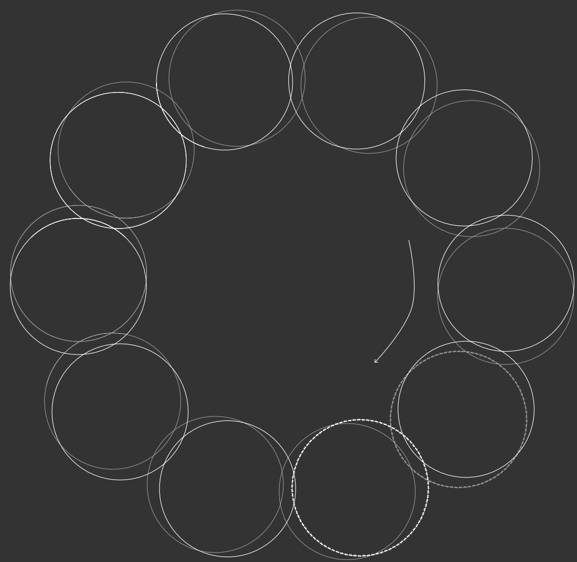
Continuity of Use and Components in Public Building Design

[ephemeral roots]



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Research Booklet

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Keywords

Redefined (contemporary) Permanence, Continuity, Lifecycle-based Architecture, Timber Architecture, Maintenance, Craftsmanship, Knowledge transmission, Primary Values, Circular Building Strategies, Design Process

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Argumentations of choice of the studio

The ability to shape my design proposal around a topic of personal interest and create my own assignment was a key reason for choosing the Architectural Engineering studio. I was also particularly drawn to the opportunity to work with timber, a material I am deeply passionate about, while benefiting from the studio's technical expertise in this area. Furthermore, the studio provides the freedom to seamlessly integrate theoretical exploration with practical, technical design, offering a comprehensive and balanced approach to developing my project.

Figure 1

Constant Flux
Own drawing

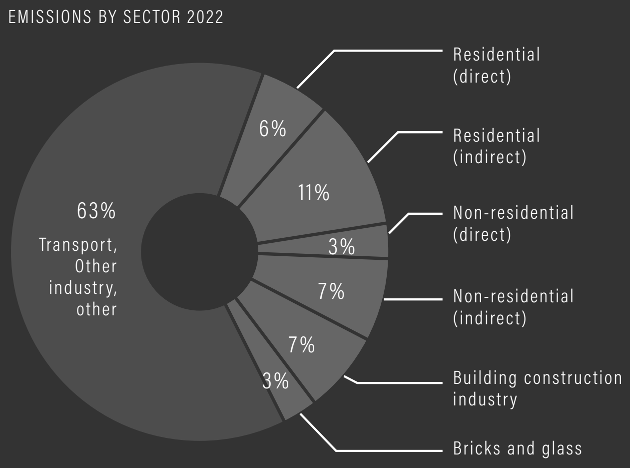


Figure 2

CO2 Emission
Redrawn. (UNEP, 2024)

The main characteristics of our nature is constant flux (Figure 1). We continuously produce, construct, destruct, preserve, discover and improve. Cultural values find new shapes at the speed of societal change. In this dynamic world, we are in a constant hustle to adapt ourselves to new realities and seek solutions to the problems we have created.

When discussing the built environment, we are now all aware of the construction industry's negative impact on our world. According to the UN Environment Programme, the buildings sector accounts for "37 per cent of energy and process-related carbon dioxide (CO_2) emissions" (Figure 2), significantly impacting climate change (United Nations Environment Programme [UNEP], 2024). In light of this, it is crucial not only to use environmentally responsible materials but also to build cleverly and, ideally, less.

In Western architecture especially, there is growing interest in concepts like material passports and an emphasis on the lifespan of buildings. Building lifespan can be understood through three broad categories: (1) physical lifespan, determined by the technical durability of major building components; (2) social lifespan, influenced by human demand, and legal requirements; and (3) functional lifespan, defined by the period before a building loses its functional value due to changes in societal or lifestyle needs (Ji et al., 2021). New buildings designed under these principles often serve as material banks, facilitating component reuse and incorporating careful planning for shearing layers—a concept popularized by Stewart Brand (1994). Within this framework, the longest lifespan typically belongs to the structure, which is predicted in Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) studies to last between fifty and one hundred years, depending on the type of structure (Ji et al., 2021). However, studies show a tendency toward declining lifespans, with newer buildings—those constructed within the last thirty years—having significantly shorter lifespans than the average across all construction periods (Andersen & Negendahl, 2022). These facts raise the question of what will happen to the building once it reaches the end of its predicted lifespan. Given the many unpredictable scenarios for the future, we cannot ignore either the natural deterioration of materials or the possibility of new demands emerging for the building's use. Therefore, it is essential to consider the continuity of the building and its components from the very beginning of the design process.

The research focuses on the critical aspects of continuity in the use of public buildings, exploring how contemporary notions of permanence connect to circular building strategies and the primary values that define buildings. Through this thesis, I seek to question and reshape the primarily Western conception of "permanence" as a critical response to the growing challenge of disposability in architecture.

?

How can a redefined understanding of permanence be integrated into contemporary public building to establish the continuity of the building and its components?

Subquestions

What are the different layers of permanence within this redefined concept, and how can they inform the foundational principles of architectural design?

How do these layers of permanence interact with sustainable design principles?

In what ways do traditional craftsmanship, joinery techniques, and maintenance practices contribute to the contemporary understanding of permanence and its layered approach?

What values ensure the buildings existence and continuity?

In what ways do traditional craftsmanship, joinery techniques, and maintenance practices contribute to the contemporary understanding of permanence and its layered approach?

Figure 3

Parthenon, Athens, GR

Maintenance work is visible on the back side of the Parthenon. Additionally, many original pieces from the building and its surroundings have been relocated to the nearby Acropolis Museum. Personal photograph, 2024.

Figure 4

Ise-Jingu, Ise, JP

The Ise Shrine in Japan, which has been rebuilt every 20 years for over 1,400 years (Rose, 2019).

Architecture fundamentally lies in the act of fixing elements in time and space. (Pavlidis, 2018). This act unfolds across different temporalities, which can be categorized into permanence and transience. In Latin, the state of permanence "permanent" finds a translation as permanēns, present participle of permanēre, per- (throughout), + manēre (to remain). It represents what remains through (time). In contrast to the short and dynamic human life, there has long been a drive to transcend our temporal limitations by creating something that lasts. In the built environment, this understanding of permanence often stays within the boundaries of materiality, which can never be identified as eternal. In the face of material decay, to what extent can we stay connected to the material world? Although it may not immediately evoke associations with permanence, the question of a building becoming obsolete or requiring a change in use is just as significant as material decay when discussing the realm of permanence.

Architecture often has the potential to outlast the human lifespan. However, people tend to consider architecture only within the limitations of their own lifetime, rarely thinking beyond these boundaries. This approach results in buildings closely tied to the immediate needs of their era. As a result, architecture is sometimes designed with limited foresight, lacking consideration for what may come next. One way architecture begins to transcend these temporal limitations is when it connects to collective memory, as seen in monumental buildings that carry shared history and identity. This connection to memory raises an important question posed by architect Edward Ford (1997): "Is modern architecture less durable than traditional architecture, and if so, is this a result of ideology, practice, or both?" Ford's question triggers a critical inquiry into the values and methods that influence the longevity of architecture today, highlighting how different perspectives and priorities can shape a building's future.

Cultural differences are, of course, unavoidable when defining durability and longevity, as each culture brings its own understanding of permanence, shaped by tradition, environment, and collective memory. For instance, in Western contexts, permanence is often associated with preserving a building's original form as an "eternal image," as exemplified by the Parthenon (Figure 3), even though it has undergone multiple maintenance procedures. In contrast, Japanese culture embraces the ephemeral qualities of materials and values the natural cycle of renewal, as demonstrated by the Ise Shrine (Figure 4), where periodic rebuilding becomes a ritual that grants the structure lasting significance.

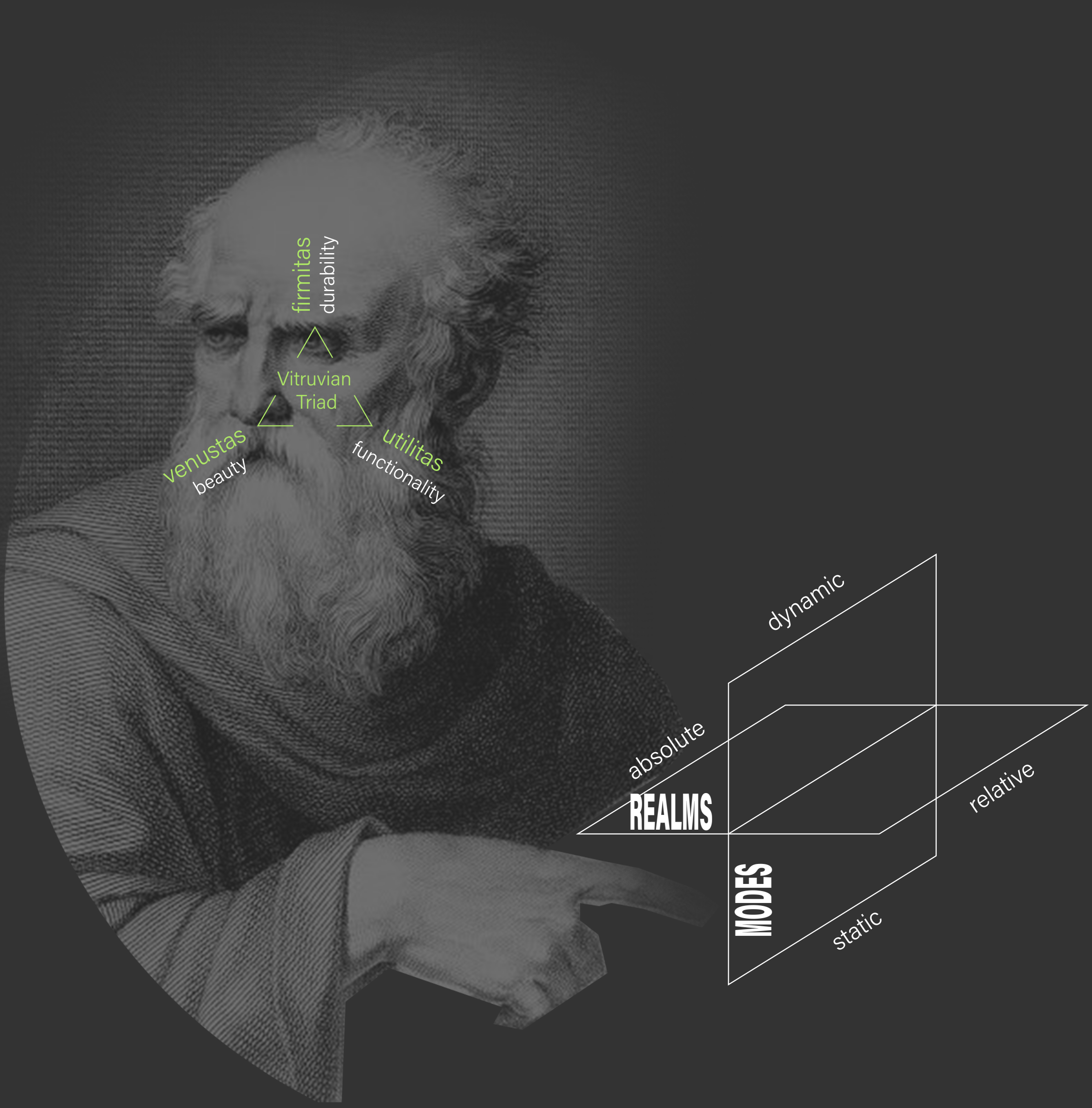


Figure 5

The contemporary concept of permanence
Created following the thoeory of K. Touw (2016).

Vitruvius' The Ten Books on Architecture is widely recognized as one of the foundational texts shaping Western notions of permanence in architecture. He identifies the essential qualities for lasting architecture through his Vitruvian Triad: firmitas (durability), utilitas (functionality), and venustas (beauty). For Vitruvius, the structural integrity of buildings is embodied in firmitas, linking material durability with a sense of eternity. This perspective on permanence aligns with what Katrina Touw (2006) describes as an "absolute" concept in her thesis. However, in a world where absolutes have been replaced by relativities, the concept of an absolute cannot be fully embraced or discussed without additional layers of interpretation. To address this, Touw unfolds the concept of permanence into different layers through realms and modes, allowing it to resonate within a contemporary context and providing a useful framework for analysing architecture. She identifies two realms of permanence, "absolute" and "relative," and two modes, "static" and "dynamic." (Figure 5)

According to Touw's distinction, the difference between absolute and relative realms lies in their orientation: while memories, images, and timeless ideals fall under absolute permanence, "our connection with natural cycles of life processes" (p. 11) characterizes relative permanence. As Touw notes, "Acknowledging that architecture requires a continuous influx of energy, in the form of maintenance, is critical towards understanding the relative permanence of architecture" (p. 11). The distinction between static and dynamic permanence lies in their approaches to longevity. Static permanence reflects traditional qualities, such as "continuity, stability, a tangible record of history, and a measurement of time" (p. 13). In contrast, dynamic permanence embraces "flexibility of location" (p. 13), allowing components to endure in new applications and locations. Through this adaptability, parts are integrated into other cycles, extending their relevance beyond their original context.

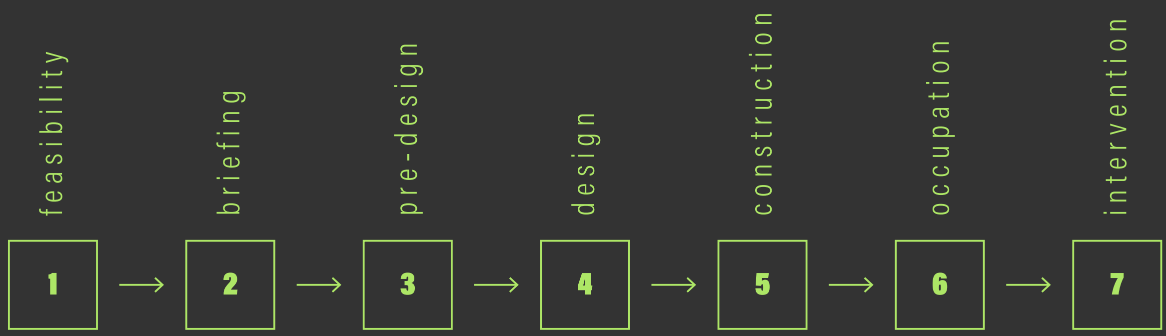


Figure 6

The building process stages
Redrawn from Pereira Roders (2007, p. 8).

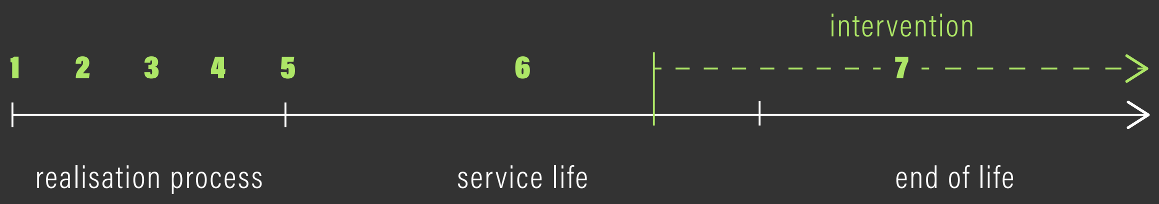


Figure 7

The building life timeline
Own drawing.

Pereira Roders (2007) examines how the design process reflects an architect's concerns and decisions, uniquely tailored to each building and its context. She argues that, although architects may handle information differently, they generally follow similar design stages (Figure 6). The feasibility stage assesses project viability, while the briefing stage translates constituent demands into a program of requirements. The design stage then focuses on transforming these requirements into design solutions, involving the measurement and comparison of variables. For a lifespan-oriented design, it is crucial to address the building's past, present, and future already during the pre-design stage, which is introduced between the briefing and design phases. This early consideration enables architects to make informed decisions regarding materials, form, and structure, ensuring a more conscious and adaptable approach. The realisation process concludes with the construction stage, after which the building's service life is defined by the occupation stage. During this stage, changes in the building's operational conditions may occur, potentially leading to an intervention stage that determines the building's end-of-life scenarios (Figure 7). Preparing for potential interventions from the outset ensures a truly lifespan-conscious approach. These interventions are scaled according to their impact on the building and are supported by circular building strategies (pp. 3-9).

ecological spiritual essential existential	**social** spiritual emotional (individual) emotional (collective) allegorical	**economic** use non-use entertainment allegorical
age spiritual essential existential	**values** other	**political** educational management entertainment symbolic
scientific workmanship technological conceptual	**aesthetical** artistic notable conceptual evidential	**historic** educational historic-artistic historic-conceptual symbolic archaeological

Figure 8

The primary cultural values
Redrawn from Pereira Roders (2007, pp. 103-126).

	1 very low	2 low	3 reasonable	4 high	5 very high
social	very unappreciated	unappreciated	neutral	appreciated	very appreciated
economic	very low cost-effective	low cost-effective	reasonable cost-effective	high cost- effective	very high cost-effective
political	highly unrepresentative building	reasonable unrepresentative	neutral	reasonable representative	highly representative
historic	building (involved actors)	neighbourhood, street	city, district	country, region	world, continent
aesthetical	very low creativity	low creativity	reasonable creativity	high creativity	very high creativity
scientific	very low production complexity	low production complexity	reasonable production complexity	high production complexity	very high production complexity
age	[25;50) 1st last generation	(50) 2nd last generation	(75) 3rd last generation	(100) 4th last generation	> 100 > 4th last regeneration
ecological	very low condition	low condition	reasonable condition	high condition	very high condition

Figure 9

The scale for rating the cultural values
Redrawn from Pereira Roders (2007, p. 198).

To make planning for the intervention stage more effective, Pereira Roders developed an assessment tool that allows designers to evaluate buildings in all their complex aspects. One of the key aspects considered is the primary cultural values, which play a crucial role in determining the lifespan of buildings through the building significance. The assessment tool identifies nine primary cultural values (Figure 8) to guide the evaluation process, each addressing a distinct aspect of a building's significance. Social values focus on the building's identity and its role within the community, while economic values assess its payability and financial feasibility. Political values pertain to the building's symbolism and its representation of governance or power. Historic values emphasize the authenticity of the building and its connection to the past, whereas aesthetic values highlight its creativeness and artistic qualities. Scientific values address the building's ingenuity, reflecting advancements in design or technology, and age values acknowledge the patina developed over time, contributing to its historical and visual character. Ecological values consider the building's continuity and its environmental impact. Finally, the ninth category serves as a place holder for other primary cultural values not explicitly covered by the previous categories. (p. 103)

Another important consideration is the early identification of a building's main purpose during the pre-design stage. If the acceptance of future interventions is recognized as intrinsic to the building's nature, neither the loss of cultural values nor structural values should become a point of contention. Instead, these interventions can be embraced as a natural part of the building's evolving lifecycle. Through these interventions, the building's values can be readjusted or redefined, ensuring its continued relevance and adaptability over time.

Figure 10

Strategies and interventions
Own drawing.

The concept of open building is considered the basis of adaptive design reuse strategies. Later on people started to search for more methods to analyse buildings compositions and interrelationships among its components, systems, and layers. The building layers model is a widely recognized framework in the literature, enabling adaptability by categorizing a building into layers based on the similar lifespans of its components (Asker et al., 2021). After Brand (1994) has expanded Frank Duffy's model of building layers concept into six "Shearing Layers": site, structure, skin, services, space plan, and stuff, Schmidt and Austin (2016) further refined the model to include nine layers: surroundings, site, structure, skin, services, space plan, stuff, space, and social, enhancing the understanding of a building as a dynamic and adaptable system.

The Circular Building (CB) concept, derived from the principles of Circular Economy applied to the building sector, enables change without loss material quality. It highlights the importance of adaptable buildings, positioning Design for Adaptability (DfA) as a fundamental enabler for achieving circularity (Asker et al., 2021, p. 20). A circular model of consumption emphasizes the need to design buildings with adaptability in mind, integrating end-of-life scenarios as an essential component of the design process. To address these scenarios effectively, DfA goes hand-in-hand with the other CB strategies, such as design for longevity and durability, design for disassembly and deconstruction, standardisation and modular design, and material passports for facilitated reuse, to achieve close-looped systems (p. 21). Many scholars have worked on the description and categorization of adaptability dimensions. Among them, Schmidt and Austin (2016, pp. 68–83) classified these into six types of change, while Hamida, Jylhä, Remøy, and Gruis (2023) provide a comprehensive overview of various concepts, organising different interventions into ten distinct categories;

Adjustability refers to the ability to modify the spatial configuration of a building through minor interventions, often achievable by users within a short timeframe. Versatility, also known as multifunctionality, it denotes the capacity to use spaces for various purposes without requiring physical alterations. Scalability relates to the potential to expand the building's volume, either vertically or horizontally, or to merge and divide its spaces as needed. Movability refers to the ability to relocate or displace the building component. Dismantlability highlights the ability to disassemble building elements efficiently and without significant effort or damage. Convertibility refers to the capacity to repurpose a building for new functions, considering physical, legal, and economic constraints. While similar to versatility in offering multifunctionality, convertibility applies to the entire building, whereas versatility is limited to internal spaces. Recyclability/reusability focuses on the ability to facilitate the reuse or recycling of building materials. Refitability denotes the ability to upgrade or enhance building components and systems to improve their performance. Accessibility relates to the ease of accessing building components and systems for maintenance, reprocessing, or modifications. Modularity refers to the use of standardised, unitised, or prefabricated building components to create regular and adaptable spatial or physical patterns, both in layouts and systems.

03 methodology

The methodology for this research focuses on developing an evaluation system to serve as a tool for analysing case studies. This system is constructed based on literature reviews and theoretical insights into contemporary permanence and its connections to various adaptability concepts and strategies. The "Evaluation Axis" (Figure 11) comprises two main components. The first component addresses "how" and "what" type of permanence buildings achieve. The Permanence Matrix, inspired by a similar framework used by Hanlin Stuer, a former TU Delft student, forms the foundation of this component and is created based on Katrina Touw's concepts of contemporary permanence. This matrix serves as a foundation for defining the type of existence achieved by the buildings.

This analysis is conducted through the lens of four Main Circular Building Strategies, described by Askar, Bragança, and Gervásio (2021). Additionally, the framework is further refined by exploring relationships and connections with the interventions identified by Schmidt and Austin (2016) and Hamida, Jylhä, Remøy, and Gruis (2023). Together, these components provide a comprehensive framework for understanding permanence within the context of circular and adaptable building practices.

These ten adaptability dimensions show also relations to the main four strategies discussed earlier;

Relative dynamic permanence aligns with the principles of Deconstruction & Disassembly. This approach emphasizes that both components and the building are not location-bound, allowing for flexible reconfigurations and adaptations. While dismantlability serves as the primary intervention for this strategy, it is further supported by concepts such as movability (the ability to relocate dismantled components), recyclability/reusability, and refitability (enhancing the performance of detachable elements). Relative static permanence follows the characteristics of Longevity and Durability, focusing on maintaining the building's existence in its original location. This is achieved through adaptation and maintenance to extend its service life. To achieve this, the supporting interventions for this quadrant include versatility (enabling spatial change), scalability, adjustability (responding to user needs and changes), refitability, accessibility and convertibility. Absolute static permanence is associated with the concept of Material Passports. This strategy facilitates reuse by providing detailed, location-bound data for each specific component, ensuring that materials are statically documented. Key interventions supporting this strategy include recyclability/reusability and accessibility. Material Passports offer a comprehensive overview of the materials used in a building, enabling effective maintenance during its lifecycle and transforming the building into a potential material bank after its service life. Even in cases of relocation, the origin and detailed information of each component remain preserved, maintaining its static permanence. Absolute dynamic permanence is closely linked to Standardisation and Modularity. Standardisation promotes the reuse of products and materials. While modularity serves as the primary determinant of this strategy, this approach is further supported by interventions such as recyclability/reusability and dismantlability, which ensure that modular units can be handled effectively and with ease. The components forming these modular units can be regarded as absolute systems, as they maintain their integrity while being relocated (movability), preserving their dynamic characteristics.

The second component of the evaluation axis addresses "why" specific buildings are valued for continued existence. Each building possesses unique qualities and cultural values that serve people in distinct ways. This component examines the primary cultural values of the buildings. As previously discussed in the theoretical framework, Pereira Roders's (2007) evaluation tool is applied in this analysis.

Four case studies were selected for analysis, each demonstrating a continuous existence in distinct ways through their relationship with various adaptability strategies and dimensions. These projects were intentionally chosen to represent different parts of the Permanence Matrix, offering diverse insights into Circular Building (CB) strategies. Furthermore, they illustrate how buildings can achieve permanence while simultaneously embracing temporary aspects of existence.

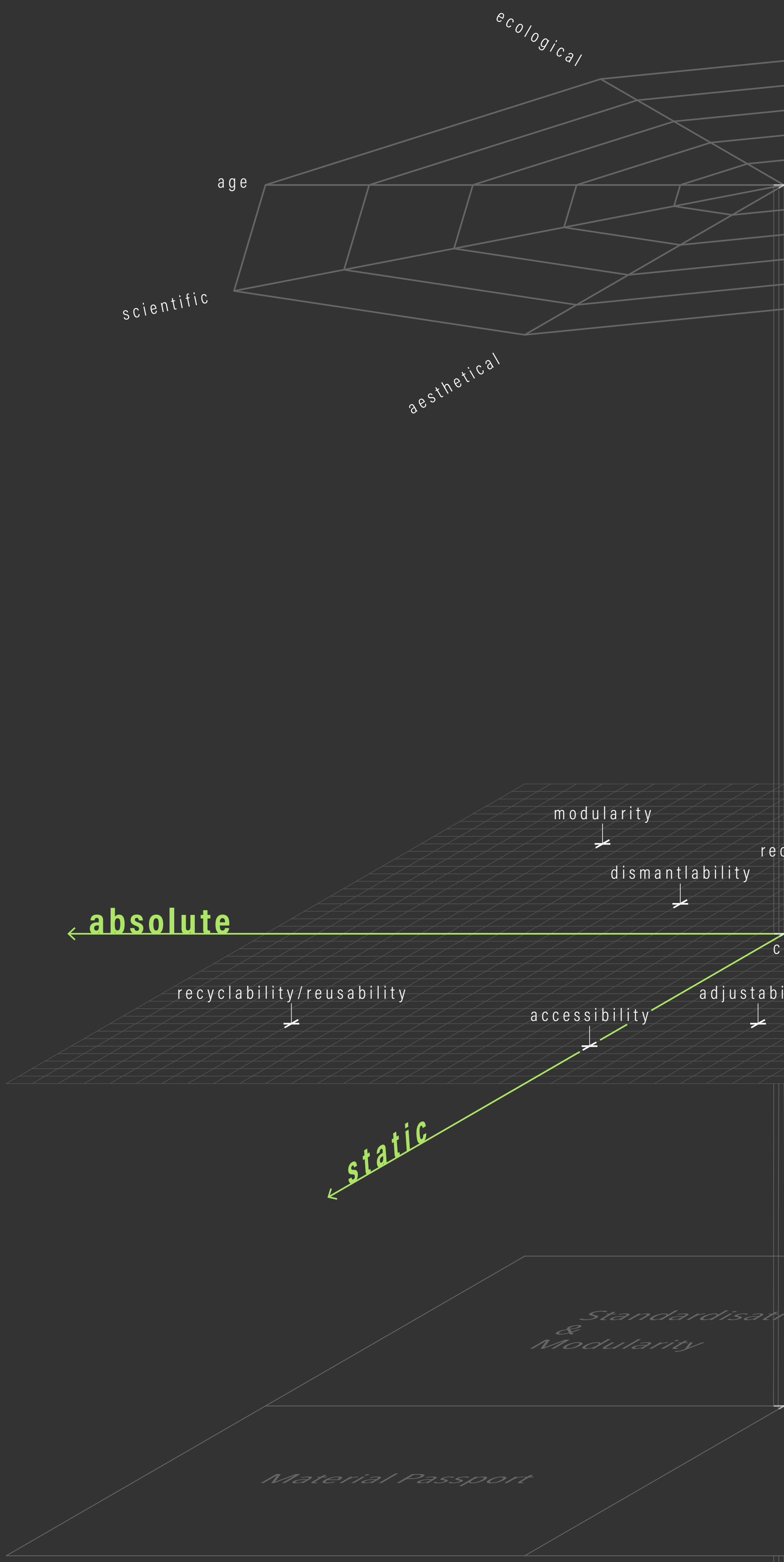
WHY

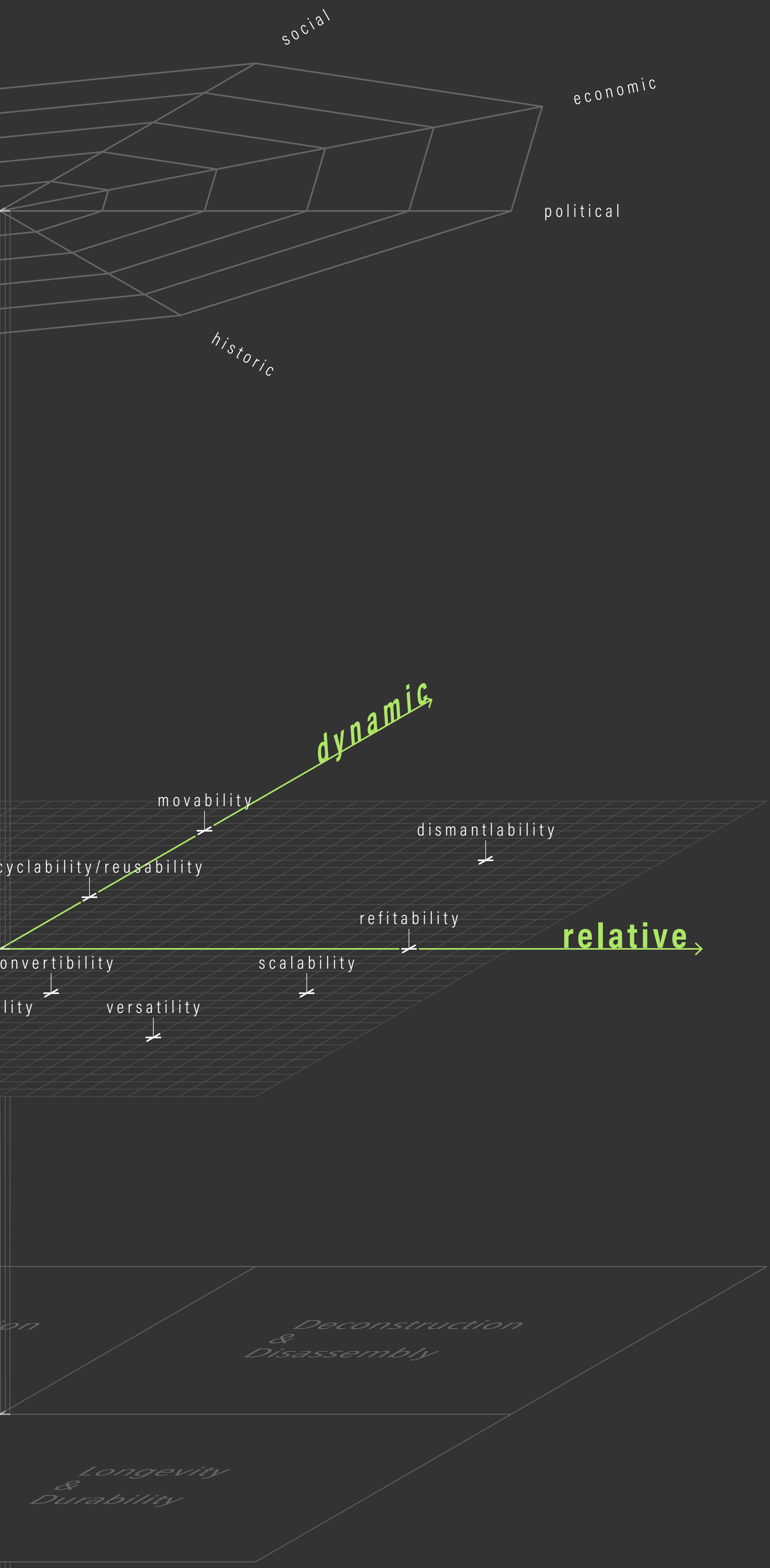
Primary
Cultural Values

HOW & WHAT

Layered
Permanence Matrix
with
Adaptability Dimensions

Main Circular
Building Strategies





social
economic
political
historic
aesthetical
scientific
age
ecological

modularity
adjustability
movability
recyclability/reusability
dismantlability
refitability
scalability
convertibility
versatility
accessibility

Service Life

End of Life

Standadisation & Modularity
Deconstruction & Disassembly
Material Passport
Longevity & Durability

Figure 11

Evaluation Axis
Own drawings.


Figure 12

Tamedia Office Building
Source: (Dezeen, 2023).


Figure 13

Ise Jingu
Source: (Rose, 2019).

Figure 14

Cardboard Cathedral

Source: (Barrie, 2013).

Figure 15

Matrix One

Source: (Baunetz Wissen, n.d.)

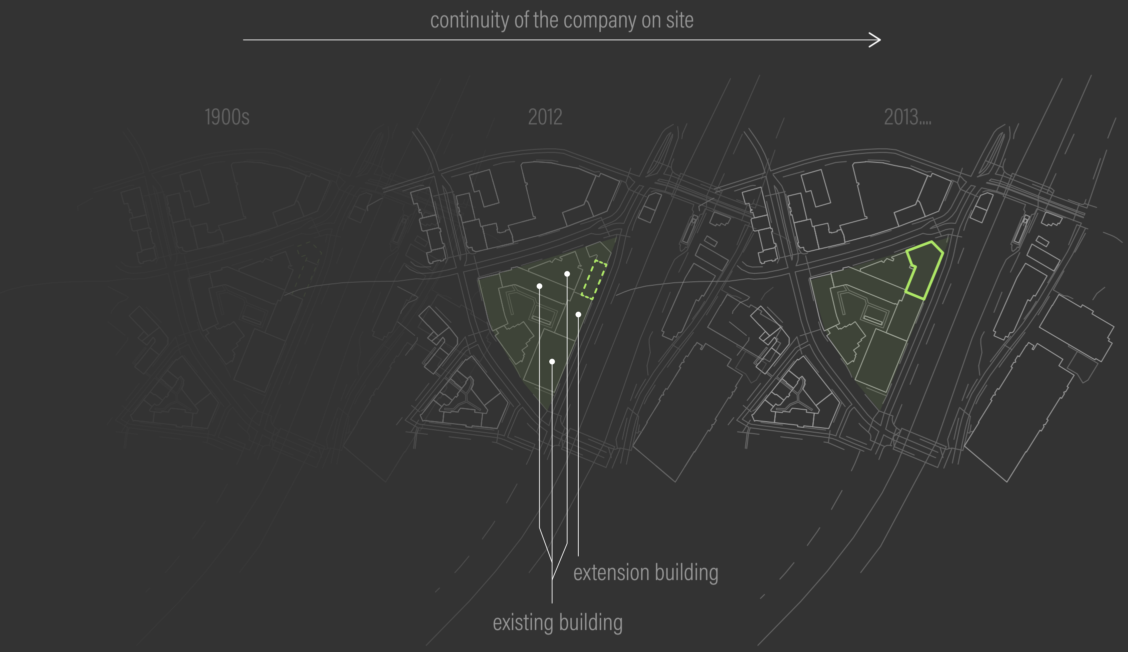
Tamedia Office Building

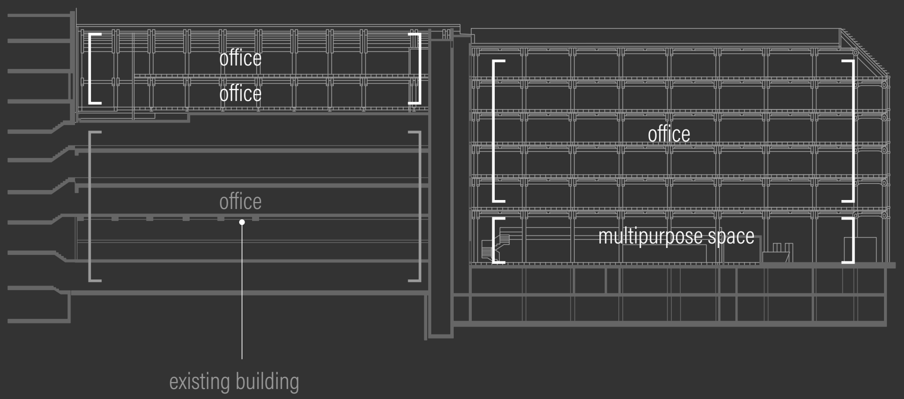
Year:	2013
Location:	Zurich, Switzerland
Program:	Office and Headquarter
Architect:	Shigeru Ban

The seven-story wooden building, designed to serve as the headquarters of Tamedia (Figure 12), stands as a testament to both architectural innovation and historical continuity. As the largest media company in Switzerland, Tamedia has occupied this site for over 100 years, reinforcing its long-standing connection to the location and its function (Lowenstein, n.d.). While it is expected that the building will continue to serve as office space in the foreseeable future, the potential for functional changes cannot be entirely ruled out. This project stands out for its rigid frame structure, that consists of entirely timber elements that constructed through dry connections. Its elaborate joints draw inspiration from Japanese miyadaiku carpentry, renowned for constructing some of the world's longest-surviving wooden structures, such as the over 1,000-year-old Horyuji Temple in Nara (Hahn, 2023). The structural system consists of a column positioned between two orthogonal beams, intersected by an oval beam to form a rigid joint. To enhance the frame's stability, the orthogonal beams are divided into three segments: two smaller spans of 3.2 meters at each end and a larger central span of 10.98 meters (Shigeru Ban Architects, n.d.). The smaller spans facing the street create a dynamic transitional space between the interior and exterior, accommodating lounges, private offices, and an open staircase that fosters spatial continuity across floors. The addition of a glass shutter façade allows the lounges to transform into semi-outdoor spaces, enhancing the building's versatility.

The building is the result of a collaboration between Shigeru Ban, who brought his distinctive design philosophy and expertise in traditional Japanese techniques, and Hermann Blumer, a expertise in innovative wood engineering. This partnership seamlessly integrates Japanese wood craftsmanship with Switzerland's carpentry heritage, demonstrating how traditional methods can redefine modern architectural possibilities (Lowenstein, n.d.). The project exemplifies the cross-cultural exchange of knowledge, pushing the boundaries of timber construction. The exposed structure and services make the building components accessible and refitable, supporting its longevity and durability. Additionally, the joinery techniques allow for easy maintenance, contributing to an extended lifespan. As a result, the building's service life can be associated with relative static permanence on the evaluation matrix. Although the building and its surrounding area have been used for office purposes for decades, its open floor plan allows users to adapt the spaces to meet changing needs. Additionally, the large central span offers flexibility for future functional changes, supporting convertibility and versatility. These characteristics promote continuity of use, making the building inherently durable even at the end of its life cycle (EOL). Furthermore, the dry joints allow the wooden structure to be dismantled, with the potential for its frames to be recycled or reused in other projects.

From the perspective of its primary cultural values, the Tamedia building stands out scientifically (5), exemplifying advanced engineering and construction techniques. Aesthetically (4), it achieves high value by showcasing craftsmanship through its visible timber joints and innovative design. Although Tamedia serves as the headquarters for Switzerland's largest media company, its importance remains primarily functional and symbolic within the local community (Social Value: 3). The building's ecological value is significant (4), attributed to its use of renewable materials and dismantling features, though it is slightly limited by the scale of resource consumption and the absence of detailed energy efficiency measures. Its economic value is also high (4), as the long-term sustainability and reduced maintenance costs offset the initial investment, despite being 20% higher than comparable projects (Lowenstein, n.d.). Politically (2), the building holds little representational or governmental significance, as its impact is primarily within the corporate sector. Historically (1) and in terms of age value (1), the building's significance is modest, as it lacks historical depth and longevity. Despite these limitations, the Tamedia building remains a noteworthy example of modern timber construction, combining innovation with sustainability. (Figure 16)



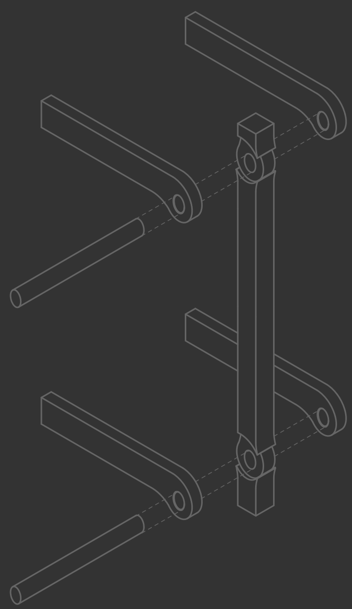


traditional japanese joinery techniques

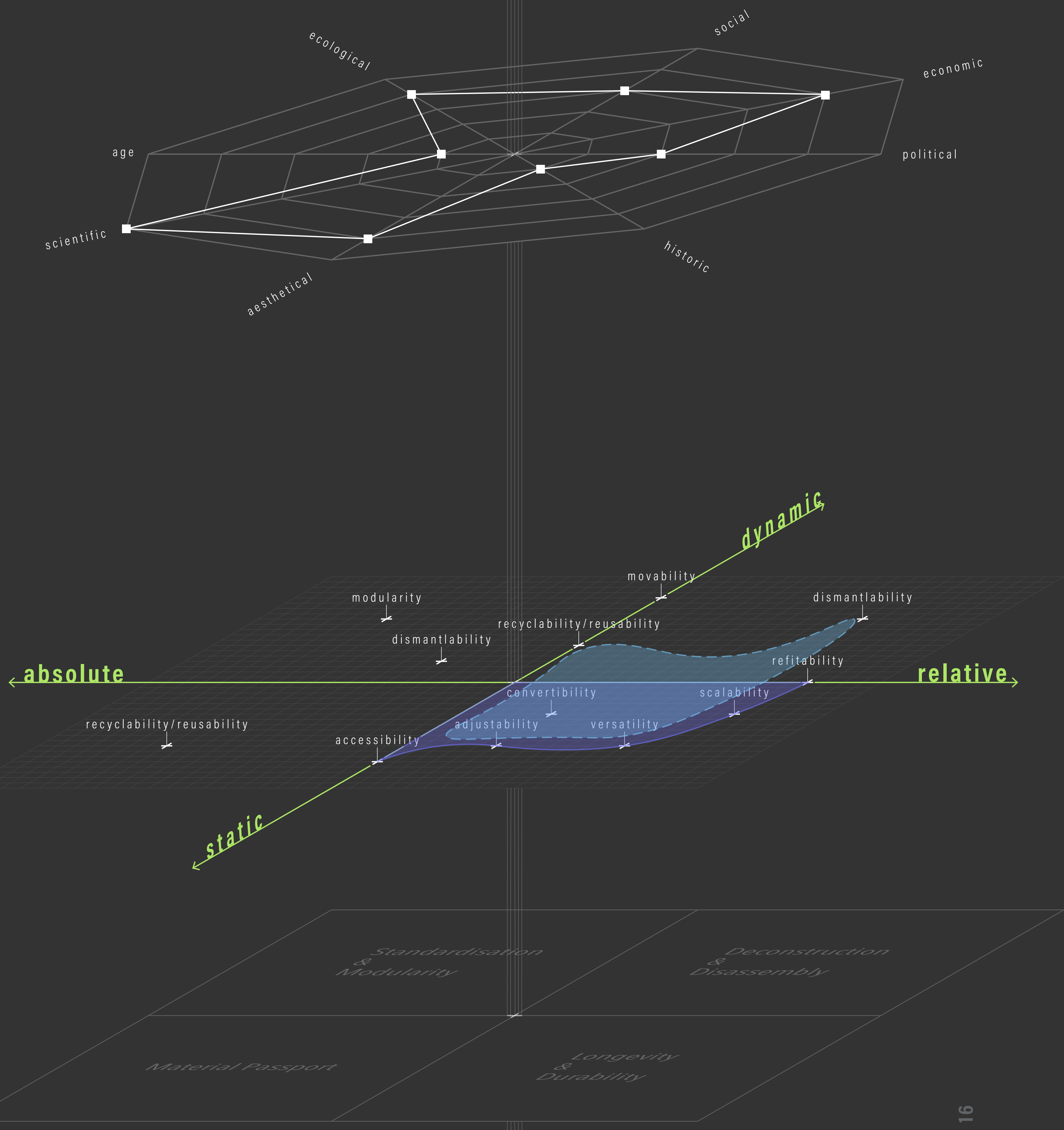
+

swiss carpentry history and modern technologies

knowledge translation



DETAIL



Evaluation - Tamedia Office Building
Own drawings and the evaluation axis.

Figure 16

Ise Jingu Temple

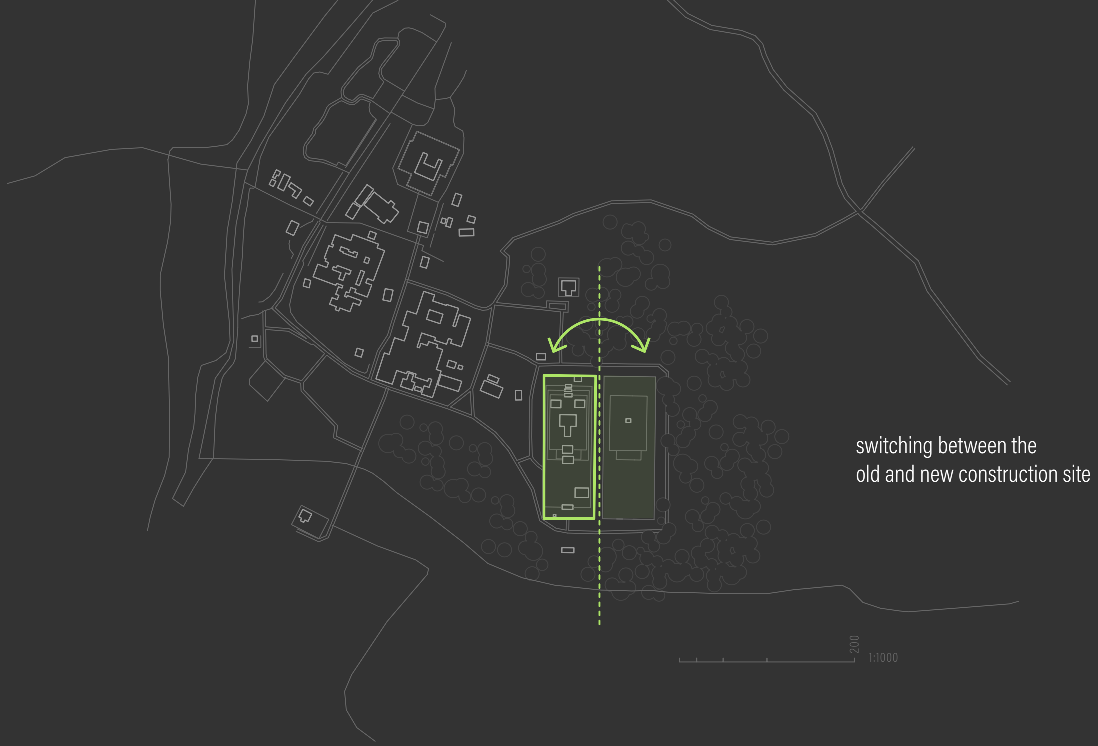
Year:	-
Location:	Ise, Japan
Program:	Temple
Architect:	-

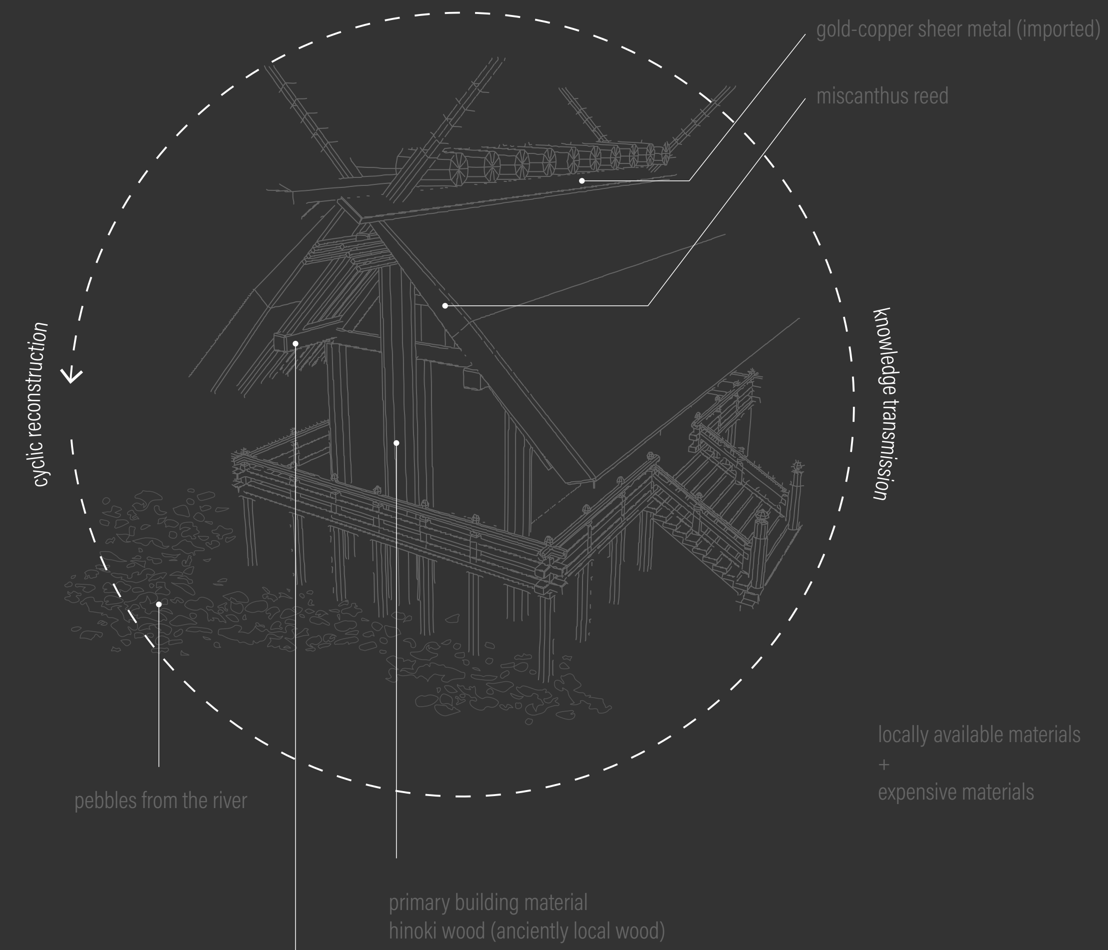
One of Japan's most famous temples, Ise Jingu (Figure 13), demonstrates a unique form of permanence by leveraging the potential of timber. The 1,300-year-old shrine is completely rebuilt every 20 years through ritualistic processes, contributing to Japan's cultural heritage as one of its most sacred and significant traditions. This cyclic reconstruction makes the temple a unique case for evaluating layered contemporary permanence. However, Ise's cyclic reconstruction is not the only example in Japan. These rituals, and the timing of the reconstruction cycles, are carefully designed to ensure that construction technologies and craftsmanship techniques are transmitted to future generations.

The materials used for the shrine reflect a contrast in origin. While local resources such as river pebbles and Hinoki wood (traditionally sourced from the shrine's forest) are used, other components like gold-copper decorations and iron fasteners are produced at high costs using advanced technologies (Adams, 1998). All components, including treasures, are carefully handcrafted with precision (こうじょ, 2013). The main structure is constructed using Kanawatsugi joints, which are assembled on-site. Since the shrine alternates between two adjacent plots, there is always a moment where the old and the new coexist. This process embodies the principles of no-trace architecture, as even the foundation leaves no permanent imprint on the site.

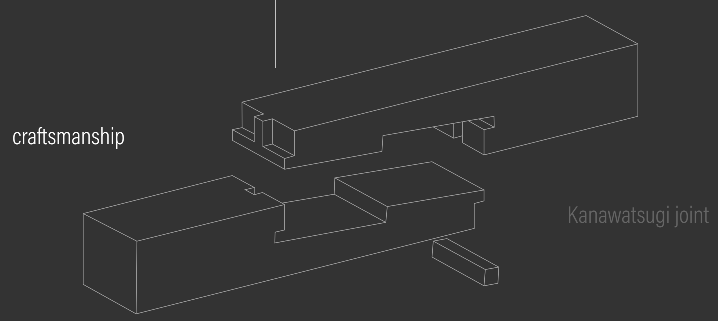
Although the primary goal is not to create a material passport, the shrine exhibits characteristics of absolute static permanence. While the physical structure is not the original, each reconstruction reproduces the exact same building. This reflects an absolute entity—in this case, the ritual itself and the symbolic idea of tradition—preserved and carried over centuries, bound to its specific location. At the end of each cycle, the components are carefully dismantled, and the materials are typically repurposed for use in other nearby shrines.

The Ise Shrine is deeply embedded in Japan's cultural and spiritual identity. Socially, it is widely appreciated as a symbol of Shinto belief and fosters strong communal connections, making it significant on a global scale (Social Value: 5). Its reconstruction tradition contributes to its historical significance (5), as it reflects centuries of continuity in rituals and cultural practices. The shrine's architectural and material qualities greatly enhance its aesthetic value (5), and the advanced traditional carpentry techniques used in its construction make it highly scientifically valuable (5) (Adams, 1998). Economically (3), while the rebuilding process involves high costs, the tradition supports local craftsmen and sustainable practices, striking a balance between cost-effectiveness and cultural value. The cyclical rebuilding of the physical structures limits their age value (2), but the continuity of the practice itself slightly elevates its significance. Politically, the shrine holds a representative status (Political Value: 4) due to its imperial heritage and role as a symbol of national identity. Finally, in terms of ecological value (4), the rebuilding process demonstrates harmony with nature by utilizing renewable resources and sustainable practices. However, rebuilding the shrine before the natural lifespan of the materials ends slightly reduces its ecological rating. (Figure 17)


switching between the
old and new construction site
200
1:1000


gold-copper sheer metal (imported)
miscanthus reed
cyclic reconstruction
knowledge transmission
pebbles from the river
locally available materials
+
expensive materials
primary building material
hinoki wood (anciently local wood)

DETAIL


craftsmanship
Kanawatsugi joint

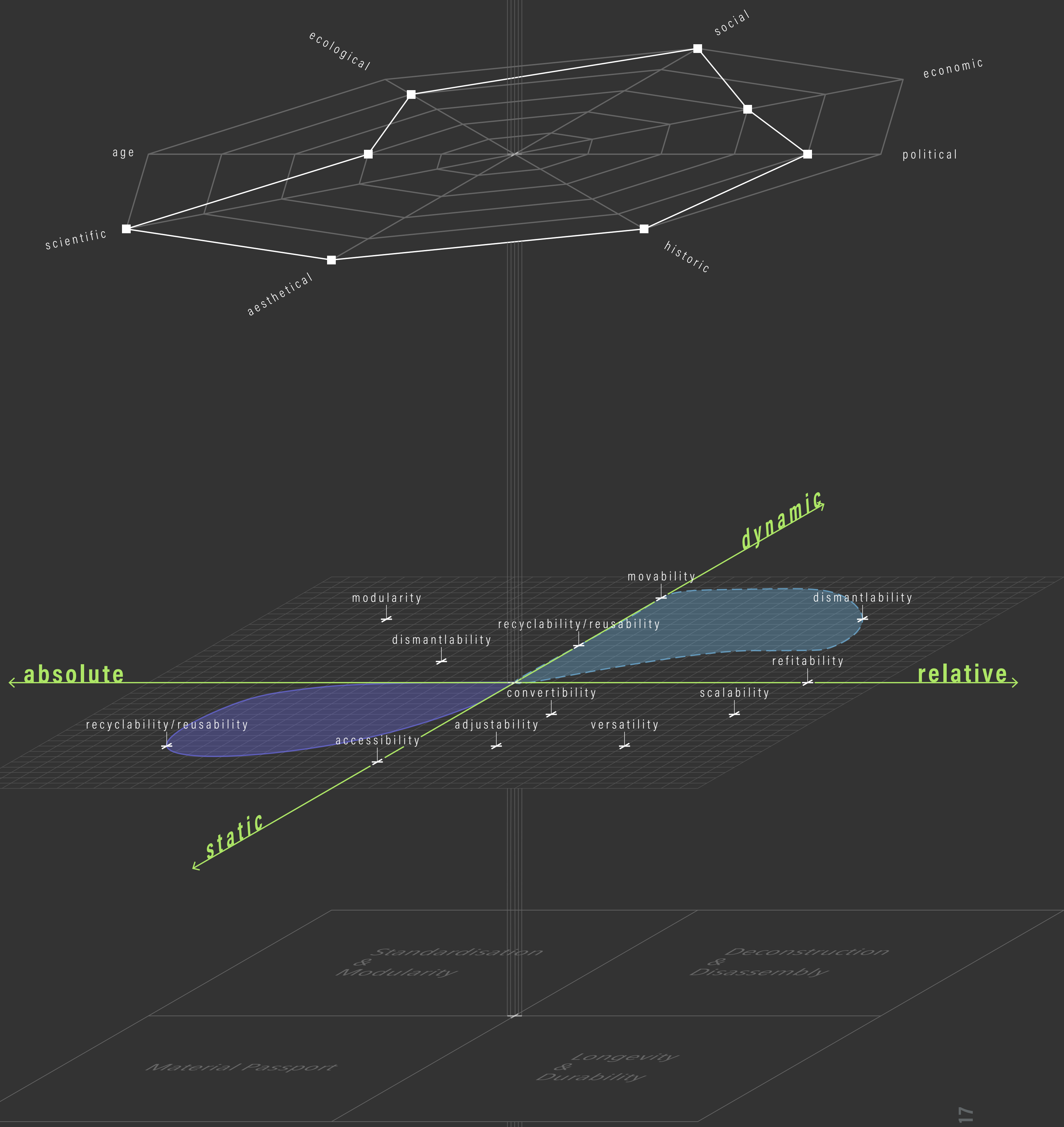


Figure 17

Evaluation - Ise Shrine
Own drawings and the evaluation axis.

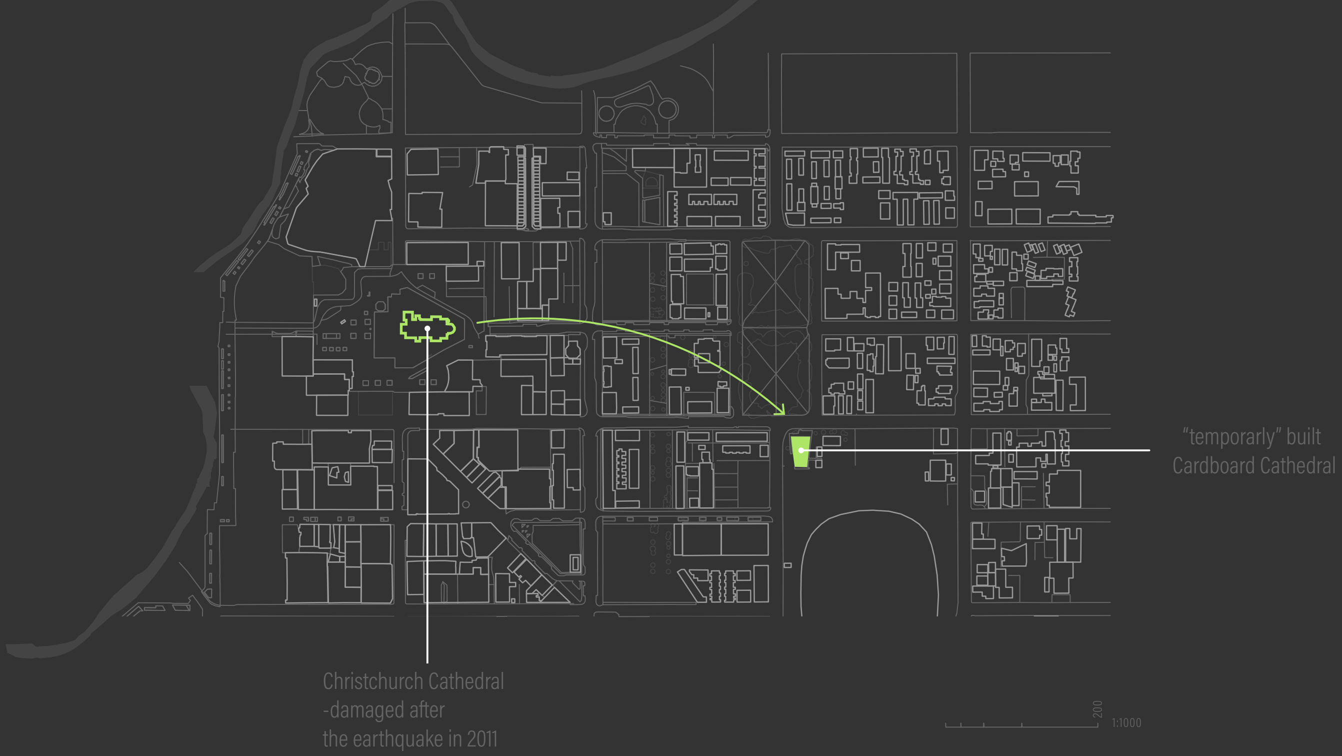
Cardboard Cathedral

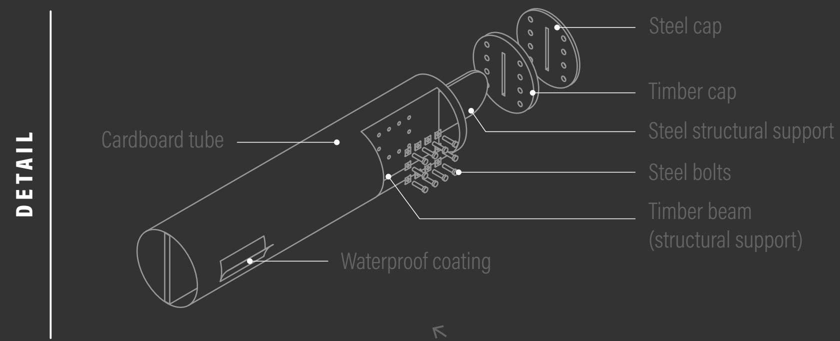
Year:	2013
Location:	Christchurch, New Zealand
Program:	Place of Worship
Architect:	Shigeru Ban Architects

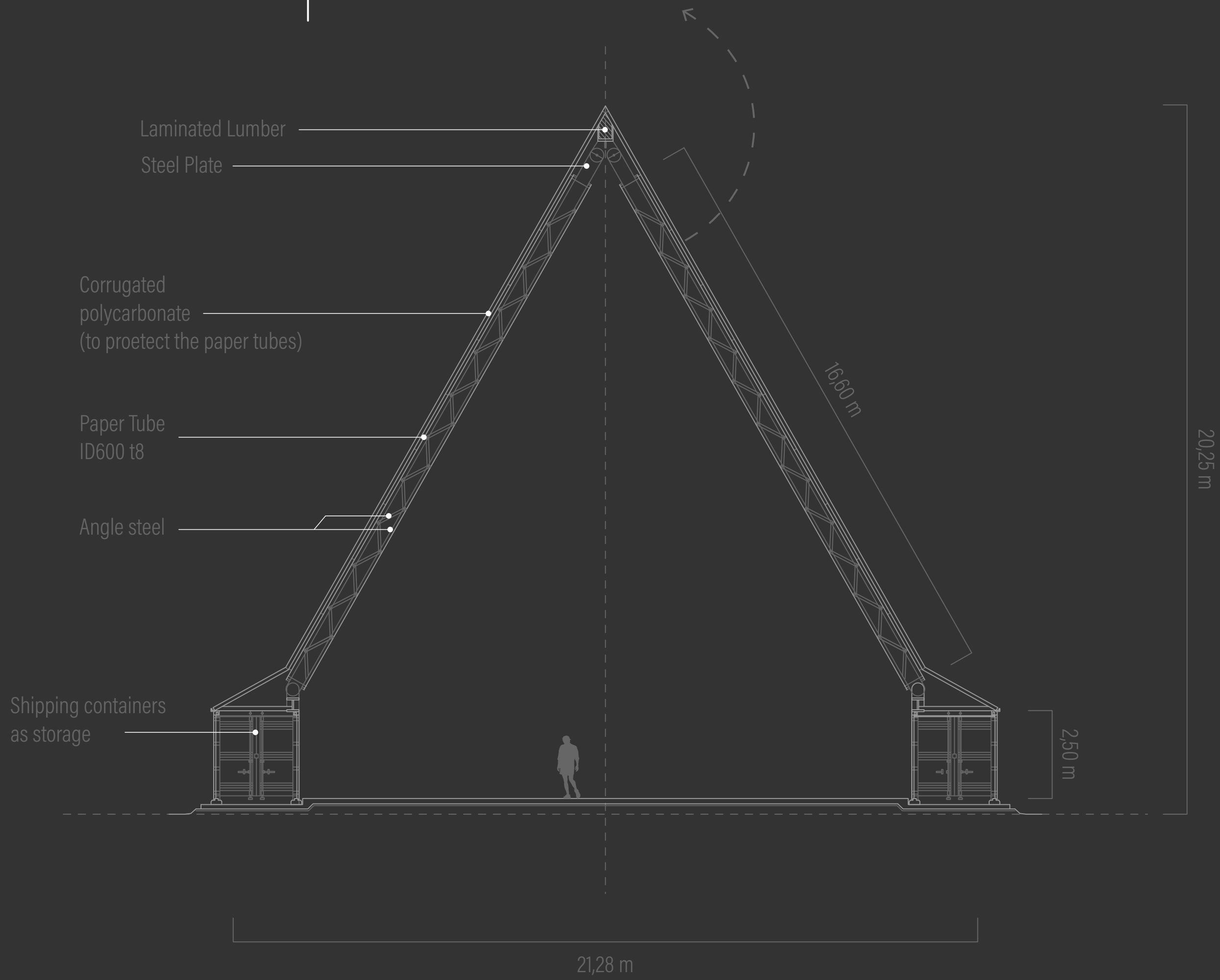
The Cardboard Cathedral (Figure 14) was built as a temporary replacement for the Christchurch Catholic Cathedral, which was extensively damaged in the 2011 earthquake. The name comes from the paper tubes used as the main structural elements. Additional to tubes, shipping containers and a lightweight skin form constitutes "the key elements of Ban's emergency architecture" (Barrie, 2014). These materials translate the geometry of the old cathedral into a new design that symbolizes revival and resilience after the disaster. The design is cost-efficient and easily assembled. The paper tubes, in particular, are lightweight, economical, renewable, adaptable, and capable of resisting water and fire once coated (Ward, 2013). Although the tubes are sturdy enough to support the A-frame structure, they had to be modified to withstand the strong winds of New Zealand. Locally sourced laminated veneer lumber (LVL) rafters were inserted inside each of the 98 tubes (610 mm in diameter and 23 meters in length) for additional support. However, challenges arose construction. Heavy rain damaged the tubes, leading to their replacement and the addition of polycarbonate lids for protection (MaterialDistrict, 2013). Despite this setback, it demonstrated the building's ability to accommodate maintenance, highlighting its refitability and accessibility. The shipping containers, used as offices and storage spaces (Barrie, 2014), also provide structural support, emphasizing the modular and flexible design of the building.

Planned with a lifespan of 10 years (Barrie, 2014), the design prioritized deconstruction and disassembly, utilizing standardized and modular elements. This gives the building a dynamic permanence quality, both in absolute and relative terms, for its intended service life. However, during its service life, the building received widespread appreciation, leading to the decision to retain it permanently. As a result, the building shifted its primary EOL strategies toward longevity and durability, while maintaining the potential for deconstruction at any time. Thus, the building exemplifies qualities of both dynamic and static permanence within the realm of relativity.

From the perspective of its primary cultural values, the Cardboard Cathedral stands as a significant symbol of resilience and recovery for the Christchurch community. It serves as a gathering space for worship and cultural events and is deeply appreciated at the local and national levels (Social Value: 4). Although the materials aimed for affordability, challenges such as finding a local producer for the cardboard impacted costs (Economic Value: 4). Politically (3), its value is neutral, reflecting its community-driven focus. The building is relatively new (Age Value: 1) but has made a notable impact on the regional scale (Historic Value: 4). Scientifically (4), its use of simple yet effective structural materials contributes to its innovative and sustainable design. Aesthetically (4), the cathedral reflects a creative and resourceful approach. Its emphasis on renewable and sustainable materials ensures a high ecological value (4). (Figure 18)


"temporarly" built
Cardboard Cathedral
Christchurch Cathedral
-damaged after
the earthquake in 2011
1:1000


DETAIL
Steel cap
Timber cap
Steel structural support
Steel bolts
Timber beam
(structural support)
Cardboard tube
Waterproof coating


Laminated Lumber
Steel Plate
Corrugated
polycarbonate
(to proetect the paper tubes)
Paper Tube
ID600 t8
Angle steel
Shipping containers
as storage
16,60 m
20,25 m
2,50 m
21,28 m

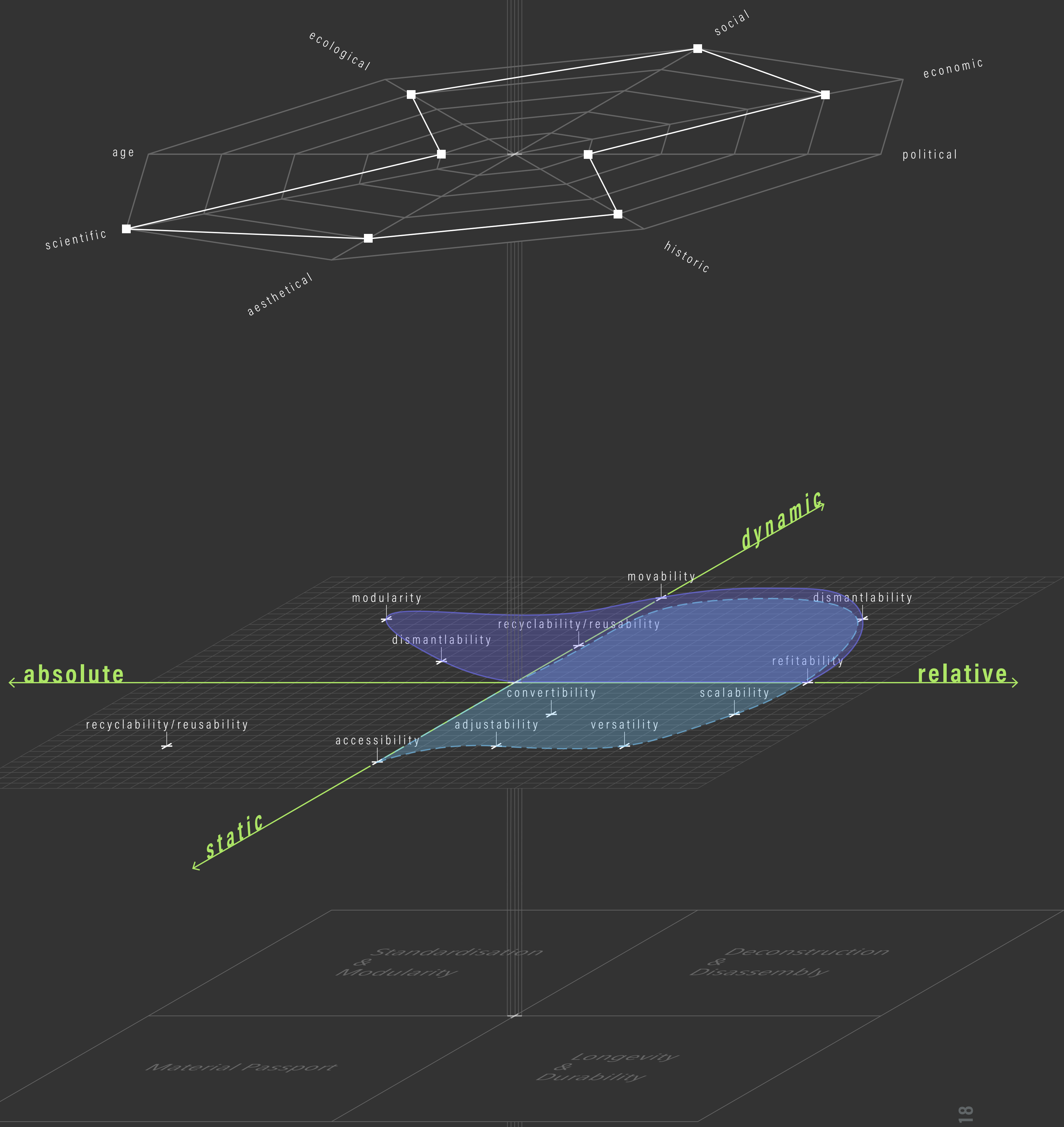


Figure 18

Evaluation - Cardboard Cathedral
Own drawings and the evaluation axis.

Matrix One

Year:	2013
Location:	Amsterdam, the Netherlands
Program:	Laboratory and Office Building
Architect:	MVRDV

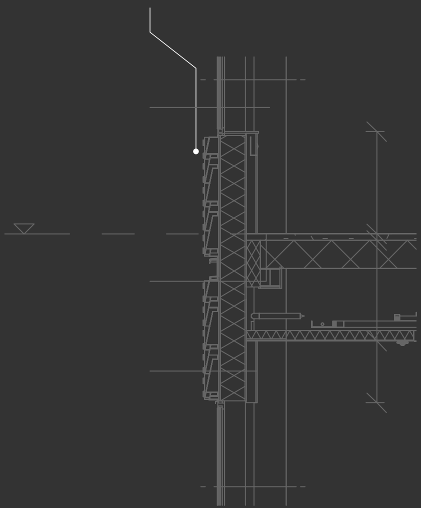
Matrix One (Figure 15), designed by MVRDV, has served as a laboratory and office building in the Amsterdam Science Park since 2023. This six-story building features a steel frame structure constructed using simple bolt-and-screw connections, making it fully demountable. The floors are composed of prefabricated concrete slabs with thin steel bracing and no fixed connections, while the surface materials are 95% bio-based and renewable. The floor plan follows a 1.8m x 1.8m grid, offering flexibility to adapt room sizes by moving, adding, or removing walls (Baunetz Wissen, n.d.). This flexibility allows spaces to serve various purposes, such as converting offices into labs or meeting rooms, reflecting the building's versatility. The building's mechanical services have been intentionally left exposed and visible, making them easier to access and maintain. Additionally, 1,000m2 of solar panels installed on the roof contribute to the building's energy performance, supporting its nearly energy-neutral operation. Natural ventilation is achieved through an opening at the entrance and the central social staircase, which promotes air circulation throughout the building. The building also boasts an extremely low CO2 footprint. Over 90% of the building is demountable, with all materials traceable through a material passport stored in Madaster (MVRDV, n.d.). This ensures that components can be reused in future construction projects without quality loss, positioning the building as a material bank.

On the Permanence Matrix, Matrix One occupies the absolute static quadrant due to its material traceability and its potential to serve as a resource for future projects. At the same time, its emphasis on longevity and durability aligns with the relative static quadrant, supported by its adaptability dimensions. At the end of its lifecycle (EOL), nearly all components can be dismantled and relocated (relative dynamic), while retaining data about their origins (absolute static).

From a cultural values perspective, Matrix One serves as a hub for researchers, scientists, and students at Amsterdam Science Park. However, its impact is primarily confined to the academic community, limiting its broader societal significance (Social Value: 3). The building's circular design and modular construction reduce long-term maintenance costs, enhancing its economic value (4) despite higher initial construction costs. As the centerpiece of the Matrix Innovation Center, the building carries a representative identity, but this is contextually limited to its academic and research environment (Political Value: 3). Being a newly constructed building, its age value (1) and historic value (1) are minimal. Aesthetically (3), Matrix One offers reasonable creativity with its practical and efficient use of materials, though aesthetics are not its primary focus. The building's true significance lies in its scientific value (5) and ecological value (5). Matrix One is nearly energy-neutral, carries the BREEAM "Excellent" certification, and exemplifies cutting-edge principles of circular construction and sustainability. (Figure 19)

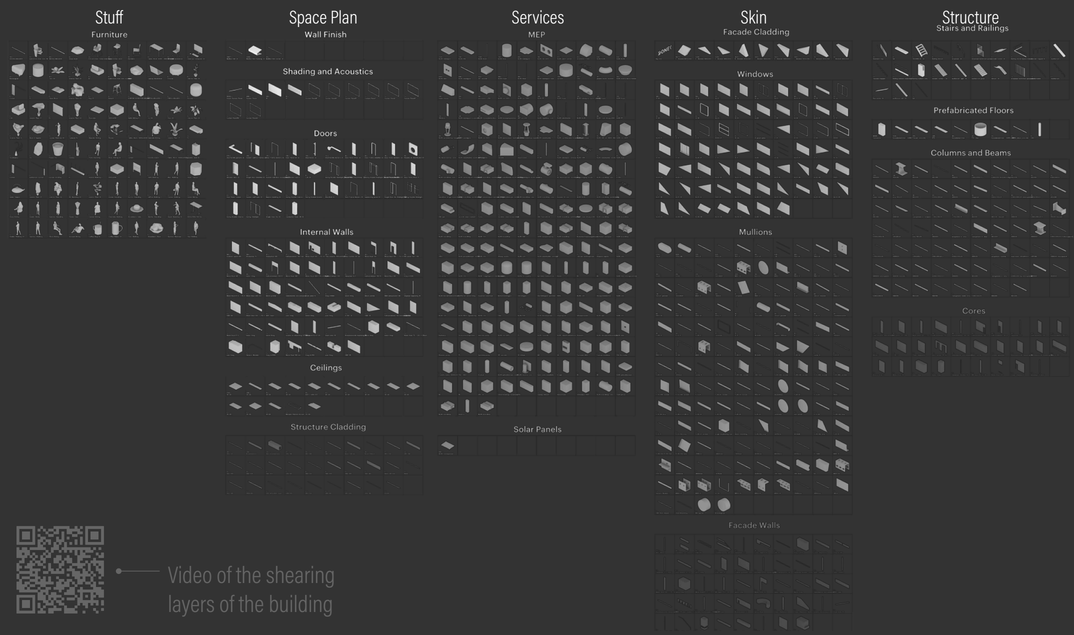
DETAIL

easily demountable and ready to reuse
facade elements (aluminum modules)



a 1,8m x 1,8m grid allows the
functions to be adapted

Brand(1994) Shearing Layers - Circular Inventory



Video of the shearing
layers of the building

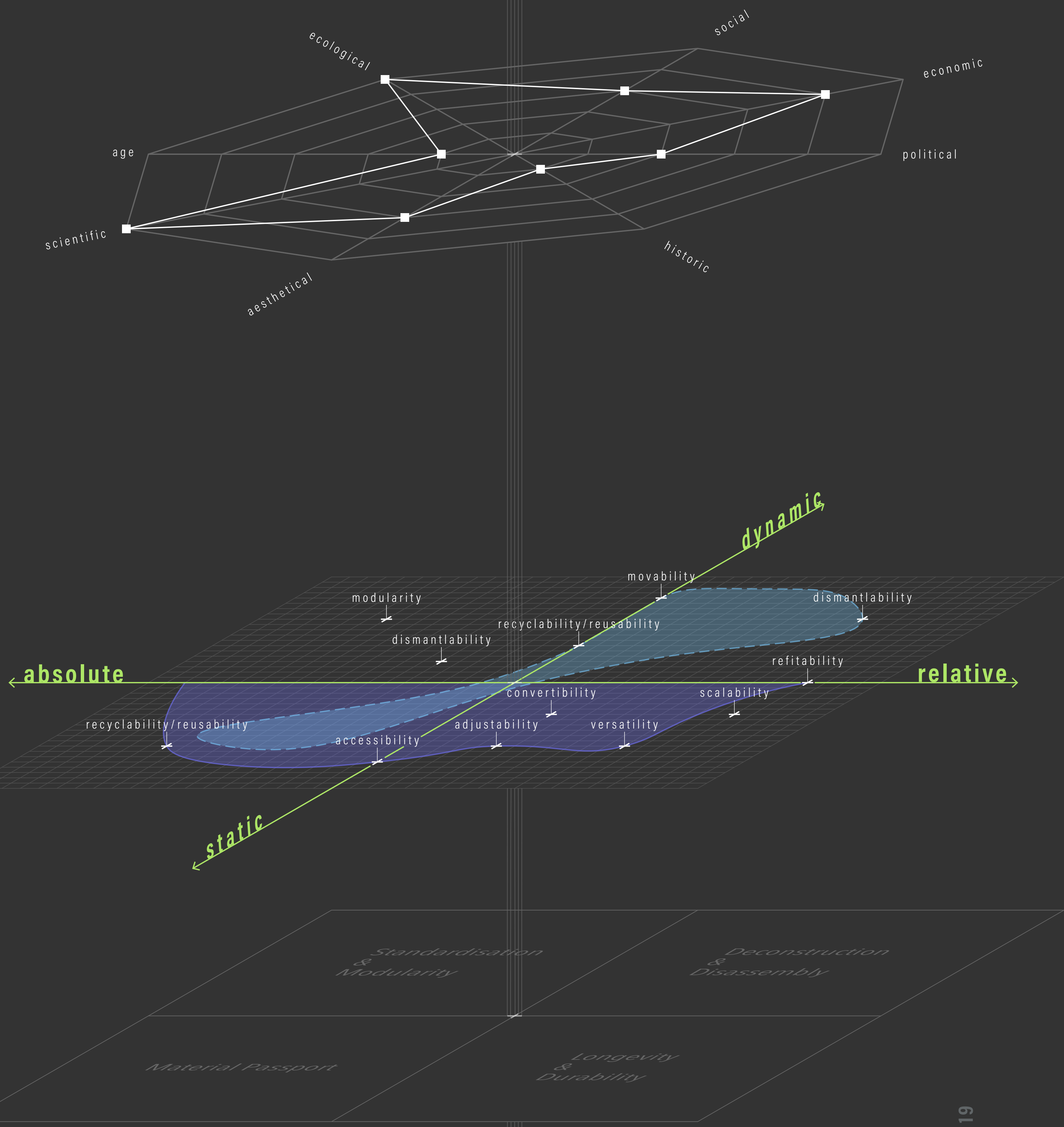
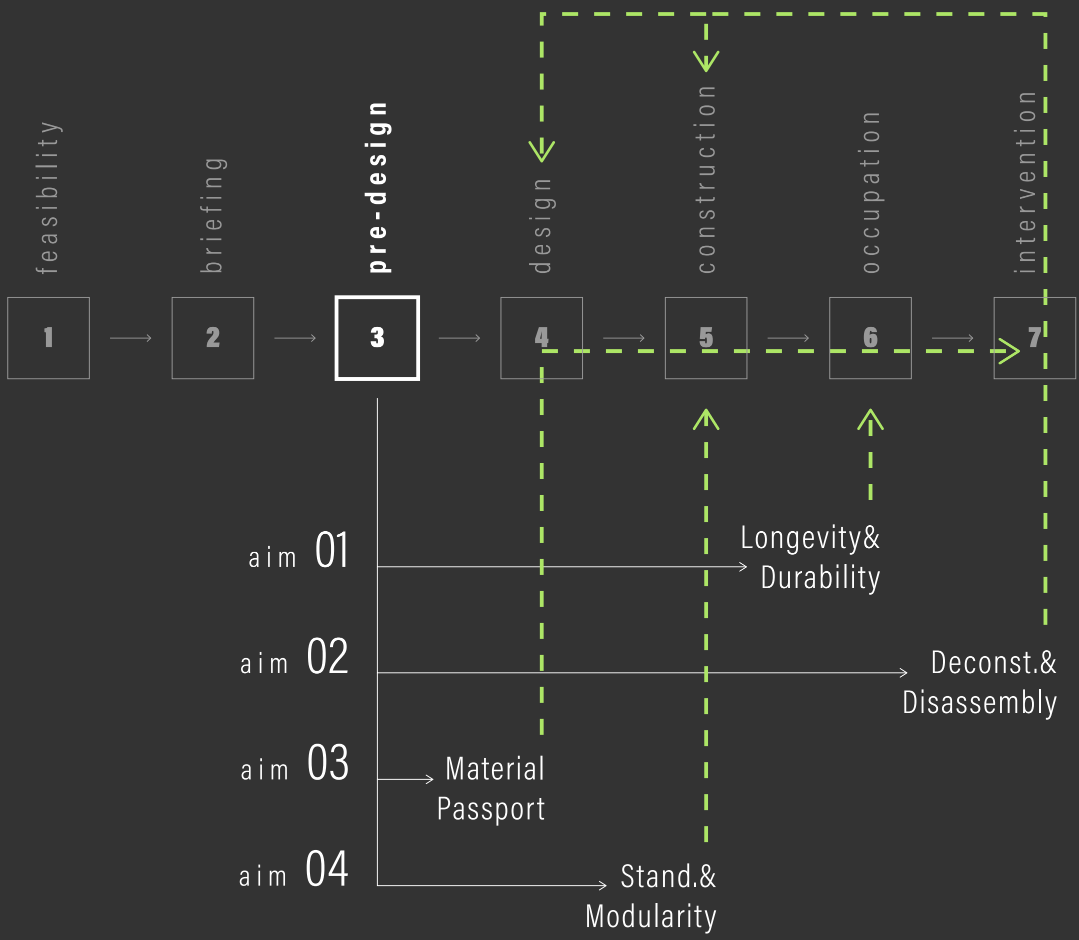


Figure 19

Evaluation - Matrix One

Own drawings and the evaluation axis.

05 conclusion initial design framework



aim 01

convertibility	⟶	function	raised floors + dropped ceilings + multifunctional spaces
scalability	⟶	size	modular units + dividable rooms + grid + local materials + structural redundancy
versatility	⟶	space	movable walls + frame construction + storage space + variety of room sizes
refitability	⟶	performance	dry sonnections + coordinated systems + changeable components
accessibility	⟶	access	access points + flexible ducts + coordinated systems
adjustability	⟶	task	user control + plug and play elements + detachable connections

The adaptability concepts and strategies explored in this research redefine the notion of permanence in architecture, shifting it away from the typical Western understanding of static durability. Instead, permanence is approached through the lens of circularity, where buildings and their components continue to exist either in their original state through extended lifecycles and repairs (durability) or by transforming into new elements with different functions and improved performance. This layered understanding of permanence dissolves the linear lifecycle of "make-use-dispose" into a continuous loop, fostering true circularity in architecture. Such an approach not only reduces waste but also lowers costs and minimizes the ecological footprint (Asker et al., 2021).

Through the case studies, this research has demonstrated how various strategies—from modular construction to ritualistic renewal—can effectively respond to the challenges of material decay, evolving social needs, and sustainability. The Tamedia Office Building exemplifies the integration of traditional craftsmanship and modern techniques, showing how joinery and design for disassembly enhance longevity and adaptability. The Ise Shrine reveals the potential of dynamic permanence, where ritualistic rebuilding preserves cultural values and knowledge over centuries. The Cardboard Cathedral illustrates the power of temporary architecture to transition into permanence through community engagement and innovative material use. Lastly, Matrix One highlights how circular building strategies, such as material passports and modular design, can provide a foundation for future adaptability and resource conservation.

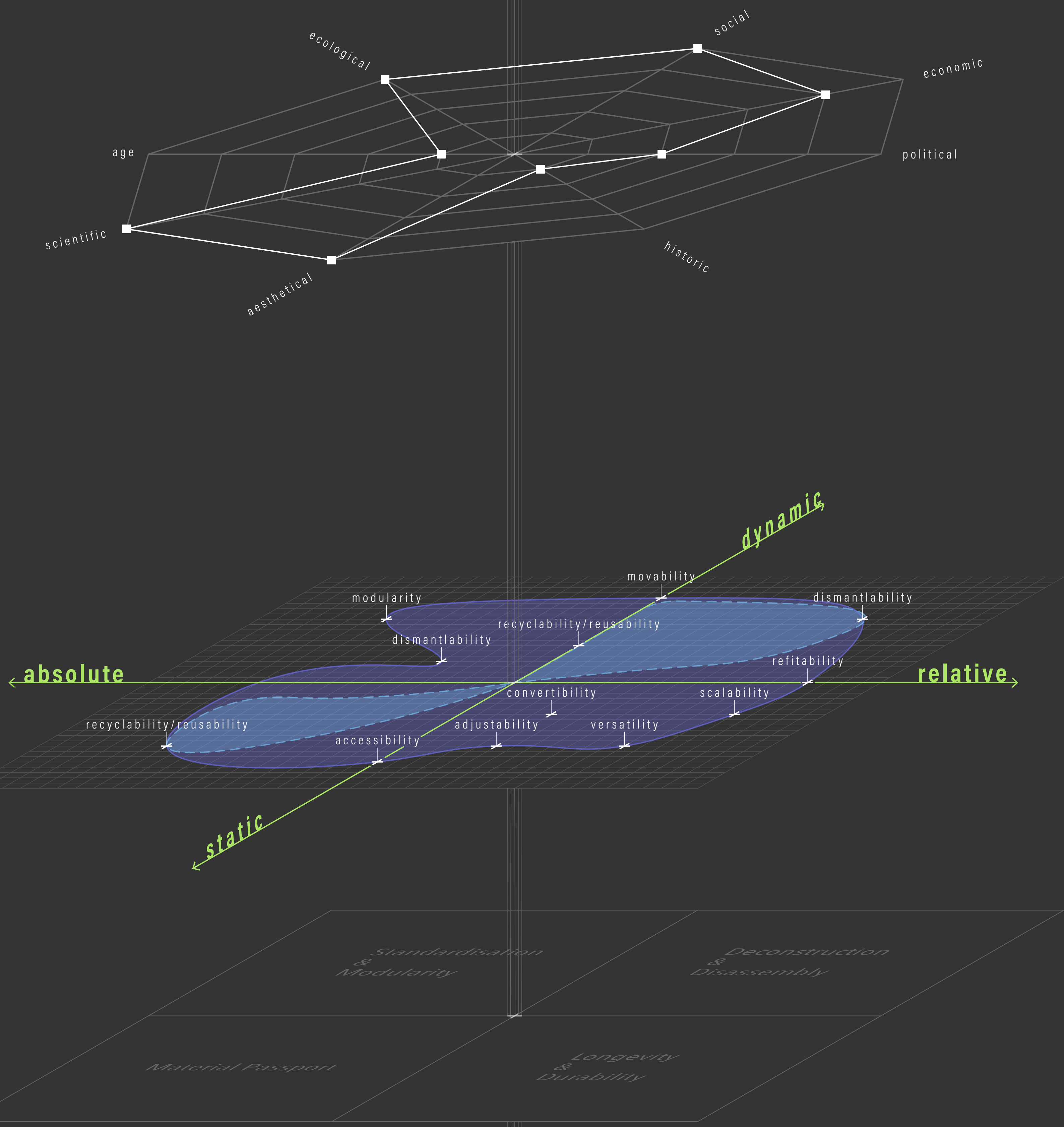
The proposed evaluation axis offers a valuable tool for designers, enabling them to determine their design goals and adopt specific circular strategies early in the design process. It emphasizes the interconnectivity between structural design and adaptability interventions, showing how structural decisions can either enable or hinder these strategies' application. The principles and strategies observed in the case studies form the foundation for a cohesive adaptable design approach, providing essential guidelines for the next stage of my design. By analysing these case studies, I have gained insights into the specific values that will define my building and have identified its position on the layered permanence matrix. These observations will guide critical design decisions, ensuring that the building aligns with the principles of adaptability and circularity.

05 **conclusion** initial design framework

Achieving balance among the four main circular strategies—longevity and durability, disassembly and deconstruction, modularity, and material passports—is crucial. Based on the findings from the case studies, the following design guidelines emerge: Starting the design process with a material passport ensures precise tracking and management of all components, providing designers with greater control over the design and its lifecycle. Additionally, incorporating modular elements into the design enhances construction efficiency and facilitates future modifications. As the building transitions to the occupation phase, the focus should shift toward ensuring its longevity and durability by prioritizing adaptable and maintainable structural elements. This can only be achieved if the building, organized by scale, is first convertible and/or scalable as a whole to accommodate changes in general function. Secondly, structural elements and mechanical systems must be accessible and refitable to facilitate efficient maintenance and component upgrades. At the spatial scale, the building should demonstrate versatility, enabling rooms to serve multiple purposes as needs evolve. At the user level, spaces should offer flexibility, allowing straightforward adjustments to suit individual preferences. Additionally, during the service life, interventions may become necessary, such as relocating the building due to environmental factors. In such cases, designing for disassembly and deconstruction becomes critical, with the ultimate goal of achieving a no-trace building with complete dismantlability at the end of its lifecycle (EOL).

As a result of the case studies, I also understood that buildings which achieve a sense of permanence tend to have higher scientific and ecological value. This is primarily accomplished through innovative structural designs and creative methods of assembling components. Age and historical significance play a lesser role in this context. Economic value is often parallel to scientific advancements, as efficient and adaptable designs minimize long-term costs.

Ultimately, this research highlights the transformative potential of adaptable architecture, where permanence is no longer tied to static immutability but to the dynamic capability of buildings to evolve, endure, and thrive within a circular framework. This approach not only reshapes our relationship with the built environment but also offers a sustainable path forward, addressing the challenges of disposability and ecological impact.


ecological
social
economic
age
political
scientific
historic
aesthetical
dynamic
movability
modularity
dismantlability
recyclability/reusability
dismantlability
absolute
refitability
relative
convertibility
scalability
recyclability/reusability
adjustability
versatility
accessibility
static
Standardisation
&
Modularity
Deconstruction
&
Disassembly
Material Passport
Longevity
&
Durability

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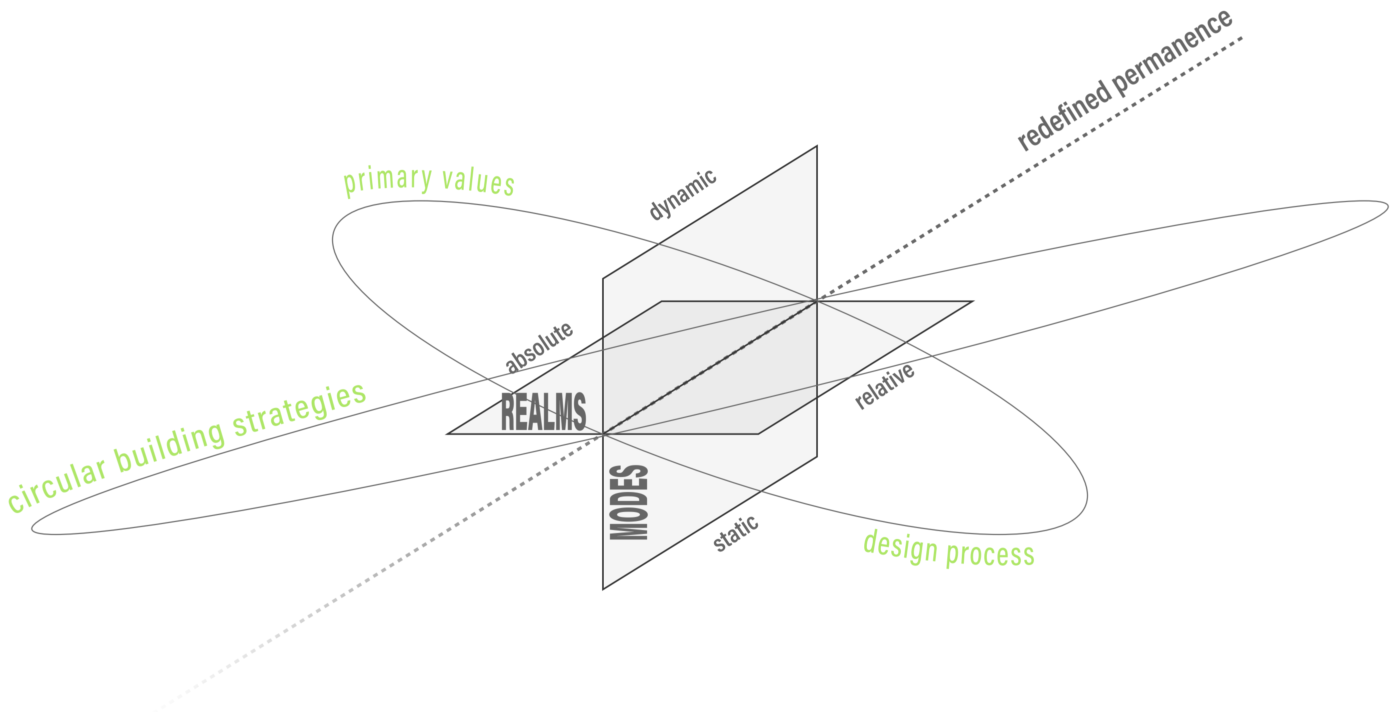
05.5 research theory to design

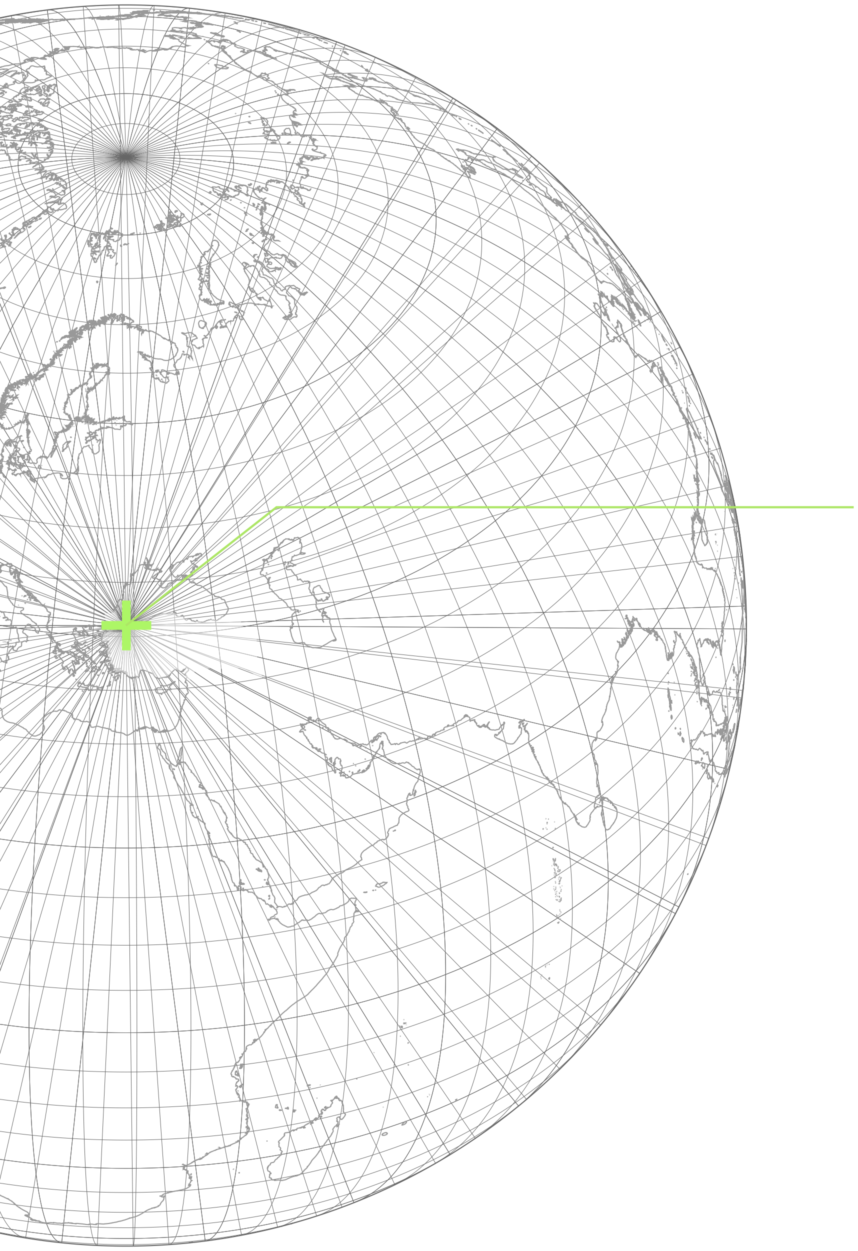
In response to the challenge of disposability in architecture, my graduation project reimagines the concept of permanence through the lenses of adaptability, material cycles, and cultural continuity. Positioned at the intersection of these theories, the design seeks to integrate their principles into a cohesive architectural approach—one that responds to the question:

How can a redefined understanding of permanence be integrated into contemporary public building to establish the continuity of the building and its components?


redefined permanence
primary values
dynamic
absolute
REALMS
relative
circular building strategies
MODES
static
design process

06 design assignment

The design assignment is to create a timber-based public building that functions as a digital archive and cultural infrastructure in the Urban Forest of Kemerburgaz, Istanbul. The design addresses architectural disposability by integrating adaptability, material circularity, and cultural continuity. Local timber and reversible construction techniques enable future disassembly, relocation, and transformation. Elements of Turkish architectural heritage are incorporated to foster emotional value and collective memory. The building is conceived not as a static object, but as a flexible system that evolves through cycles of use, maintenance, and care. It will be built in phases, following and contributing to a forest management system that treats wood as a renewable, living resource. In doing so, the building aligns with the rhythms of the forest, respecting natural growth cycles and reinforcing a reciprocal relationship between architecture and nature.



Istanbul, TURKEY

lat: 41.015137, long: 28.979530

Population: 15,66 million

Area: 5.461 km^2

06 location

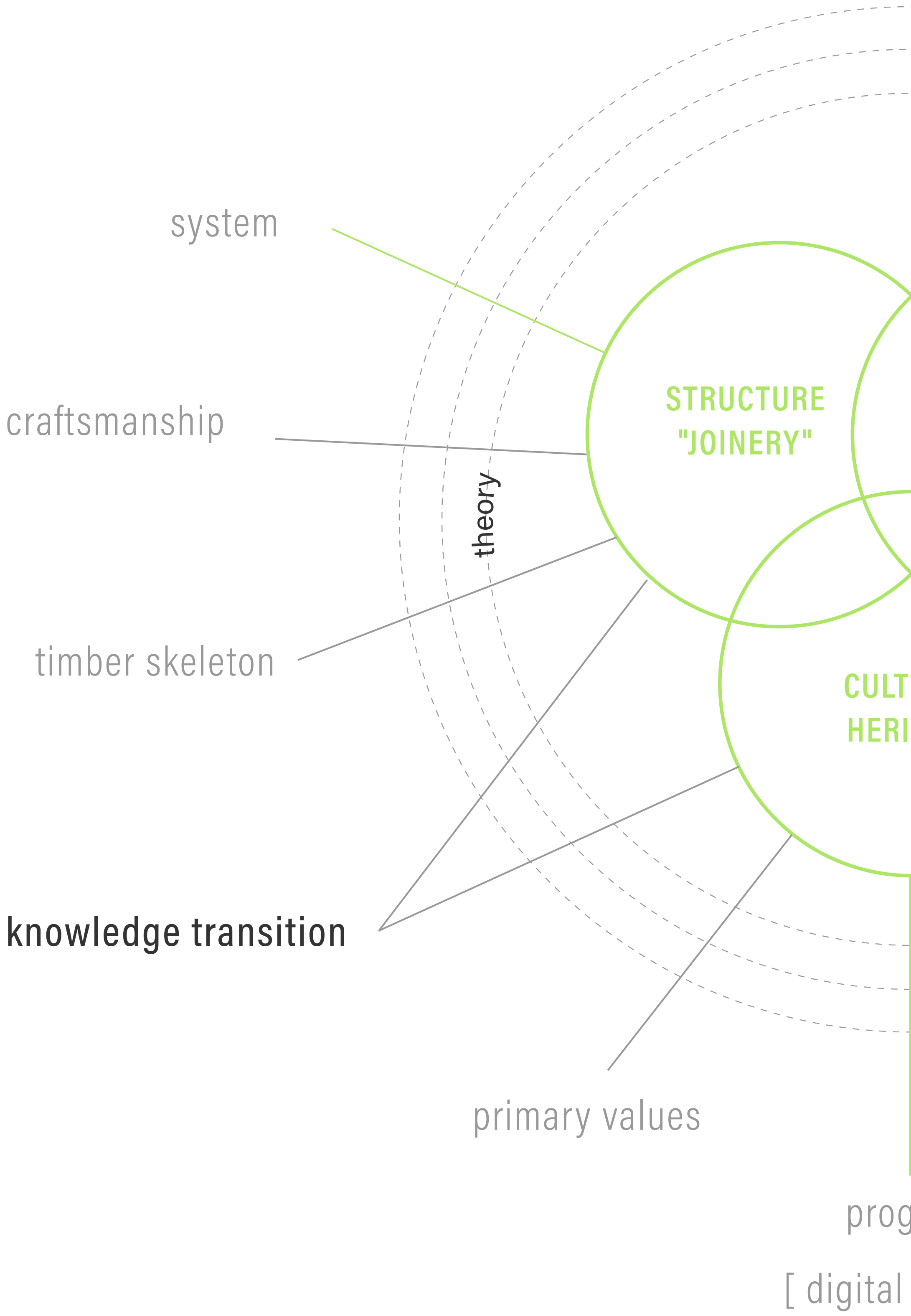
1 h, 20 min – 1st distance

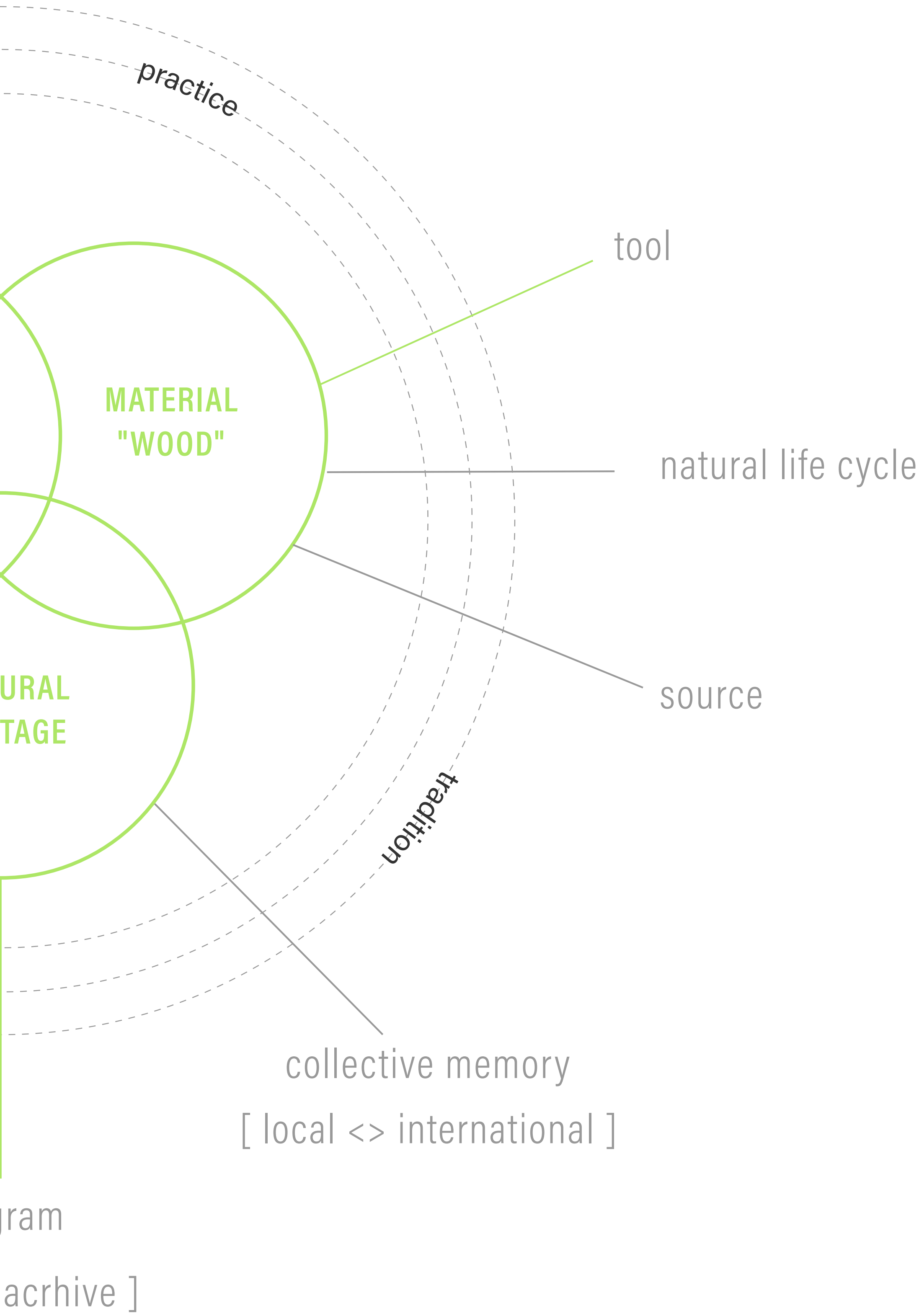
1.10 h, 20 min – 2nd distance

104 – museums

57 – universities

06 design core concept




practice
tool
MATERIAL
"WOOD"
natural life cycle
source
URAL
TAGE
tradition
collective memory
[local <> international]
ram
acrhive]