an extended setting, based on how the emphasis on the relationship between the interior and the exterior is articulated. These approaches are: 1) *Inside-out*, 2) *Outside-in*, and 3) *Inside-outside* (Figure 2). The *Inside-out* approach emphasises the visual connection between interior and exterior environments, realising the architectural qualities of this relation by emphasising the focus from the interior to the exterior. This approach invariably seems to lead to object orientation of the built form. Similarly, the *Outside-in* approach tends to make the interior space subservient to criteria pertaining to the exterior. Common examples of this approach are semi-open structures that serve as sheltered spaces providing a temporary stay in architectural landscape projects. The *Inside-outside* approach, which underpins this research, emphasises built forms that shape their spatial qualities through the ways in which they meet, incorporate, and interact with circumstances of their local context as one integrated system negotiated by an extended threshold: the architecture envelope.

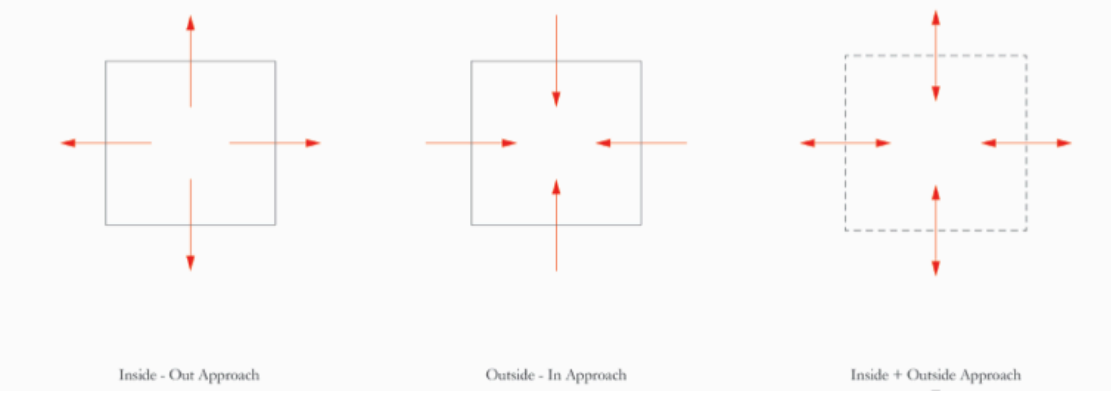

Figure 2. Diagram representation of prevailing approaches in creating an extended setting for the built form – produced by Sareh Saeidi, Spring 2018.

Architecture is “the spatial semblance of a world made visible” (Langer, 1953, pp. 97–98) in a field of invisible forces "that “give[s] shape and rhythm to everyday life of the body” (Kwinter, 2002, p. 14). When considered this way, architecture can be seen as a system of forces, on the one hand, pertaining to

> …‘micro-architectures’ [that consist of] those relations smaller than the object that saturates it and composes it, [and on the other,] those relations or systems that are greater or more extensive than the object, that comprehend or envelope it, the ‘macro-architecture’.
>
> (Kwinter, 2002, p. 14).

If we take this notion of correlated micro and macroscales a step further and define a scale in-between the two, that represents the relations between a selected number of microarchitectures, we could define a mesoscale. This is the scale through which we can discuss the role of architectural envelopes and their relationship with the exterior environment. As part of the mesoscale discussions in architecture, the following paragraphs seek to clarify the notions of milieu, environment, context, and local specificity as the commonly used notions in the discussions of the architectural context or environment.

Architecture consists of elements that affect and are affected by the environment in which it exists. It is therefore essential to first discuss what the definition of environment

entails. A term that is commonly used in various disciplines to refer to the surrounding environment of a subject is *milieu*. Historically imported from mechanics to biology in the 18th century, the notion of milieu has been used across other disciplines as well, including philosophy and physics (Canguilhem, 1980, pp. 1–17). In Canguilhem's view, "the environment [*Umgebung*] is precisely nothing more than a [hu]man's Umwelt", centred on and oriented by human perspectives and pragmatic experiences, which are relative to a living animal (1980, p. 11). Uexküll (1980) classified various realms within this notion of milieu by distinguishing between the environment of behaviour specific to an organism (*Umwelt*), the ordinary geographical environment (*Umgebung*), and the universe of science (*Welt*) (1980, p. 11). The concept of milieu today mostly refers to an "aggregate of influences or conditions which shape or determine the being, development, life, or behavior of a person or a thing" (Spitzer, 1942). This concept is associated with the theories of French philosopher Auguste Comte (1798–1857) and French critic and historian Hippolyte Taine (1828–1893).

An essential aspect of the physical environment is climate. One of the basic tasks of architecture is to provide climatically attuned living spaces. The word climate is "derived from the ancient Greek verb klínein [meaning] "to incline" [which] describes the tilt of the Earth's axis" (Hausladen & Liedl, 2012, p. 12). However, the term "climate" covers a wide range of life, as do many terms in Greek. One definition of the term is "the environment that conditions, ether, space, place – and the ocean embracing the earth" (Spitzer, 1942, p. 11). Another refers to a rather general term "as a protecting, embracing or encompassing thing" (1942, p. 11). In its more common use in contemporary culture, climate, as opposed to weather, refers to the "state of the Earth's atmosphere as established by statistics, over a period of time […] relevant to a location, a region or the whole Earth" (Hausladen & Liedl, 2012, p. 12). Climate is commonly classified in three scales: macroclimate, mesoclimate, and microclimate.

The architecture of closed-systems and steady-state design approaches "tend[s] to be deprived of its inherently mediatory capacity" such as natural ventilation, shading, utilisation of diurnal and seasonal use of space (Frampton, 2007, p. 384). The preoccupation with a building's energy consumption includes excessively relying on benchmarks with little or no discussion of adequate equivalent alternatives. An underestimated design aspect is the fact that "architecture […] has the potential to consciously modify natural microclimates" (Garcia-German, 2017, p. 172) and biological environments. Traditions in vernacular architecture that were adapted to their local conditions, climates, and cultures to temper both indoor and outdoor environments are usually overshadowed in today's architectural practices, while the dependency of buildings on mechanical add-ons has increased. Many of the buildings today are built using "imported abstracted knowledge insensitive to ethnic requirements and oblivious to the subtle wisdom gained by an intimate experience of the local nature and microclimate and architecture's potential for adaptation" (O'Cofaigh, Olley, & Lewis, 1996, p. 2). An effective built form within this definition "exists in the midst of an evolutionary process and is embedded in systems of all kinds, yet has choices and creative ranges about how to deploy itself" (O'Donnell, 2015, p. xvi) or can adapt to unpredictable changes and create atmospheres accordingly. A locally specific form is one that integrates and interacts with its surrounding environment in a unified way while sustaining specific microenvironments.

This research uses the notion of context to refer to the existing surrounding environment of the built form, including conditioned and natural circumstances which the architectural form responds to and interacts with and in which it exists. Context thus distinguishes itself from milieu by regarding not only the physical surrounding environment of the built form, resulting from various interactions and interdependencies, but also aspects of its perception. The definitions of environmental contexts, in their broad sense, have frequently been used to refer to aspects of sustainability and energy efficiency in the past five decades, disregarding the sensory and experiential aspects of the built space. However, before being overloaded with today's environmental and ethical responsibilities, they were focused around aspects of

increasing comfort and creating aesthetic and sensory effects in the immediate experience of architecture (Hardy, Martin, & Poletto, 2008, p. 14).

Of the most notable discussions around spatial moods and atmospheres in the architectural discipline is perhaps what Norberg-Schulz called "the spirit of place" (Norberg-Schulz, 1979) and its role in understanding architecture – a topic that was later picked up and extensively discussed by other contemporary architects. The spirit of place refers to *Genuis loci,* derived from a Roman concept that denotes what a thing is and what it "wants to be" (Kahn [1969] 2013); this defines "a living reality" – although Norberg-Shulz does not name it as such – in a given context (1979, pp. 18–23). However, this description of the spirit of place does not necessarily provide a clear definition of atmosphere and is rather abstract, perhaps intentionally, to make room for individual interpretations of the notion. On the other hand, although more pragmatic and less formally theorised, approaches such as those of Peter Zumthor or Renzo Piano, which define atmosphere through intuitive feelings and practiced-based experiences, are widely recognised as "atmospheric architecture" (Leatherbarrow, 2009, pp. 609–694; C. Borch, 2010, p. 8). Atmospheric architecture could be exemplified by projects such as Sverre Fehn's Storhammarloven or works by Zumthor, Gunnar Asplund, and Sigurd Lewerentz that create a specific architectural experience through their spatial qualities.

In defining architectural quality, Zumthor refers to the state that occurs when a building "moves" him – that is, the feeling it gives him (Zumthor, 2006, p. 11). Atmosphere is the mood of a space that produces a specific feeling in the person who experiences it. It is strongly related to a bodily engagement and to subjective perception. Thus, the atmosphere is perceived through one's emotional sensibility – "a form of perception that works incredibly quickly" (2006, p. 13). According to Böhme, "The notion of atmosphere always concerns a spatial sense of ambience" (Böhme, 2014, p. 43). It is not a singular moment of perception but rather a sustained presence in a situation – a continuum (Pallasmaa, 2014, p. 20). An essential aspect of atmosphere, according to Pallasmaa, is that "it is an immediate experience of the whole, the entity, and only later can one distinguish the details that are part of it" (Pallasmaa, 2014, p. 37). Therefore, the experience of atmospheric quality in architecture is by definition an embodied experience. Conversely, it is something of "the prototypical 'between' phenomenon" (Böhme, 2014, p. 43) that initially arises from the atmosphere – the materials and details of the built space – but is eventually experienced and felt through the individuality and perception of its occupant. Pallasmaa believes that atmospheres are emotionally experienced before being intellectually experienced, and this emotional architectural encounter is a multisensory perception that includes various senses as well as bodily memory (Pallasmaa, 2012). Through his built works, Zumthor shows that the perception of atmosphere is not confined to architectural interiors, but also how architecture and its surrounding environment integrate to form a certain atmosphere (Zumthor, 2006). Included in this discussion is the classical tradition in architectural practice of site visits, through which the architect tries to get a sense of the place. This provides a bodily experience through which he or she gains an understanding of how to position the project in relation to the existing circumstances that even today are an essential part of the design process. This given, or existing, surrounding is in itself a design material, something that the architect works with to capture a specific mood or a desired atmosphere.

The notion of atmosphere in the scope of this research engages with aspects of envelope design that create or intensify the experiences of architectural space by the inhabitant. Therefore, creating atmospheres focuses on *distances* through which the building is experienced and within which a defined environment is governed or conditioned. Leatherbarrow defines three kinds of distances (Figure 3) through which a building is experienced: "the local (even intimate) horizons of enclosure, the ambient surround of the building's immediate vicinity, and the distant reaches of its extended topography" (2009, p. 215). These definitions are employed in design studies and experiments of this research to reflect on the role of architectural envelopes in affecting and shaping not only the interactions

between architecture and its context, but also the experience of the environments and atmospheres of both.

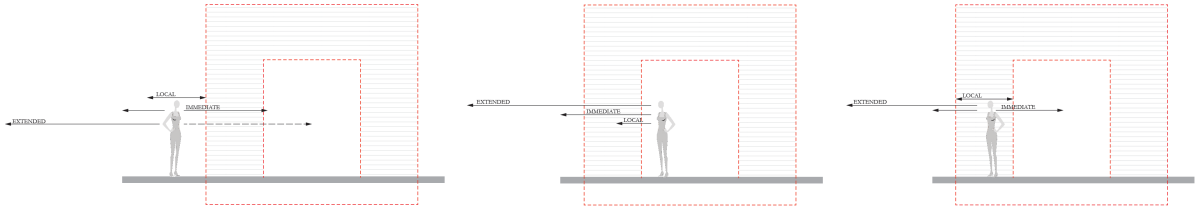

Figure 3. Diagram representation of distances through which a building is experienced based on David Leatherborrow's definition (2009) – produced by Sareh Saeidi, Spring 2018.

The two following sections discuss conceptual and methodological approaches through which the aforementioned scopes are addressed and analysed. The investigation first aims to define ranges of mutual effects and dependencies between interior and exterior environments by way of analysing historical and contemporary case studies. The chosen projects address the design of non-discrete envelopes, focusing on factors of local specificity and atmospheric performance. Non-discrete envelopes (see Hensel, 2013, pp. 31–44) identify built forms that are embedded in their surrounding contexts in such a way that the separation from their surroundings disrupts their architectural means, functions, and character (Saeidi Derakhshi, 2017, p. 16). Architecture's character here refers to the identity of the built form in relation to its local culture, materials, and construction techniques. Second, the studies aim to develop a method through which site-specific datasets and information are translated into knowledge for an informed design process of small-scale design experiments. The experiments were undertaken in master-level student projects in the Research Centre for Architecture and Tectonics (RCAT) and the Advanced Computational Design Laboratory (ACDL) studio at the Oslo School of Architecture and Design (AHO). The studies include identification, collection, application, analysis, and evaluation of context-specific data in correspondence with project-based conceptual approaches that together inform the design process of architectural envelopes.

Case studies

This section explores examples of traditional and contemporary architecture to extract principles that lead to designs which marry exteriority and interiority. The cases encompass integrated design systems that result from the combination of natural and human-made elements or provisioned and un-provisioned design strategies representing the building's flexibility in meeting future changes post-construction. The following paragraphs examine case studies focusing on two main approaches that consider the exterior environment as an integral part of architectural design: climatic and aesthetic. The climatic and functional aspects of the case studies showcase how design specifications create new exteriors in the vicinity of the built form that have an impact on the architectural experience. The outcome of these studies aims to map out conceptual approaches that can inform the development of a working method for the research.

In order to systematically approach and sustain the development of the notion of architectural envelopes, two taxonomies were produced: a) a systematisation of selected conceptual approaches to the notion of envelopes based on review of the literature within the architectural discipline, and b) a taxonomy of envelope types based on an analysis of built projects (Saeidi Derakhshi, 2017). The taxonomy of envelopes attempts to classify the approaches to envelope design by recognising different tendencies towards the emphasis on form versus performance in architectural practice. The analysis distinguishes between three approaches: *discrete* envelopes, *non-discrete* envelopes, and envelopes with a *dual* character.

Non-discrete envelopes are separated into three types: *extended thresholds*, *dissolved thresholds*, and *multiple envelopes*. Extended thresholds have been extensively discussed as transitional spaces that are shaped through multiple, articulated, and animated screens or layers of materials, or thick (wall) structures either through studies of historical cases (Hensel & Sunguroğlu Hensel, 2010a, 2010b, 2010c) or more contemporary examples and discussions (Hensel, 2011; Hensel & Turko, 2015, pp. 38–50 & 178–269). This research's definition of extended thresholds is elaborated in the following paragraph. The notion of dissolved thresholds was inspired by Kengo Kuma's book *Anti-Object,* in which he elaborates on his idea on erasing the architectural object through his works via an approach in which architecture closely integrates, and at times dissolves, into its immediate surroundings (Kuma, 2008). Multiple envelopes represent a design strategy in which envelope layers are arranged and positioned in proximity and in relation to one another to fulfil various design aims, i.e. from providing spatial effects to acting as insulation (Saeidi Derakhshi, 2017, p. 17). Kipnis terms the strategy of "form[ing] a collecting graft, usually by encasing disparate formal and programmatic elements within a neutral, modernist monolith" as *InFormation* (Kipnis, 2004, p. 43). The emerging spaces of this design strategy activate through "visual layering, programmatic innovation, [or] technological effects and events" (2004, p. 43) that define their relation to one another through these in-between spaces. Tschumi refers to the in-between spaces of his work as spatial organisers that, in the case of projects such as Le Fresnoy, have a strong experiential presence and are a "mode of spacing that gives room for the event" (Tschumi et al., 1999, pp. 33–44). These approaches represent a spatial realisation of the building envelope through material organisation, which defines it as an in-between inhabitable space, accommodating various uses of its spaces and atmospheres.

Extended thresholds conceptually represent built forms that provide various climatic and atmospheric conditions through their envelopes' spatial organisation and degrees of enclosure. The notion of extended threshold closely relates to the notion of free-running buildings (de Dear & Brager, 1998) as an integrated design approach that addresses issues of thermal comfort and climatic tolerance through spatial and material organisation. The free-running building method provides a variety of indoor climates due to the joint necessity of non-discrete architectures and the inhabitants' adaptation abilities (Saeidi Derakhshi, 2017, p. 11). Extended threshold is an approach in which the extent of exteriority and its effects on the enclosed lived spaces are more difficult to frame, measure, and analyse. In this approach, the threshold of the building envelope is treated as an extended space, which is either semi-closed or exposed. The envelope becomes a means of creating inhabitable spaces through degrees of shelter. The dissolved threshold is similar to the extended threshold, with the distinguishing difference being that here the definition of enclosure and sheltered space by means of walls is challenged and redefined through the abstraction and removal of wall structures. Among the five projects that are discussed in the following paragraphs, four are extended threshold types and demonstrate two different concepts of constructed exteriors and design provisions. The first two of these case studies are Persian courtyard houses and traditional Japanese houses, in which the constructed exterior environment fulfils the climatic and atmospheric needs of the interior spaces. The other two case examples include two contemporary houses (Lina Bo Bardi's Glass House and John Lautner's Sheats-Goldstein residence) that, through their spatial openness and arrangement, allow for future growth of the surrounding vegetation that co-modulates the microclimate of the built form. The last case study is the Inverted House in Japan. This study characterises the Inverted House as an example of the dissolved threshold. The design approach of the project defines a modulated climatic threshold in which the spaces are mainly exterior, but serve specific activities that are normally placed in fully sheltered interior spaces. The erasure of the exterior wall of the project creates exposed spaces that highlight the limits of a bodily experience by way of nearly full exposure to exterior conditions.

The necessity of architecture corresponding to its local climate has led to well-developed climatic design strategies throughout architectural history, in which "weather shapes

the built environment along with the designer and the inhabitant" (Hill, 2012, p. 3) and "traditional forms […] turn limitations into advantages" (O'Cofaigh et al., 1996, p. 22). Traditional Persian architecture considers the human to be the spirit of the space, and the built space as the body for that soul (Khaghani, 2012) – a body that is carefully adjusted to its local conditions. Iran is divided into four climatic zones, each of which has different architectural typologies and construction principles corresponding to regional weather conditions. Traditional Persian architecture also principally focuses on the strong integration of architecture in its local context, taking into account site conditions, available local materials, climate, and culture. The courtyard houses showcase the most developed design strategies that tame the hostile climate of hot, arid areas by focusing on such principles. Persian courtyard houses are walled-in plots that are surrounded by *Iwans* – the use of which is designed with considerations of the diurnal activities and seasonal changes (2012). Iwan is a vaulted space that is usually closed on three sides and open on one side, accommodating a semi-open inhabitable space adjacent to the enclosed rooms of the house. Iwans could be defined as extensions of open space into the enclosed space that are used, especially during the warm seasons, as autonomous living spaces to prepare for the transition from one condition to another, i.e. from open to closed or light to dark. The courtyard house has an introverted arrangement that is formed by rooms surrounding an inner open quadrilateral yard that integrates spatial, functional, and aesthetical aspects of the house. The most celebrated aspect of the courtyard is its seasonal and climatic design feature, which facilitates the demands of daily life. This seemingly simple form "implicitly [embodies] an intimate knowledge of the locality and its potential for sustainable life" (O'Cofaigh et al., 1996, p. 2). Courtyard houses could be of considerable size, depending on the wealth of the owners, consisting of living spaces, a business chamber, and sections for servants. The biggest inner yard is the private living zone, with smaller ones belonging to servants and the business sections of the house. The lowered courtyard also allows natural light into the basement of the house, which benefits from the ground's thermal capacity to provide a cooler space during the summer and a warmer one during the winter. The ground level rooms are mainly used for daily living activities and receiving guests, while the upper floor consists of smaller rooms that are used as private zones and sleeping areas, positioned in ways to allow the wind to breeze through small windows, which are in many cases covered with sunscreens. Islamic sunscreens or *Mashrabiyah* minimise the effects of intense sunlight and reduce heat while providing fresh air and needed privacy through perforated surfaces. (For further reading on this subject please refer to (Fathy, 1986, pp. 46–49). The inner courtyard of the house is a constructed microclimate and garden, open to the sky, that provides light and fresh air for the living spaces according to seasonal changes and climatic conditions. This microclimatic, conditioned exterior consists of vegetation and water basins that work together as an integrated system to fulfil the comfort needs of the inhabitants of the house. These integrated elements, along with considerations of orientation, avoid undesired climatic factors by blocking excess sunlight and surface reflections through vegetation, redirecting airflow, and evaporative cooling. The vegetation usually consists of deciduous trees that shed their foliage over the course of the seasons, therefore providing favoured seasonal conditions for the living spaces by allowing or blocking sunlight. This characteristic ascribes seasonal patterns of use for the enclosed rooms based on their location and their exposure to the sun and prevailing wind direction in order to capture the summer wind and avoid the undesired wind of the winter (Figure 4).

The spatial organisation of the house is based on increasing degrees of enclosure, starting from the courtyard as the core open space of the house and leading to semi-open Iwan structures that provide a sheltered extended space (Figure 5). The enclosed rooms, being the last of this spatial gradient, are open to Iwans and are provided with openable panels, the number of which varies based on the importance and seasonality of the room. For instance, the room in the summer zone is also usually the gathering space for receiving guests and has five or eight panels that, once open, extend the room into the adjacent Iwan area. The rooms around

the inner yard are interconnected, and the corners of the overall rectangular organisation of the house usually provide the space for service areas such as staircases to upper floor levels. Therefore, the built exterior of the Persian courtyards primarily depends on the aspects of climate and privacy, arranged in four zones around the quadrilateral yard, providing "a conduit for air and light in the midst of the crowded urban fabric while ensuring visual and spatial privacy" (Rabbat, 2010) through its controlled exteriority.

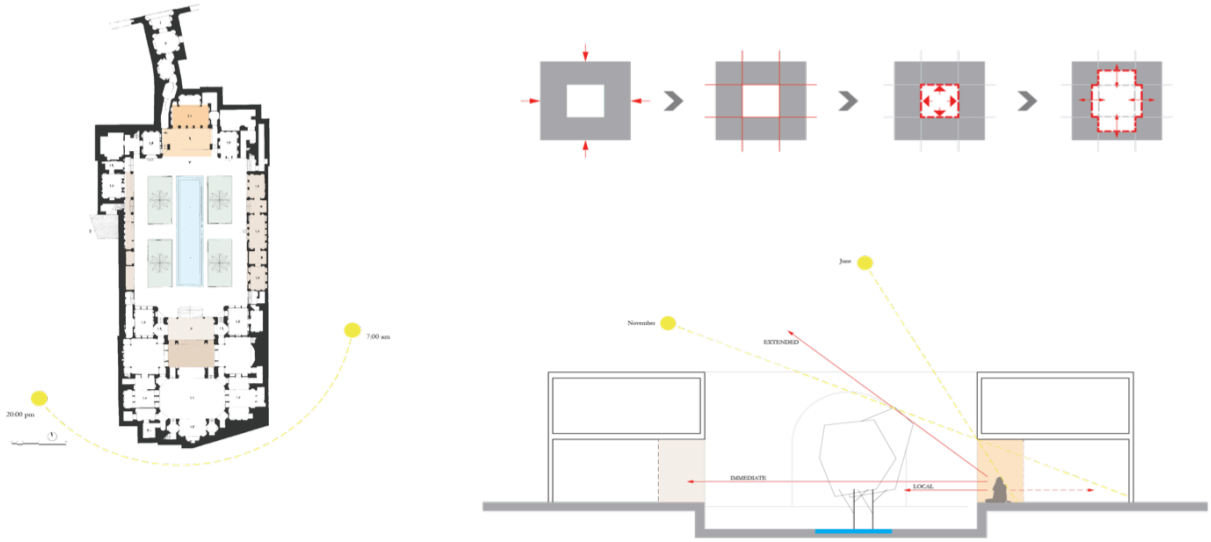

Figure 4. (Right) Plan drawing of Borujerdi's house (built in 1857) in Kashan, Iran. (Right top) The plan organization of traditional courtyard houses of Iran and (Right bottom) diagram representation of the spatial gradience in traditional Persian courtyards – produced by Sareh Saeidi, Spring 2018.

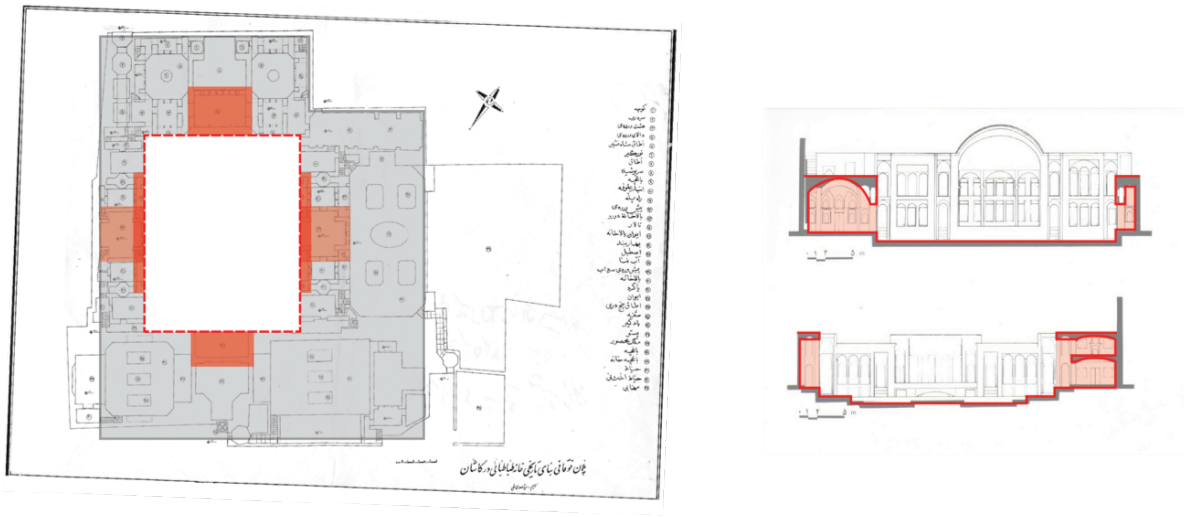

Figure 5. Semi-enclosed Iwans and the lowered courtyard setting at Tabātabāei's house (built in the early 1880s) in Kashan, Iran. The Iwans on the north-south axis in a Persian courtyard house are usually bigger and were used for hosting guests or holding events. These Iwans usually have finer decorations than the east-facing ones.

Similar to the conditioned exterior of courtyard houses, the garden of a traditional Japanese house is also a constructed exterior that is closely integrated with interior spaces. Inhabitants

of these houses are culturally accustomed to an environment intimately linked to nature. In a Japanese garden nature is reinterpreted, redefined, and abstracted to create beauty or to express spiritual or emotional value. Therefore, the garden does not represent nature per se but rather an idealised version of it (Keane & Ohashi, 2012, pp. 117–128). As such, traditional Japanese architecture is positioned in nature in such a way as to accomplish balance and harmony. This entails a certain sophistication that arises from the deep understanding and appreciation of the lessons learnt from nature. Though these gardens are designed to accommodate a range of phenomena, such as tsunamis and earthquakes, they also display the pacifying influence of Buddhism, which sees humans as an integral part of nature, and of the native Shintō religion, whose gods inhabit nature (2012, pp. 117–128). The traditional houses merge with nature rather than stand in opposition to it, treating the building and the environment as equal parts within an ensemble. The constructed garden of the house consists of various types of vegetation that correspond to their adjacent rooms. In other words, the atmospheres and characters of the exterior is meant to compliment the design intentions of the interior.

This could be regarded as an extended setting of the interior, the compositional choices of which correspond to various selections of materials, arrangements, and scales of the indoor spaces. The orientation of the enclosed rooms, which has an interconnected arrangement, is designed to complement the exterior scenery. The limit of the constructed landscape is defined by the garden wall that shapes a separate, enclosed area essential to the creation of a Japanese garden (Bring & Wayembergh, 1981, p. 180). The overall arrangement thus creates an exterior that obstructs undesirable visual aspects, protects the garden from physical intrusion, and allows for a designed miniature garden (1981). The height, orientation, aesthetics, and placement of vegetation, as well as the way the ground is treated and designed for strolling purposes, affect the experience of these environments from both an interior-exterior and exterior-interior point of view (Figure 6 and 7). Other essential elements that establish the close relationship between interior and exterior environments of Japanese houses that work together with this constructed exteriority are architectural elements that define extended spaces, such as Engawa, veranda, and Tsuboniwa. Engawa is a peripheral corridor between the enclosed rooms and the garden. This continuous corridor usually stretches along all sides of the building and provides a climatically sheltered space. Once the adjacent shoji screens are open, the Engawa and inner rooms form a continuum (because they have the same height and floor level) while maintaining the existing visual and spatial threshold conditions between the spaces. Being closed from one side by the interior spaces and sheltered by long eaves, the semi-open Engawa provides a pleasant space for enjoying the constructed garden and its seasonal beauty. Another defined space for enjoying the natural beauty of the constructed exteriority of a Japanese house is the veranda, which is an open platform raised from the ground and usually located at the edge of a small pond or lake. The veranda is specifically known as a moon gazing terrace – an interface between heaven and earth. The shoji screens in Japanese houses redefine the experience of the interior-exterior relationship in a fully enclosed space. The level of transparency of rice paper, when the panels are closed, diffuses the common impression of wall solidity and produces a sublime indirect connection to the outside – not only through the atmospheric ambience of daylight in the interior, but also through the interplay of light and shadow. The pocket garden or Tsuboniwa is a defined closed exterior that functions as an interface between different interior zones, providing access, light, and ventilation similar to the small inner yards of Persian courtyard houses. The Japanese garden is what Yoshinobu Ashihara calls a Positive-Negative space, referring to the positive space (P) as an intentionally planned space, while the negative space (N) is a more spontaneous one (Ashihara, 1981, pp. 20–41). As such, both the Japanese gardens and Persian courtyards can be regarded as P-N spaces due to their intentional separation from natural space for a particular function or quality, while remaining open to unpredictable conditions of the climate and the natural world. This reinforces the relationship between the constructed and the natural by way of spatial organisation.

Figure 6. Representing images of the role of the garden as an extended setting of the interior space in a traditional Japanese house. Photo: (Left) Sanbō-in, Kyoto, Japan, photographed by Haruzo Ohashi – (Right) Stepping stones from the Imperial Carriage Stop to the Gepparo pavilion at Katsura Imperial Villa, near Kyoto, Japan, photographed by Yasuhiro Ishimoto, 1954, gelatin silver print, Kochi Prefecture, Ishimoto Yasuhiro Photo Center.

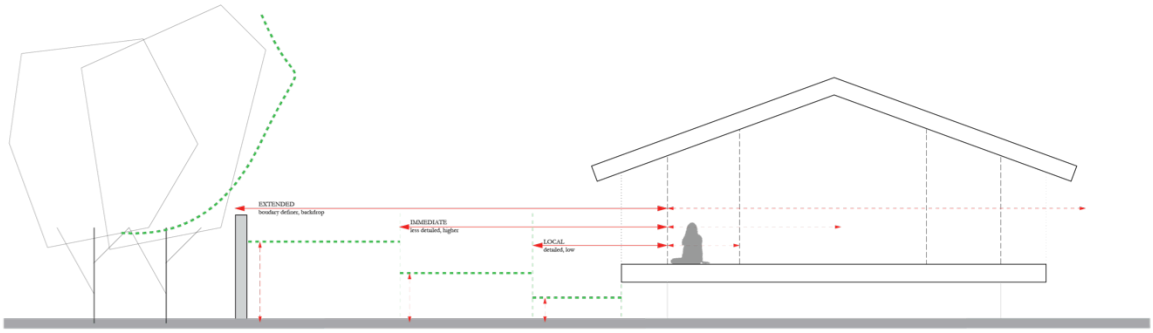

Figure 7. Arrangements of vegetation based on the visual aesthetics of different plants in relation to the spectator's proximity within the framed view. The placement of low vegetation in close proximity to the building allows for a spatial flow that is interrupted by the backdrop vegetation or the garden wall as boundary definers of the extended setting. The diagram is produced by Sareh Saeidi, 2018.

The Inverted House is the prize winner of the 5th LIXIL International University Architectural Competition in 2015, sponsored by the LIXIL JS Foundation, designed by the Oslo School of Architecture and Design (AHO) team, and was built the same year. The competition theme was to design a "House for Enjoying the Harsh Cold" in Hokkaido in Northern Japan. The idea of the design team was, as the project name indicates, to turn the house inside out to embrace the cold of the exterior environment. In this house, the exterior is not for contemplation or to be viewed from the warm interior space. In contrast, the house exposes the inhabitant to a climate that can reach −40 °C in the winter and turn into a mild and gentle environment during the summer (Figure 8). The building is a mediator that provides an inhabitable exterior, partially climatically sheltered by different roof slopes and floor levels. The daily life activities of the house include cooking, dining, taking a bath, or sleeping, which take place in semi-sheltered exterior spaces directly adjacent to the core structure of the house, with the option of sleeping inside during the worst weather conditions. These living spaces challenge the inhabitants' comfort and ability to adapt to the cold, to endure the cold, and what temperature they define as cold (Figure 9). The design illustrates how the architecture envelope, understood as a mediator between inside and outside environments, facilitates the inhabitation of a semi-

sheltered exterior. The Inverted House is an example of tackling flexibility of use and inhabitation, location specificity, extreme climatic conditions of the region, and the culture-related identity of the house as inherent design criteria for a radically different spatial and climatic organisation and experience. Although the house yields to its climatic context, it also shelters from it by redirecting undesired winds or shielding from rain through its roof structure.

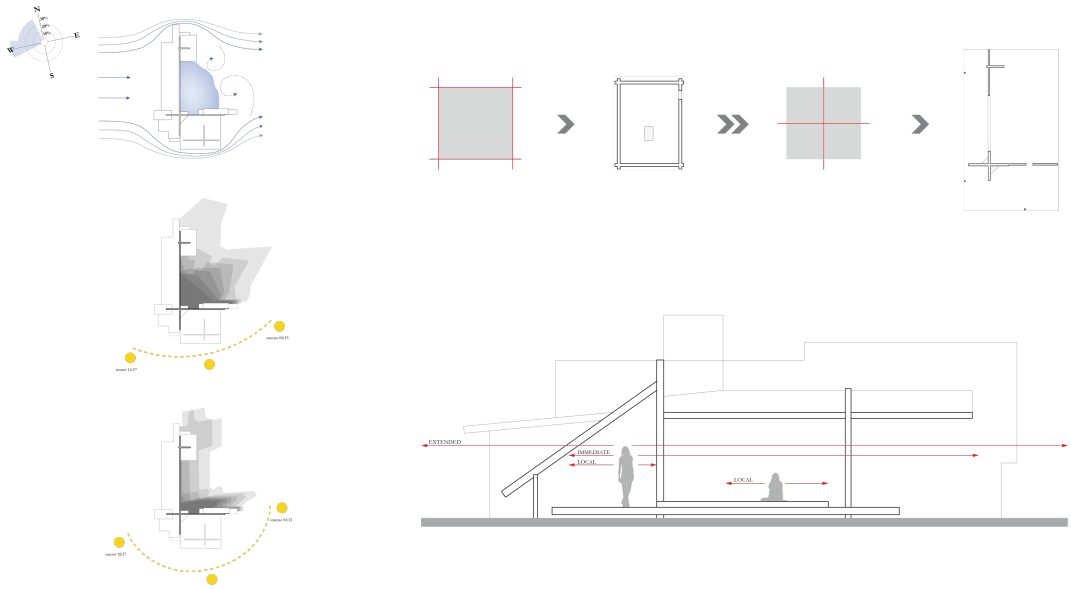

Figure 8. (Left) Diagram representation of the spatial arrangement, wind, and shading analysis for snow collection in the Inverted House in Hokkaido, Japan – by the AHO team in 2015. (Right top) Diagram of the design's concept illustrating the conversion of traditional Japanese introverted plan to an open extroverted organization. (Right bottom) Sectional representation of perceptive distances in the Inverted House's main outdoor rooms – produced by Sareh Saeidi, Spring 2018.

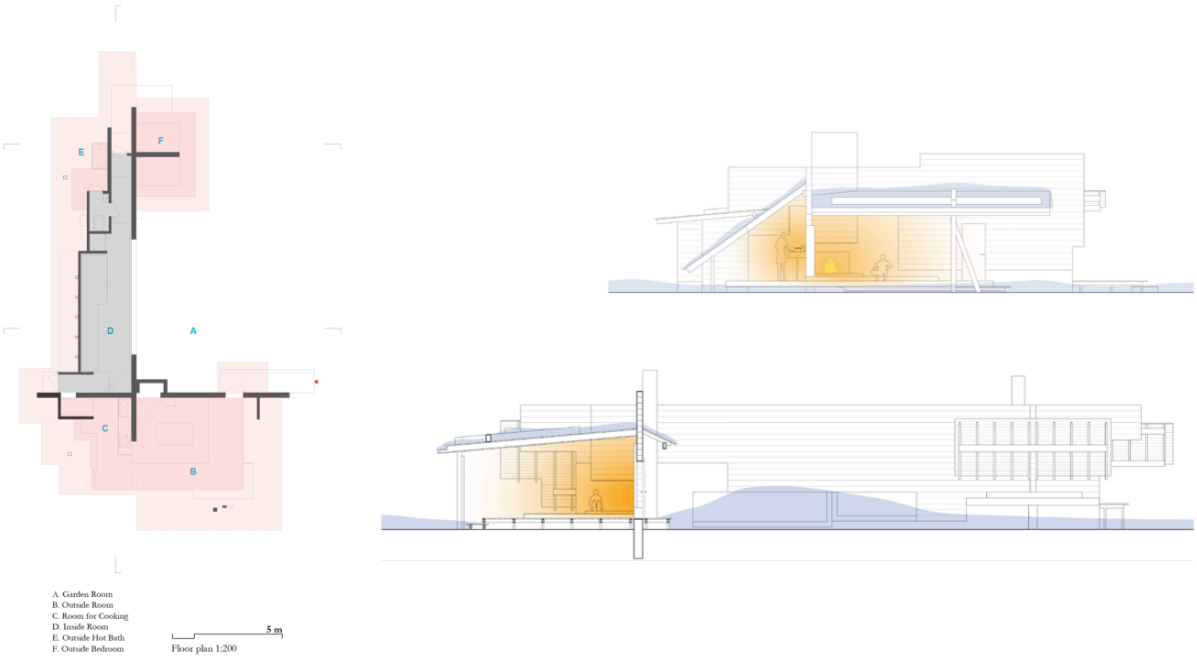

Figure 9. Plan drawing and sections of the Inverted House – produced by the AHO team in 2015.

Today's rapid environmental changes require flexible and adaptive designs that can provide a strong symbiotic relationship between architecture and its surroundings. The task of designing a complete environment could therefore be expressed as the goal to pursue "[t]he ecological balance of human and animal and plant life [to] be correctly adjusted both internally and to the given exterior physical conditions" (Alexander, 1964, p. 3). This includes both individual and collective dynamics of life, economical forces, infrastructure, and other influencing factors in a design in which "its own regeneration and reconstruction does not constantly disrupt its performance" (1964, p. 3). In such an environment, "architectural elements fuse themselves to the latencies of the ambient environment, adopting their capacities for change or movement" (Leatherbarrow, 2009, pp. 37–38). Therefore, spatial configurations of the interior in relation to the exterior need not only have permanent features, but also temporary ones, which allow for contingencies and unpredictable exchanges between the two over time. Indeed, there are various design approaches in architecture that allow for more spatial flexibility. One of these is spatial continuity, which enables the possibility of adjustments to future changes in the built space. Adolf Loos believed that architecture cannot be conceived in plans but through the relations and connectivity of spaces that give rise to a spatial continuum and facilitates certain types of perception (Risselada, 2008). This is clearly captured in the houses he designed, through the spatial order of walls and their wide openings which, while emphasising their phenomenological and structural importance, provide spatial continuity between rooms. In the context of this research, spatial continuity is arguably a well-fitting approach to the *extended threshold* typology. The connectivity of the spaces offers a freedom through which the built form can adapt to and harmonise with given conditions. Space, as such, becomes a lived experience within which change and adaptation define the notion of architectural performance. The following paragraphs examine two examples of buildings that take into account the capacities of architectural design to respond to changing environmental conditions over time.

The first example, the Glass House of Lina Bo Bardi, was constructed in 1950 in São Paulo. The vegetation on the sloped site was removed for the purpose of construction, which, at the time, offered distant views and aided in creating the iconic representation of the building. This condition changed as the vegetation grew back to its full height. The house has a spacious front side, a minimised footprint achieved through pilotis that lift the floor from the ground, and an atrium in the middle of the building that provides light for the core areas. It also gives space needed for the growth of the tree that is in the atrium. These are provisions that facilitate a new relation of adjacency and exposure, resulting in a different interior atmosphere due to the close proximity of the interior to the vegetation (Figure 10 and 11). However, this remains a visual experience separated by the fully glazed outer walls of the living areas. Nevertheless, the closeness of the surrounding vegetation provides an experience of living in a canopy, as well as creating a specific atmosphere through the interplay of light and shadow. This also improves the thermal comfort of the interior by providing shading and reducing solar penetration. Similar relations between the built form and the local climate in regard to vegetation can be seen in numerous historical examples, one of which is the Fin Kiosk in Kashan, Iran. In this garden, the type and height of vegetation is designed to accommodate thermal comfort for the semi-open and enclosed spaces of the built kiosk located in the centre of the garden (Faghih & Sadeghi, 2012, pp. 38–51).

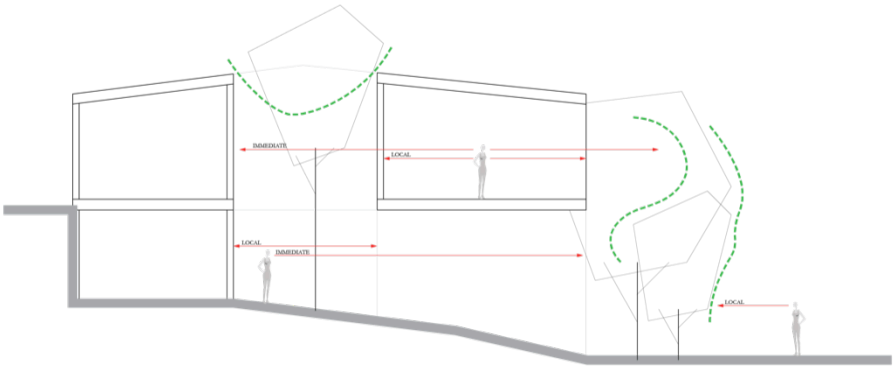

Figure 10. Diagram representation of the spatial relations in the Glass House of Lina Bo Bardi (designed in 1951) – produced by Sareh Saeidi, Spring 2018.

Figure 11. Glass House, Lina Bo Bardi, São Paulo, 1950. Photos of the Glass House after construction, showing the exterior of the house and the extensive exterior views from inside (left column), almost similar photos of these spaces in more recent photos taken from the house (middle column), and the middle atrium (right column).

The second example, the Sheats-Goldstein residence by John Lautner, was completed in 1963 in Los Angeles, California. Its spatial organisation is tailored to mediate between site conditions and design intentions. The house is located on a hillside, meeting the edge of the slope on one side, and dense vegetation on the other. The proximity of the vegetation to the north side of the building promotes specific strategies for material organisation and openness of form. The context is represented by the distant views, openness, and fluidity of the semi-closed and enclosed spaces that are in part framed by local rocks and vegetation (Figure 12). The boundary between the interior and the exterior is often diffused, especially in the way the boundary edges of the building meet the surrounding vegetation. This is achieved through considerations of material organisation, for example through the detailing at the intersection of glass panes and stonewalls, which, apart from obscuring the division between the interior and the exterior, allows for specific degrees of penetration of vegetation into the enclosed rooms. Design considerations that facilitate a unifying expression of spatial flow in the building include the detail of the building's edges meeting vegetation, site conditions, and the use of

glass to disrupt the boundary definition of the enclosure through both transparency and reflection (Figure 13). This provides the adaptability required to create a space in which the exterior and interior environments merge.

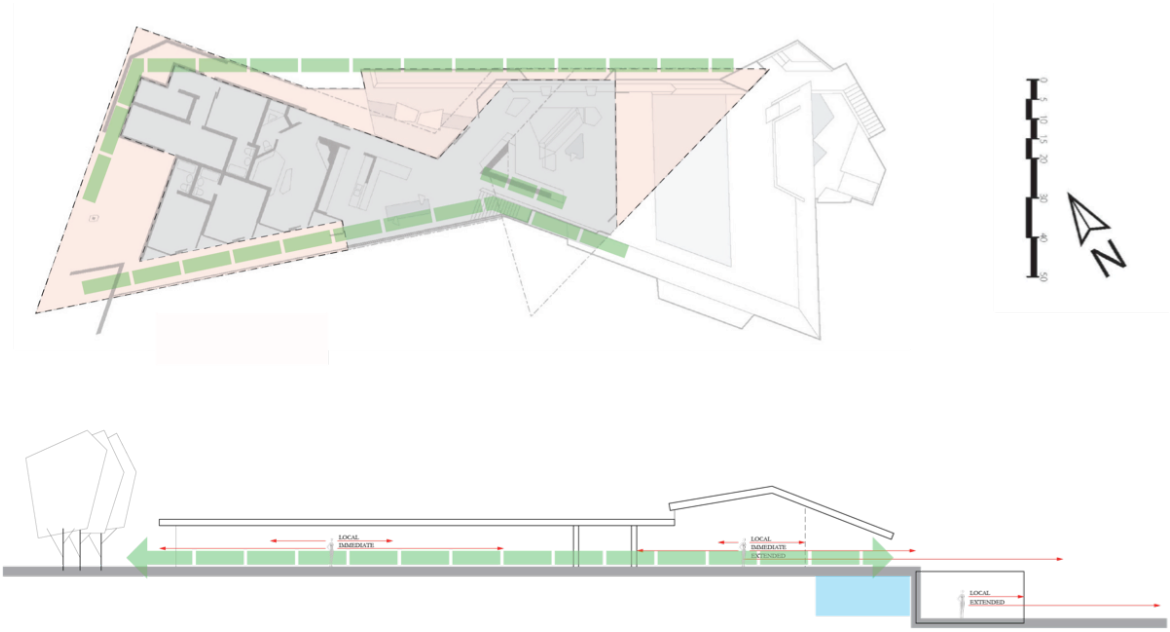

Figure 12. Sheats-Goldstein residence designed by John Lautner, built between 1961–1963 in Los Angeles, California. (Top) Plan drawing in which coloured areas are indicators of the enclosed interior (gray) and the semi-closed extended spaces between interior and exterior spaces (beige). The dashed lines indicate the vegetation growth along the building. (Bottom) Sectional representation of the spatial openness that allows for the vegetation growth along and across – produced by Sareh Saeidi, Spring 2018.

Figure 13. Photos of the Sheats-Goldstein residence, showing the house's main room in its surrounding topography (top left), vegetation growth in the interior spaces (bottom middle), and other photos capturing the close integration of the house with its surrounding vegetation in the extended spaces.

The aforementioned two case examples indicate that the temporary state of an architectural envelope can accommodate transitions between interior and exterior spaces that are both functional and experiential. The exteriority of the built form then becomes a powerful means for design provisions based on local specifications and conditions, which heightens the spatial experience of interior spaces through their exterior context.

Design experiments and developed methodology

In the context of this work, factors for defining suitable relations between interior and exterior environments include qualitative and quantitative analyses of design concepts; the atmospheric effects and climatic comfort aspects of the interior such as ventilation, shading, solar penetration, material organisation; and aspects regarding the proximity (visual distances) of contextual features. The investigations conducted in this section focus on the aforementioned parameters to achieve various climatic and aesthetic experiences of architectural envelopes through a tailored design approach. The experiments address determining factors for designing interior spaces in relation to the exterior environment based on the conceptual aims of the project, and the identification of relevant contextual information sets. This includes a discussion of ways that collected local data can be visualised, applied, and analysed in the design process. A major part of the design approach is comprised of site-specific data identification, collection, and processing based on the project concepts. The investigations include questions on how to correlate and interpret data while acknowledging the relative deficiencies of the collected data (related to the contextual conditions in which they were obtained). The aim was to identify an information-based design process for a locally specific architectural envelope design. The work was undertaken in the RCAT & ACDL master-level studio during the fall semester of 2016. The Advanced Computational Design Laboratory (ACDL) is the innovation laboratory of the Research Centre for Architecture and Tectonics (RCAT) at the Oslo School of Architecture and Design (AHO). The studio brief asked for the design of research facilities and accommodation for six staff members, which could be converted into a vacation home. The site is located in a terraced vineyard called Graspoli, which belongs to Fattoria di Lamole in Chianti, Tuscany, Italy.

Landscapes provide an environment for the co-existence of various species and organisms. Humans systematically constructed rural landscapes in the course of agricultural activity imposed on natural landscapes (Sereni, 1961 in Agnoletti, 2012). Experts frequently posit that cultural landscapes are the result of culture as an agent acting upon natural areas (Sauer, 1926 in Agnoletti, 2006). Such landscapes are therefore the locus of a historical integration of social, ecological, economic, and environmental factors that significantly influence their development and provide their surrounding context with a cultural identity.

Today, rural areas are often diminishing, and the cultural and national identity and knowledge that has been passed down and refined through generations is getting lost. Although some of the productive landscapes are currently regarded as sites of cultural heritage in Tuscany, many others are abandoned, resulting in dense re-forestation and loss of biodiversity. Currently, the layouts and agriculture of these areas are shaped by industrialisation and the use of machines. In the vineyards, these setups are directly dependent on how the owners want to grow the grapevines. Traditionally, the vineyards have been constructed in the form of terraced landscapes to account for steep slopes. Yet, the demand for the use of large machines to facilitate the workload and the maintenance of these landscapes led to the transformation of stepped vineyards into sloped landscapes. This transformation has led to a decrease in the quality of grapes and subsequently the wine. Among the most influential factors in growing grapevines are the altitudinal and thermal conditions of the vineyard. Therefore, the thermal variations between night and day must be carefully considered as one of the main impacts on the quality of the wine produced. Experienced vineyard owners believe that to tackle the questions of the lowered quality, terraced landscapes must be revisited and revalued. The elements and features of a terrace landscape such as dry stonewalls, terrace width, rainwater

management, and grapevine pruning all affect the quality of the wine produced. An example is the significant impact of the dry stonewalls on the photosynthesis of the grapevines and thus the matured grapes: "The [dry stone]walls have a heat-storing function that gives back thermic energy accumulated during the day, creating a peculiar favorable microclimate […] which thrive[s] in dry soil" (Contessa, 2013, p. 30).

The RCAT & ACDL studio engaged with a terraced landscape to contribute to developing an understanding of the current states of such landscapes and ways that architecture can be designed for and integrated with them on multiple levels. The architectural designs were meant to employ local resources and materials and utilise passive means for modulating the microclimate. The design task demanded built forms that emerged from interactions between architecture, climate, and agriculture, such that the proposed architecture would not interrupt the production of the wine and therefore not change the microclimate of the site. Thus, students were asked to investigate the current condition of the vineyard to be able to determine to what degree they could intervene with the existing microclimate of Graspoli's landscape. The design studies were framed around the notion of performance, including both climatic studies and the existing site analysis. The notion of performance within the focus of the author's PhD research emphasises aspects and strategies of architectural design by which the build form can tackle and respond to questions of climatic design and the design's adaptability to changing local conditions. The designs encompassed 200 sqm, one-third of which was used to form transitional spaces. Site-specific data was collected and informed associative modelling for an iterative process of development and analysis of the projects. The design process consisted of testing the concepts within an iterative process of parametric modelling, simulation, and evaluation through which initial ideas were refined and evaluated continuously until they fulfilled the aims of the projects.

The site-specific data included three months of measurements collected by weather stations mounted on site. This data included solar penetration, air and soil temperature and humidity, wind direction and speed, and precipitation. The data was cross-referenced with climatic data from the local meteorological station, which is located at a distance of approximately one kilometre from Graspoli. The orientation and positioning of the projects varied, with some directly positioned next to the grapevine rows and dry stonewalls, and others by the borders of the terraces. The design approaches pursued by the master's students included a) a designed journey through the site, b) proximity as the determining factor in framing views to the natural horizons or borders of the built, and c) climatic conditioning accommodating both human comfort and wine cultivation.

The variety of the design aims and concepts enabled different experiential design processes in the studio. The PhD research benefited from this as it aided in the understanding of the dynamics of the iterative design process. The process also provided the research with methods of identifying relevant tools of analysis and corresponding data based on design concepts. This included ways various focuses must be applied, analysed, and critically reflected upon during the design process, and how to develop the built knowledge further at each stage of the analysis. The design experiments aimed to closely engage with the local context on multiple levels, including both the existing microclimate together with the physical elements and the topography of the site. The three selected projects, which are elaborated on in the following paragraphs, contributed to the development of earlier methods of the research by focusing on the clarification of approaches on thermal comfort and distances in experiencing the aforementioned envelopes. The various skillsets of the students allowed for different modes of investigation, ranging from expressive hand sketches to data-driven simulation and analysis. These included a main methodological approach within each team, together with climatic and site analysis. Team one used hand sketches and photometric studies of the site as a storytelling method to visualise the existing atmospheric qualities of the landscape and how the design aimed to engage with these qualities. Team two utilised serial sections as an analytical tool for developing their integrated design sketches. Meanwhile, team three collected and employed

various datasets that provided information on factors regarding thermal comfort simulation and analysis, as well as algorithmic form optimisation.

The first two teams chose to design a path through which the visitor is guided to experience the site. Team one used hand sketches and sequential photographic studies to design the visitors' experience through a walking path in the vineyard. Their design focused on emphasising on various distances of the body to elements of the site in order to incorporate tactile experiences, along with capturing specific views within the designed path. The primary photometric studies were focused along the main path that led to the selected terrace on which they designed their building (Figure 14). The studies were focused on the atmospheric and perceptive differences of moving uphill or downhill along the slope, and the perceptive differences caused by the proximity of the visitor to the grapevines or distant landscapes created expansive vistas on the horizon. This storytelling method enabled the group to communicate and develop the experiential qualities they were aiming to achieve in their design project. The specific location-dependent features and collected information assisted in unfolding the notion of transitions as changing states of experience along the site. Design considerations included the differences of going uphill versus downhill. The close proximity of landscape elements such as grapevines, grapes, leaves, and dry stonewalls when moving uphill facilitated a bodily experience of the site on a human scale, while going downhill provided views of the valley (Figure 15).

Figure 14. Hand sketches and sequential photographic studies to design the visitors' experience through a walking path in the vineyard. Their design focused on emphasising on various distances of the body to elements of the site in order to incorporate tactile experiences, along with capturing specific views within the designed path. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL), The Oslo School of Architecture and Design (AHO), Fall 2016. The project was designed and visualised by students Ignacio Madinagoitia and Gunnar Sørås.

Figure 15. Diagram representation of spatial relations and perceptive distances of the project's extended setting. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL). The visualizations are produced by the design team (Ignacio Madinagoitia and Gunnar Sørås) and the diagrams are produced by Sareh Saeidi, Spring 2018.

Team two aimed to create a continuous atmospheric effect for their built forms by incorporating the existing dry stonewalls in small semi-closed and closed spaces along, through, and in-between the walls. These integrations with the dry stonewalls were shaped along the main axis of the terraced landscape and slope. The designed interventions were arranged along the main axis of the site, and in the direction of the slope alongside the main downhill water drainage system. The experiences are achieved through the position and movement of the body in relation to the wall. The proximity of the visitor to the stonewall and the ways he or she moves through, along, under, in, or on these structures is designed to activate an experiential understanding of the built interventions and the terraced landscape (Figure 16). These experiences correspond to Leatherbarrow's ways of experiencing architecture in terms of distances between the body and the built form. In this case, local distance is the close adjacency of stonewalls to the body, which provides a tactile experience, while framed views of the surroundings in the immediacy of the walls heighten the experience and understanding of the vineyard. The extended topography, on the other hand, goes beyond the farthest views of the site and reveals extensive vistas of the Tuscan landscape. Another factor from which the designed semi-closed and closed rooms benefit is the thermal inertia of the dry stonewalls, which provides a cooler interior during the day and a warmer one in the evening.

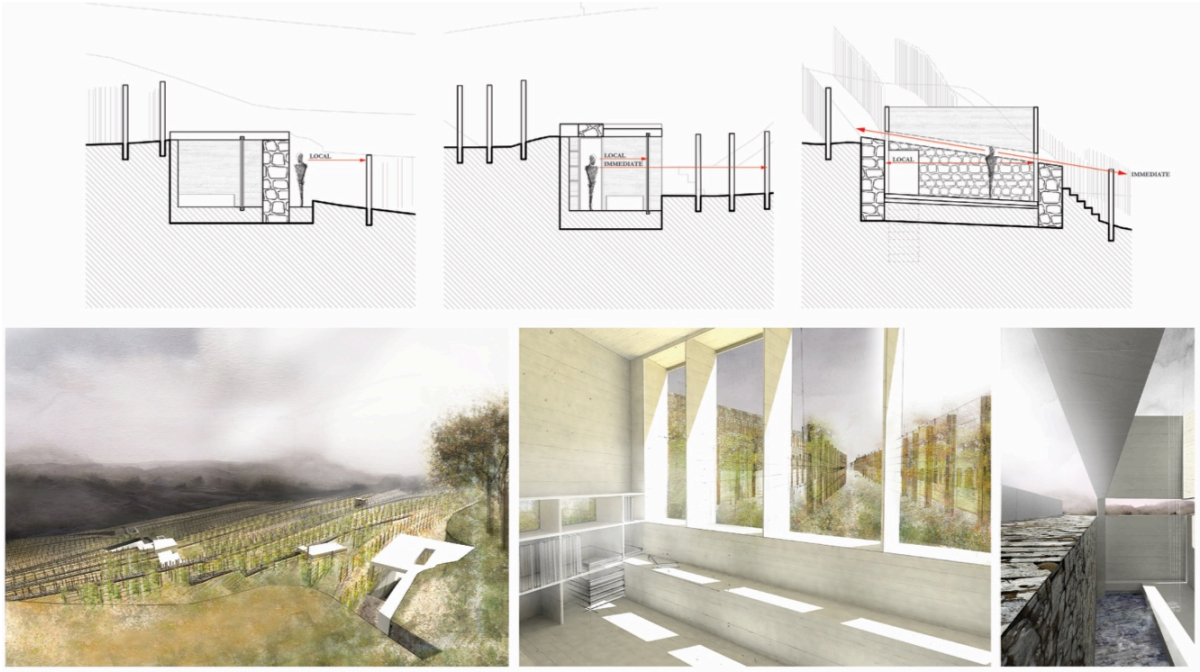

Figure 16. Sectional representations of the perceptive relation of the inhabitant to the existing dry stonewalls that are closely integrated in the terraced landscape, and the visualised views of the distances from and in the designed interventions. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL). The diagrams are produced by Sareh Saeidi, Spring 2018. The project was designed and visualised by students Andra Nicolescu and Kristian Taaksalu.

The third team put the emphasis on spatial provisions within the thematic focus of thermal comfort and human adaptation. The project aimed to create a built form that responds to its microclimate by way of an explicit free-running building (FRB) approach by providing climatically adaptive living zones. FRB provides a variety of indoor climates through implementing strategies related to the topics of inhabitants' acceptance, forgiveness, expectations, and adaptive capacities using clothing, spatial arrangements, thermal inertia, and flexible use of space. The project utilises local climatic conditions to enhance thermal comfort for the built space by focusing on two aspects. The first aspect focuses on ways by which the building integrates with its surrounding landscape and affects its immediate climatic context. This was assessed by extensive solar gain and shading analysis for comfort studies, consisting of temperature, humidity, and wind speed. The other aspect focuses on indoor comfort requirements relative to the inquiries of a research facility and accommodation for researchers. The influencing factors regarding perceived comfort temperature were environmental and human-based. The environmental factors consisted of air temperature, radiant temperature, air velocity, humidity, and related inhabitation factors, including individuals' clothing, activity, and metabolic heat (Figure 17 and 18).

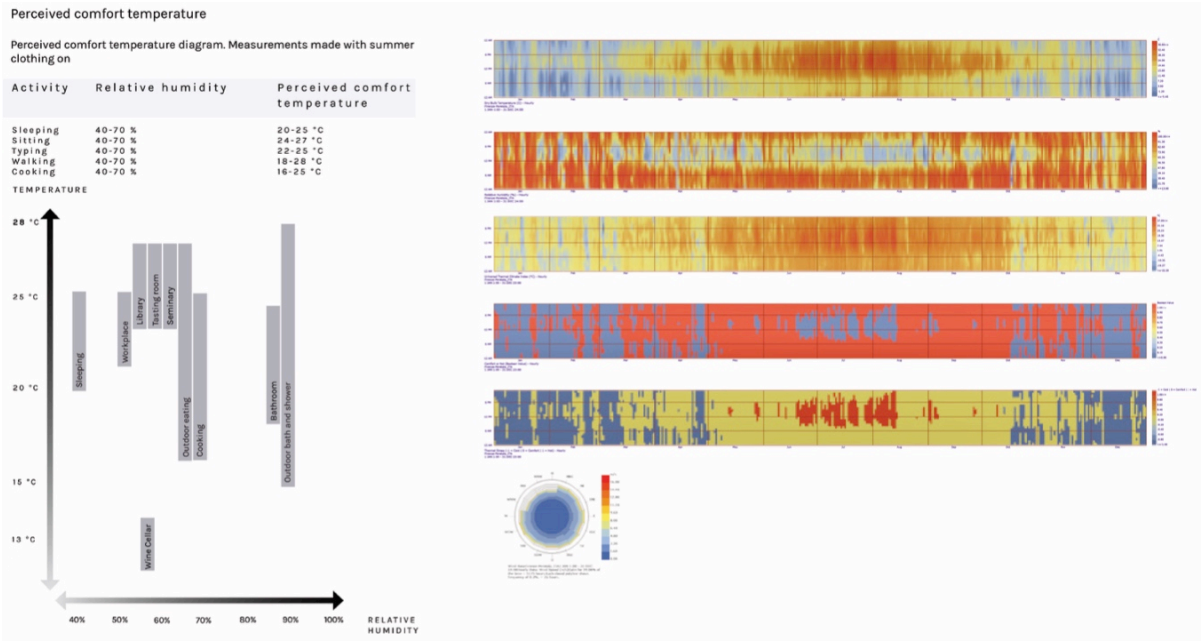

Figure 17. Diagram representation of perceived comfort temperature (left), estimated with summer clothing on, based on the literature review. Visualisation of yearly climatic data (right) for thermal comfort analysis, including relative humidity, dry bulb temperature, and factors of thermal comfort. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL). The project was designed and visualised by students Joar Tjetland and Maria Lagging.

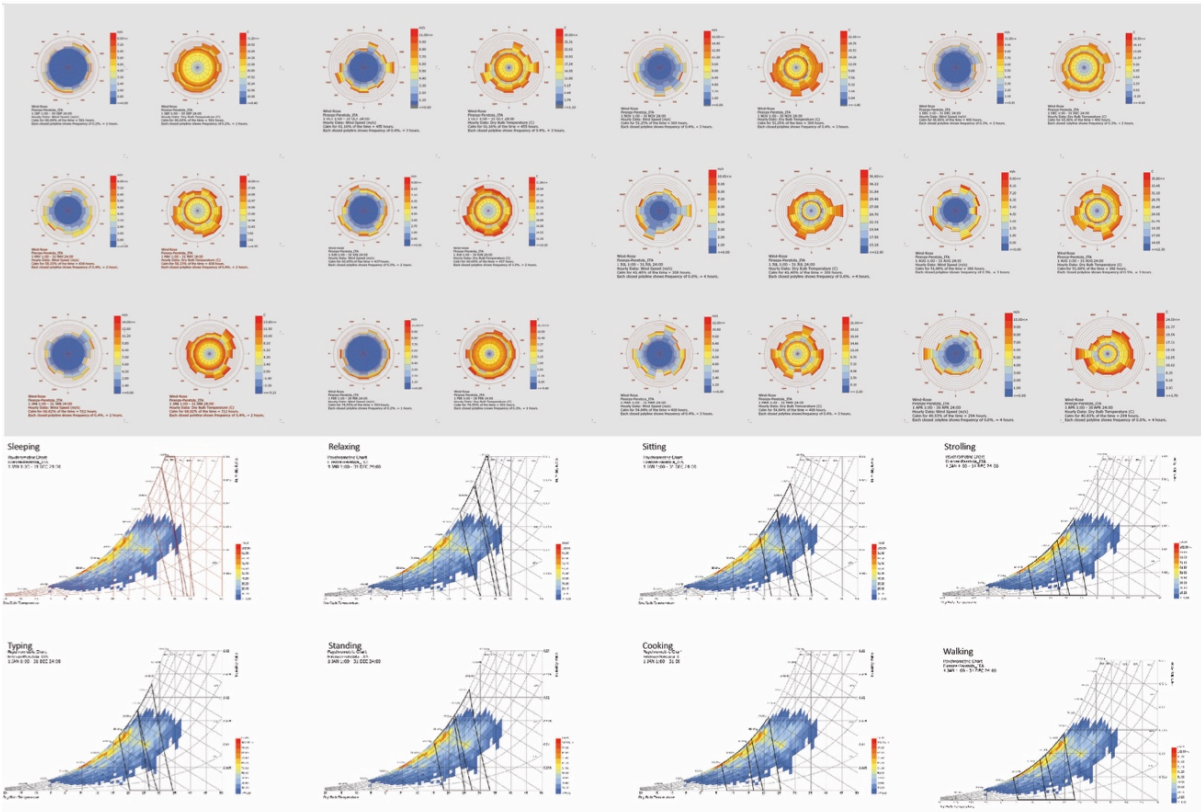

Figure 18. Visualisation of yearly wind analysis and psychometric charts of various activities based on the building's program, which informed the design project and placement of various spaces of the building together with solar radiation studies. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL). The project was designed and visualised by students Joar Tjetland and Maria Lagging.

This project is located on the highest possible altitude of the terraced site, connecting two terraces through a sequence of above- and below-ground spaces. The form optimisation and inclination of the surfaces results from the analysis conducted to ensure a minimal degree of shading by the surroundings, such as grapevines and trees. The required gradients of microclimates are designed using architectural modifiers consisting of walls, flooring, screen walls, roofs, and designated activities of the inhabitants in different spaces of the project. Factors such as materiality, heat storage, shading, natural ventilation, and precipitation are applied as design drivers.

South-facing surfaces are minimised to avoid the impact of solar radiation and the resulting heat gain for exterior and interior spaces. The optimisation analysis was conducted using the *Galapagos Evolutionary Solver*, with the indoor peak temperature in summer as the highest value for the generic optimisation. Galapagos is an open source plugin for *Grasshopper,* providing a generic platform for the application of evolutionary algorithms that can be used for a wide variety of problem solving by non-programmers. Grasshopper is a graphical algorithm editor developed by Robert McNeel & Associates; it is tightly integrated with *Rhinoceros* 3D modelling software. Material choices in various zones of the building correspond to considerations of ventilation, heat gain or release, humidity, and solar gain to fulfil each zone's climatic demands. Considerations of the programmatic distribution and climatic design of various zones mainly accounted for climatised interior and exterior zones that were supplementary to one another in maintaining the overall microclimatic design of the project. On a conceptual level, the semi-open rooms and transitional spaces provide the spatial continuity of the exterior into the semi-sheltered spaces. The bedroom modules, located below ground, follow the course of the terraced landscape, while the rooms for social activities and gatherings are partly integrated on the step between two terraces and are partially embedded in the lower terrace. The below-ground zones benefit from the thermal insulation of the soil and also employ thermal inertia and user-based adaptation (Figure 19).

The design process was based on the extensive use of mind maps and iterative associative modelling, analysis, and simulation. Comfort analysis and simulations were conducted using *Ladybug* and *Honeybee,* two open source plugins for Grasshopper that help explore and analyse environmental performance by evaluating a building's energy consumption, comfort, and daylighting (Sadeghipour Roudsari & Pak, 2013). In order to finalise the design concept, these analyses included shading, airflow, solar gains, and the materiality of the exposed surfaces. The mappings also incorporated aspects such as adjustable seasonal use of various spaces.

The utilisation of advanced digital tools provided an informed mode of design within which various microclimates were iteratively assessed and analysed, resulting in an effective inhabitation model. The main design driver in decisions regarding spatial organisation in relation to comfort temperature was dependent on factors of program, activity, and clothing. Common approaches that have a high focus on energy efficiency can be criticised for utilising standards of human comfort and excluding other influencing aspects, such as the cultural background and its impacts on the perception of thermal comfort. In contrast to this, FRB provides enough flexibility for allowing patterns of adaptations based on individual needs, while also having the capacity for post-occupancy changes.

The various focuses of the aforementioned experiments enabled the research to map and identify the effective relations between the datasets and tools of analysis required for the design concepts. These mappings facilitate an understanding of the workflow and the development towards a synthesised approach for designing with multiple criteria, as well as conceptual approaches to architectural performance and performative envelopes.

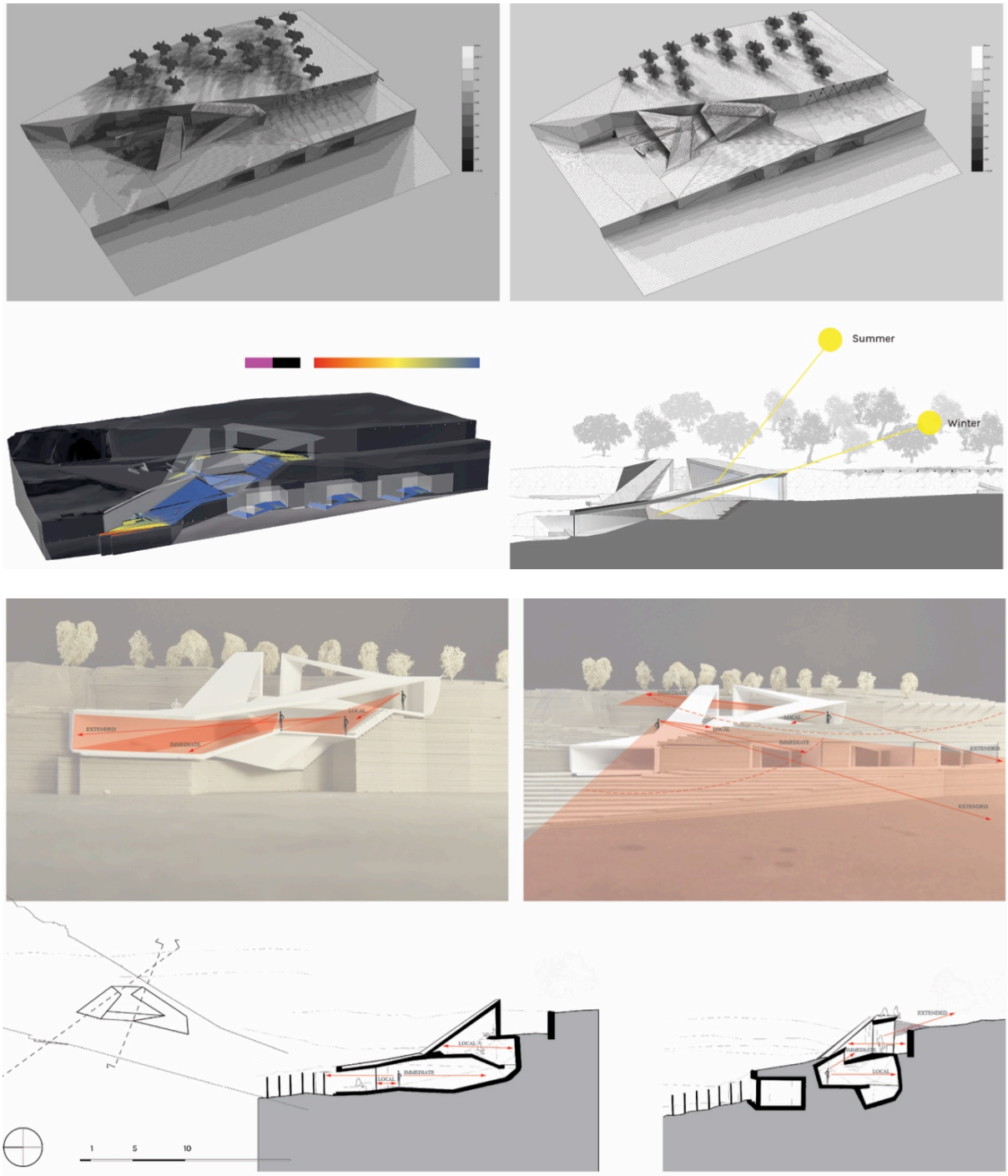

Figure 19. Comparative study of shading analysis and solar radiation between winter (December – top left) and summer (June – top right). The studies were decisive for pairing various activities to programs of zones based on the required thermal comfort (2nd row from top). The four images at the bottom represent the diagrammatic representation of the project's extended setting in relation to enclosed and semi-closed spaces that define the building's threshold. Performative Envelopes II Workshop conducted by Sareh Saeidi at the Advanced Computational Design Laboratory (ACDL). The project was designed and visualised by students Joar Tjetland and Maria Lagging, and the diagrams are produced by Sareh Saeidi, Spring 2018.

Discussion and conclusion

The importance of the role of building façades has been a significant topic within architectural discourse. The discussion tends to fall under four thematic approaches: structural and static; expressive and representational; socio-political and economical; and environmental analysis and issues of sustainability (Saeidi Derakhshi, 2017, p. 33). This research aimed to initiate a repositioning of the relationship between built forms and their surrounding environment with the goal of advancing the role of the locally specific exterior in the conceptual perspective and method. This was systematically approached through a number of case and design studies. The conducted studies demonstrate a design approach that utilises the exterior environment to create climatic, atmospheric, and adaptive qualities for the interior.

The design process of architectural envelopes as extended settings was developed through digital modelling and analyses to facilitate design iteration and application of collected contextual data, such as climatic datasets. Contemporary technological advances, open source platforms, and available tools have enabled architects, engineers, and others in related disciplines to access and gain insight into various data sources easily. The role of information-based processes is to provide a preliminary base for design iteration and analysis that can assist a better understanding of locally specific conditions. The process of translating gathered contextual information into applicable knowledge for the design process includes various steps, starting from the identification of relevant datasets that correspond to the programmatic and conceptual aims of the project. After parsing the relevant information, quantitative and qualitative analysis can be conducted using the available data. Visualising and mapping the interconnections and relations between different sets of information enables a better systematic understanding of the existing conditions. This elevated understanding allows for an informed design process in which design considerations closely incorporate, respond, and interact with the acquired knowledge of the project's contextual circumstances.

However, in the backdrop of open source datasets, modelling and simulation are the prevailing tendencies within current architectural design education and practice, shifting architecture towards data-driven, computer-generated methods. The resulting architecture, therefore, is frequently based not data, with little further critical or reflective thinking, often not formulating and exploring alternative concepts. In addition, the main portion of the conducted analyses is focused on the impact of the buildings' forms on urban microclimates (such as wind tunnels, shading, and solar gain analyses) which is conducted by environmentalists and urban planners. While these big-scale analyses are essential for understanding the bigger context of design, finer analyses and evaluations that examine ways of intervening with microenvironments and the immediate exteriority of the built form remain underexplored. The conducted workshops required the researchers to reflect on and gain insight into the aforementioned concerns of the data-assessment process. The design process clarified various stages of site-specific data handling. It facilitated the understanding of how to parse the needed data in correspondence with design ideas, and consequently assisted with the identification of analytical and simulation tools based on the project inquiries. In addition, it informed this research how to develop a flexible methodological frame to correlate data with design concepts and how to repurpose them in case of unsatisfactory results.

The rising awareness in today's practice of problems of computational and data-driven designs has led to the engagement of architects with questions related to the identification of contextual information and ways of analysing data. Gaining an understanding of information, empowered by interdisciplinary insights, facilitates the transformation of data into applicable knowledge for the design process. What should be emphasised is that implementing contextual knowledge can significantly benefit from recursive thinking and reflection on the subjective realisation of the context, which includes aspects such as social and cultural insights. It is also necessary to bear in mind that although designing in this way results in a built form that corresponds to its local atmospheric and functional needs, the design would still be dependent

on latent contextual changes and must therefore provide a flexible structure to adjust to future needs.

The sections on case studies and design experiments help to clarify this research's definition of performance by distinguishing it from the common definitions of energy efficiency and technological focuses, instead favouring functional aspects of the built form that emerge from the interactions of architecture with its surrounding context. The discussions specifically facilitate identifying the differences between the approaches of the non-discrete envelopes typology, thus further developing the earlier studies of the author's PhD research on the taxonomy of envelopes (Saeidi Derakhshi, 2017, p. 15). These approaches are identified as dissolved threshold and extended threshold, and they articulate the building envelope in ways that provide intermediary semi-open spaces between the interior and exterior environments. The main difference between these two approaches is their degree of enclosure in relation to their adjacent exterior environment, which is considerably higher in dissolved thresholds. This typology refers to design approaches that provide exteriorised interiors, in which the removal of a building's outermost wall forms extended spaces that are considerably exposed to exterior conditions while providing a degree of climatic shelter (such as the Inverted House). Extended thresholds, on the other hand, provide a well-defined microenvironment (formed by a void in the core of the building or a roofed veranda in case of the presented examples) with certain limitations regarding the spatial depth. Furthermore, they are also sheltered and affected by their adjacent enclosed spaces. Within this domain, a considerably difficult task is to define the means of designing extended settings through building envelopes.

This investigation proposes a guideline for designing extended settings as an extension of the notion of the exterior of the built form, based on the findings of the conducted case studies and design experiments. In light of this investigation, the following points need to be considered within the design process of architectural envelopes, including both design approaches and concepts framed in the scope of designing non-discrete architecture and its typologies. The three typologies of non-discrete envelopes consist of: extended thresholds, dissolved thresholds, and multiple envelopes, which are all discussed at length in the case studies section of this article. The typologies provide a spatial extension, which is emphasised either in the interior or exterior realm, by representing various approaches in integrating these two environments through means of building envelopes. In designing an extended setting for the built form, design considerations must articulate functional, aesthetic, and experiential aspects in correspondence with contextual circumstances, or specifically single out one aspect based on the particular aims of the project. The functional aspects mainly incorporate programmatic, climatic, and comfort design factors, while aesthetic ones include strong visual connections between the interior and the exterior. The integration of these two aspects can intensify the experience of the extended setting through a conscious design of emerging atmospheres and spatial interactions.

Various design concepts that assist in designing the immediate exterior of the built form as an inherent extension of the interior are: graded enclosure (interstitial/ transitional spaces providing spatial sequences), controlled spatial continuity (interiorised exteriors accommodating microenvironments through semi-open spaces), and spatial openness (exteriorised interiors acclimatised to the exterior environment, challenging the notion of interiority as a spatial enclosure). As conceptualised in the case studies section of this article, each of these concepts includes architectural elements that shape the envelopes' spatial definitions in different typologies. Two main design approaches for creating the gradient of spatial enclosure are the material organisation of envelope surfaces and positioning multiple layers of envelopes in correspondence to one another, forming a visual or permeable gradient. Elements and design approaches that develop a controlled spatial continuity also provide semi-open spaces between the two architectural realms of the interior and the exterior. These spaces are usually defined through a kind of mass subtraction of the building form to generate a conditioned space, such as courtyards or pocket gardens, Iwans, Engawa, veranda structures,

or even niches, as an inhabitable extension of the exterior environment. Another design strategy, which creates both a controlled microenvironment and sequential degrees of enclosure, is the elevated ground – or pilotis – that allows an intermediate space through an uninterrupted exteriority. The last design strategy is spatial openness, which is similar to the other two but is differentiated by challenging the notion of building envelopes through the erasure of a building's outermost wall to accommodate a semi-open transitional space. In this approach, various interrelated aspects of the exterior directly affect the inhabitation patterns of these interiorised spaces, the experience of which is highly dependent on subjective perception.

This article contributes to advancing the earlier discussions of the research in architectural envelopes, which explained their role towards the interior environments, by defining their close relations with the (locally specific) exterior environments. The studies indicate design strategies for articulating spatial extensions that provide conditioned exteriors which are supplementary to interior spaces. These strategies marry experiential and functional concepts by extending the spatial relation between the interior and exterior environments. The presented research thus seeks to further develop the earlier proposed conceptual approaches by identifying challenges and ways of integrating conceptual ideas and specific contextual knowledge for creating atmospheric qualities through the climatic conditioning of architectural envelopes. These efforts led to a design process for architectural envelopes, the spatial qualities of which emerge from iterative processes and discussions, rather than preconceived ideas of designing locally specific architecture. The diagrams extracted from the case studies can serve to expand the conceptual approach and act as design guidelines. As such, the diagrams constitute generalised principles that need to be re-contextualised and adapted to specific settings. Therefore, these principles are not generally applicable regardless of context and the specific exterior environment. On an overarching systematic level, the diagrams also serve to illustrate and embody concepts and approaches that can serve to advance and refine the architectural envelope concepts and taxonomy produced in an earlier stage of this research. The next stage of the research will test select diagrams and architectural envelope taxonomies in a design project conducted by the author with the aim of refining the methodological approach to architectural envelopes.

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