

Laboratory EAST, EPFL Lausanne (Hrsg.)
Greenhouses.
Studies on Types

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Neuerscheinung Oktober 2026

Glashäuser als vielfältiger Gebäudetyp

→ Das Gewächshaus typologisch untersucht: als Wohn-
raumerweiterung, Wintergarten, Pufferzone oder
thermische Gebäudehülle

→ Beispielteil mit Referenzprojekten aus ganz Europa mit
typologischer Übersicht

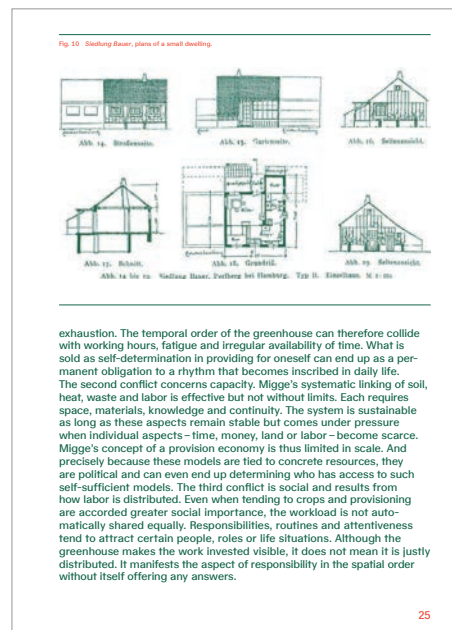
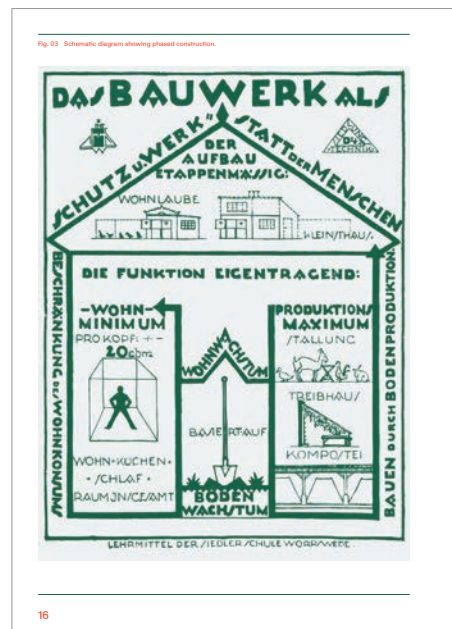
→ Das Gewächshaus als Lowtech-Ansatz für intelligente
Genäudekonzepte

Ein *Greenhouse* ist weit mehr als nur eine Gebäudeerweiterung
oder ein eigenständiger Bau. Seine konzeptionelle Bandbreite
reicht von Umgebungsverhältnissen, die Leben ermöglichen, bis
hin zu Konstruktionen für den Pflanzenanbau.

Die deutschen Begriffe Gewächshaus oder Treibhaus greifen
jeweils zu kurz, um die Typologie umfassend zu beschreiben,
Greenhouse meint einerseits atmosphärische Bedingungen und
andererseits einen Gebäudetyp. *Greenhouses. Studies on Types*
vertieft dies, indem das Gewächshaus nicht als festes Modell, son-
dern als eine Reihe architektonischer Prinzipien betrachtet wird.

Das Buch untersucht aus typologischer Perspektive, wie *Green-
houses* eine neue räumliche Logik einführen – sei es durch
Pufferzonen, thermische Hüllen, Wintergärten oder zusätzliche
Wohnräume. Diese Zwischenräume gestalten Wohn- und Ge-
meinschaftsbereiche neu, verändern Mikroklimata und tragen
so zu aktuellen Debatten über klimaresponsive Architektur bei

Dem Konzept der Reihe «Studies on Types» folgend
untersucht das Buch zunächst das typologische Konzept des
Gewächshaustyps – als historisches Manifest, als zentrales
Element der Solararchitektur der 1970er-Jahre und als reflexiver
Anstoss zum Nachdenken über thermische Steuerung – und
analysiert anschliessend eine breite Auswahl von Fallstudien,
die von Studierenden des Designstudios EAST porträtiert und
neu gezeichnet wurden, um einen detaillierteren Einblick in die
verschiedenen Ausformungen dieses Typs zu geben.



Ein Bildatlas, der alle untersuchten Fallstudien und historischen Referenzbauten zusammenfasst, ergänzt das Buch. Als Nachschlagewerk und systematische Übersicht konzipiert, veranschaulicht er die relationale und transformative Rolle von Gewächshaustypologien des 20. Jahrhunderts sowie deren Potenzial, den architektonischen Raum zu bereichern werden könnten.

Über die Herausgeberschaft

EAST – Laboratory of Elementary Architecture and Studies of Types, EPFL Lausanne

Während sich die Funktionen im Laufe der Zeit ändern, bleibt die Architektur bestehen. In Unterricht untersucht EAST jene Aspekte, die die Nutzung, die Morphologie und die räumliche Gliederung von Gebäuden bestimmen. Die Geschichte und der Wandel dieser Aspekte dienen als analytische Grundlage für den Entwurf neuer Gebäude sowie für die Wiederverwendung und Umgestaltung bestehender Gebäude. Ebenso dienen städtische Siedlungen als Laboratorium für architektonische Ideen, die mit den technischen Mitteln und Raumkonzepten unserer Zeit am Laboratory weiterentwickelt werden. Die gemeinsame Projektarbeit im Atelierraum sorgt für eine kontinuierliche Diskussion unterschiedlicher Gestaltungsansätze und hilft den Studierenden, ihre Ideen auszubauen.

Tiago P. Borges ist Architekt, Postdoktorand und Dozent an der EPFL. Seine Arbeit konzentriert sich auf typologische Studien, wobei er einen besonderen Schwerpunkt auf typologische Übertragungen sowie auf die historischen und konzeptuellen Zusammenhänge zwischen Gewächshäusern und Wohnräumen legt.

Anja Fröhlich ist ausserordentliche Professorin für Architektur und Design an der EPFL und Co-Direktorin des EAST Laboratory. Sie verfolgt einen typologischen Ansatz für die Architektur der Stadt und stützt sich dabei auf ihre Doktorarbeit, um zu untersuchen, wie Form das Gemeinschaftsleben organisiert und räumliche Beziehungen artikuliert.

Martin Fröhlich ist ausserordentlicher Professor für Architekturdisein an der EPFL und Co-Direktor des EAST Laboratory. Er ist Mitbegründer von AFF Architekten (Berlin / Lausanne) und von AFFECT, einem Forschungsprojekt zum Thema zirkuläres Bauen.

Solar House, Oswald Mathias Ungers Landstuhl, Germany	140	Tiago P. Borges	
House in Ins, Jeannette Gygax, Peter Gygax Ins, Switzerland	142	Greenhouse Studies	Greenhouses have traditionally been described in terms of oppositions – indoors and outdoors, inside and outside, productive and domestic, nature and technology – to the point that these have become established clichés. Historically, these have shaped our understanding of greenhouses – at least since they emerged as social spaces – as intermediate spaces with a highly ambivalent character. The difficulty is that this framing can flatten or exclude the very nuances that theoretical study seeks to unpack. For one of the few artefacts where architecture and climate intersect, this is a rather vague and imprecise basis for its useful and productive use.
Maison Serre, Françoise-Hélène Jourda, Gilles Perraudin Lyon, France	144		
ESA Energy-efficient Student Residence, Heinrich Eissler, Wolf Hoffmann Kaiserslautern, Germany	146		
Collective Housing in Biel, LOG ID Biel, Switzerland	148		
Housing for the Elderly, Otto Steidle Berlin, Germany	150		The three “Greenhouse Studies” design studios we developed at EPFL set out to challenge this status quo. The greenhouse is, after all, an architectonic artefact that breaks with the conventional logic of most buildings, which typically shield interiors from the exterior climate. Its identity emerges from the active relationship between an architectural and a climatic condition. Typologically, it operates between a core and an exterior, as a spatial and climatic articulation that prompts us to reconsider how climate interacts with architecture and how it is produced. Our experience from the design studios has shown that “rhythm”, “density”, “distance” and “transparency” are not only spatial qualities but can also describe the microclimatic conditions of architecture.
Terraced Housing, Castel “Zur Linde”, H.R. Spycher and Sons, M. Wagner Schmittlen, Switzerland	152		
Via Felsenau 1, AAB – Atelier für Architektur und Bauökologie Bern, Switzerland	154		
F3 House, WORKSHOP/Koh Kitayama Yamato, Japan	156		In this publication, we consider greenhouses not as autonomous objects, but as relational ones, each tied to a core domestic practice or a clearly defined space. Where the greenhouse intersects with this primary space – the housing unit – it can extend, structure or reorganize patterns of domestic life. In the projects, we therefore examine not just their formal qualities but also their relationships with the house, the outdoor climate, the seasons, and their inhabitants. This relational perspective invites us to rethink conventional typological structures that link form and function. Rather than imposing taxonomic rigidity, it identifies recurring relationships: degrees of integration, modes of microclimatic mediation and levels of interaction with domestic life.
House in Coutras, Lacaton & Vassal Coutras, France	158		
“Cité Manifeste” in Mulhouse, Lacaton & Vassal Mulhouse, France	160		
“Bois le Prêtre” High-Rise Housing, Lacaton & Vassal Paris, France	162		
Maison Commune, Plan Común Plantín, France	164		While the floor plan has become the standard means of representing domestic spatial organization, it is not entirely suitable for contexts in which climate and habitation overlap. For example, how can we analyze microclimatic types? How can we organize less tangible concepts, such as thermal gradients, humidity and seasonal patterns of habitation?
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combines light, growing space and shelter, marking an initial spatial transition between gardening and living. The fact that the *Kleingartenstadt Südgelände* project was never put into practice is revealing for precisely this reason. As a conceptual model, it illustrates the core of Migge's approach in which self-sufficiency emerges through phases and capacities – and not through predefined house types.

Heat and Climate

For Migge, energy is not an abstract quantity. It is a resource to be organized spatially. What we now refer to as "passive" or "low-tech" strategies was, for Migge, based on a simple premise: cultivating plants equates to a form of managing energy because food is a "product of solar energy" and the yield depends on the "amount of light and heat" a plant receives.⁵ The greenhouse was an essential lever in the supply of energy: a space that concentrates and buffers environmental energy.

Migge's approach to thermal economics began not with ways of producing energy but with creating conditions under which the sun can be made productive. Put simply, "without light and heat, there can be no intensive plant cultivation", and "heat is not solely the product of sunshine – it can often mean the absence of wind and weather, which cool the air and soil".⁶ Climate is thus not a given environment; it is an effect to be produced: "In true horticulture, 'soil fertility' and 'climate' are created".⁷ The greenhouse as an enclosure that limits cooling embodies this principle perfectly. The actual medium here is glass: it makes solar heat productive, can contain and retain heat so that it can be transferred for other purposes. Migge's deliberations on organizing thermal processes arose during a period when fossil fuels were, in principle, available but expensive and politically unstable in everyday life: coal shortages, rising prices and irregular availability made ensuring heat supply something that needed to be reliable and robust. Migge translated these considerations into concrete design decisions, particularly in the shaping of the shell and transitions.

This principle underlies Migge's design for an *Erwerbsiedlerhaus*⁸ that he designed together with Leopold Fischer in 1925 for the "Heim und Scholle" exhibition in Braunschweig. Fig. 05 shows the semi-detached form of the model home that was built, and the floor plan in Fig. 06 makes it clear that it was intended as a mass-producible housing model for a typical five-person family at the time. What is revealing about this plan is the way the living spaces are surrounded by buffer zones – a veranda, animal pen and conservatory – and how the boundaries of the house are defined by the need to organize climate as a spatial condition.

Fig. 05 Pilot project of the *Erwerbsiedlerhaus* in Braunschweig.



Fig. 06 Floor plan of an *Erwerbsiedlerhaus*.



Fig. 09 Siedlung Bauer, plans of a large dwelling, divisible into two halves.

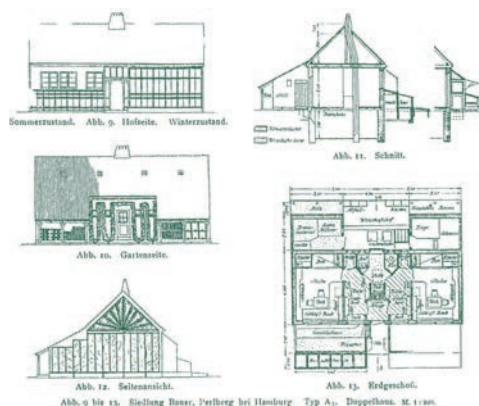
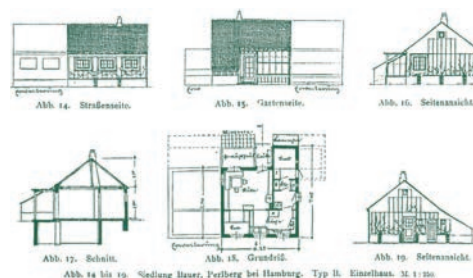


Fig. 10 Siedlung Bauer, plans of a small dwelling.



and organization of work not only coexist but actually merge into a shared practice. It lessens dependencies on "external" systems of supply and provision – whether governed by markets or as public infrastructure – and places it firmly in the hands of the household, transforming everyday life into a productive domestic economy. However, this also has its own implications. Any autonomous, spatially organized system entails the allocation of responsibilities, and the fact that this can lead to conflicts is not a side effect but part of its logic.

The first conflict concerns time. Tending to plant crops follows biological and climatic rhythms and not the logic of wage labor. Plants require regular attention, and tending to them is repetitive. Omissions have concrete effects, resulting in stagnant growth, crop losses and

exhaustion. The temporal order of the greenhouse can therefore collide with working hours, fatigue and irregular availability of time. What is sold as self-determination in providing for oneself can end up as a permanent obligation to a rhythm that becomes inscribed in daily life. The second conflict concerns capacity. Migge's systematic linking of soil, heat, waste and labor is effective but not without limits. Each requires space, materials, knowledge and continuity. The system is sustainable as long as these aspects remain stable but comes under pressure when individual aspects – time, money, land or labor – become scarce. Migge's concept of a provision economy is thus limited in scale. And precisely because these models are tied to concrete resources, they are political and can even end up determining who has access to such self-sufficient models. The third conflict is social and results from how labor is distributed. Even when tending to crops and provisioning are accorded greater social importance, the workload is not automatically shared equally. Responsibilities, routines and attentiveness tend to attract certain people, roles or life situations. Although the greenhouse makes the work invested visible, it does not mean it is justly distributed. It manifests the aspect of responsibility in the spatial order without itself offering any answers.

Fig. 11 Winter: Conserving thermal energy.



Fig. 12 Summer: Convective ventilation and solar chimney effect.

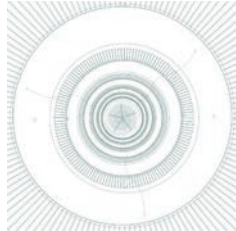


Fig. 13 Winter: Solar gains and conserving thermal energy.

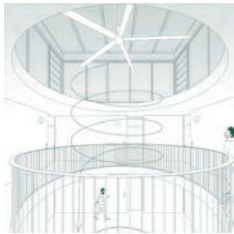
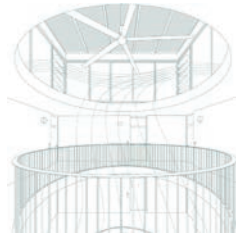


Fig. 14 Summer: Convective ventilation and venturi effect.



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Fig. 15 Winter: Air renewal and reduction of ventilation losses.



Fig. 16 Summer: Convective and cross ventilation.

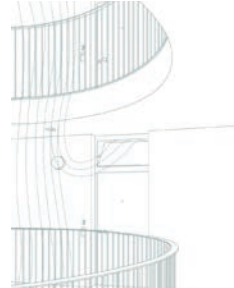
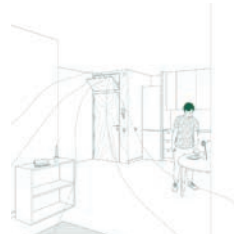


Fig. 17 Winter: Air renewal and reduction of ventilation losses.



Fig. 18 Summer: Cross ventilation.



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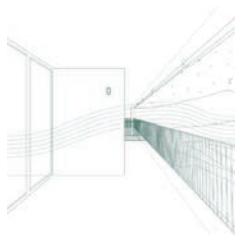
Fig. 23 Winter: Capturing solar energy.



Fig. 24 Winter: Solar protection.



Fig. 25 Winter: Cross ventilation.



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The regulations are stubbornly prescriptive at a time when greater flexibility is needed.

In-between spaces allow architects to work with an expanded comfort logic without violating the strict criteria where they still apply. They create a climatic perimeter that accommodates variability, and acts as an architectural "time buffer" against the temporal mismatch between present codes and future climates. This is by no means an attempt to undermine safety. Fire and health requirements remain essential. It is, however, a call to recognize that the current regulatory model's inability to accommodate spatial comfort gradients leads to the over-dimensioning of HVAC infrastructure. The "gray zone" makes gradients possible.

In practical terms, this means:

- locating high variability in spaces that can legally tolerate it,
- using those spaces to reduce loads on the regulated core, and
- shrinking HVAC requirements rather than merely improving its efficiency.

In-between spaces become a disciplinary tactic: a way to reintroduce climatic intelligence into a compliance-driven culture.

Retrofitting the Existing: Adding Climatic Layers Instead of Rebuilding

Most of the building stock in 2050 already exists today. The energy embodied in these structures means that their demolition and renewal is non-viable in environmental terms. In-between spaces offer one of the most effective means of retrofitting existing buildings by adding a climatic layer.

- Enclosing balconies seasonally can create temperature buffers.
- Adding lightweight galleries can reduce ventilation losses.
- Roofing over courtyards can generate shared temperature-mediating spaces.
- Transforming stairwells into ventilation stacks can facilitate hybrid ventilation strategies.
- Reorganizing circulation through shaded corridors can create cool routes in heat waves.

These interventions are more than "energy upgrades". They reconfigure habitability and social life. A shared landing becomes an inhabited threshold. A courtyard becomes a winter refuge and a summer ventilator. Such retrofitting strategies are spatial and not only technical.

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was a kind of El Dorado for architects. Ten years later, perhaps, it was the Ticinese architects who were really highly regarded, but at that time it was Finland. We admired Alvar Aalto enormously, the quality of Finnish architecture in general, and many of the young Finnish architects of the time. We visited many buildings that we admired, especially collective housing complexes, and they made a strong impression on us and shaped our vision of collective housing and communities.

Jeannette Gygax
But it was especially the younger generation and the Finnish scene we admired. Aalto was already old at the time, and we met other Swiss architects who worked there. Everyone said, "Do not go to Aalto; he is too old."

Tiago P. Borges
Let me gradually shift focus now to the 1970s. You left Finland in 1968–69 and returned to Switzerland, where you went to Geneva. 1973 was the time of the energy crisis. What was the atmosphere like in Switzerland?

Peter Gygax
There were many protest movements at that time, but professionally speaking, it did not influence us very much. When we started out, we tried to build in a way that we thought would be more ecological than what we had learned: a little less concrete, more wood. That was often the case, but it was not

something that was imposed on us, or even that everyone asked for. Finland inspired us very much because they used wood a lot for building and were much more advanced than Switzerland in insulating houses. We learned a lot about energy use in buildings from our time in Finland.

Tiago P. Borges
So, you brought those ideas back with you to Switzerland. When the energy crisis came in 1973, did you feel a change coming about, or did that only happen later?

Jeannette Gygax
In 1973, we built the first house with rotating solar collectors.

Peter Gygax
We were among a few who took an interest in energy issues. We wanted to design a house that would make good use of sunlight. Following the 1973 energy crisis, we took a detailed look at what was being built in Switzerland and elsewhere in this regard. As part of that, we came across two or three examples, especially in France and New Mexico. Jacques Michel and Jean Pierre Cordier, Felix Trombe or Steve Baer and Wayne Nichols were some of the names that stood out. They gave us the impetus to learn more and the motivation to try such methods ourselves.

Jeannette Gygax
I remember we even thought about going to New Mexico!

Fig. 35 Exterior view of the house in Dornach, 1977.



Tiago P. Borges
So, on the one hand, you were looking at solutions that were, let's say, comparatively low-tech – I'm familiar with some of those examples, and one could not call them technology-driven – and on the other, you were innovating because your solar elements were rotating. How did you find your place between technological innovation and architecture that employed vernacular, low-tech principles, making do with what is available and responding through form and space?

Peter Gygax
That was exactly our aim: to make houses that respond well to climate

through architectural means: orientation, fenestration and thermal retention.

Jeannette Gygax
Precisely. Our first house was still thoroughly "conventional"! The only unusual elements were the collectors and energy storage system. It was only later that we began to respond using architectural strategies.

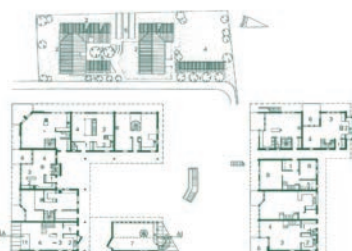
Luciano Antonietti
In other words, a matter of space.

Jeannette Gygax
Yes, that is what interested us. Not technical gadgetry.

Fig. 37 Exterior view, Cooperative Aarhe-Rohrmatt in Kaufdorf, Bern, 1985–1996.



Fig. 38 Ground floor plan, Cooperative Aarhe-Rohrmatt in Kaufdorf, Bern, 1985–1996. Floor Plans and Cross Section, Scale 1:400: 1. Entrance; 2. Kitchen; 3. Dining room; 4. Living room; 5. Bathroom, shower, toilet; 6. Greenhouse, sunroom; 7. Community room; 8. Bedroom; 9. Work, play; 10. Storage; 11. Open area; 12. Gallery; 13. Balcony, terrace; 14. Attic; 15. Covered walkway; 16. Workshop; 17. Shed; 18. Vestibule; 19. Laundry.



we were proposing. But in their essence, individual houses are inevitably a form of isolated, individual living.

Luciano Antonietti
So, at some point you had to say, "enough is enough" – a stance also shaped by values and by a stronger commitment to community.

Jeannette Gygax
Living in Siedlung Halen was very significant for me. A sense of community is without a doubt good for society, and we experienced this firsthand there. We have carried something of that experience over into our own living situation. We live in a block of flats in Bern with friends of a similar age. As such, we were able to pass on the detached houses we previously lived in to the next generation.

Luciano Antonietti
Have you ever lived in a house that you designed yourselves, or in a house with a greenhouse space where you experienced it from the inhabitants' viewpoint?

Jeannette Gygax
Yes, in Halen, actually. We had a house with a large roof terrace, known as a solarium. We converted this space into a greenhouse space with removable glazing and many plants.

Peter Gygax
It was our prototype greenhouse.

Tiago P. Borges
We have talked about domestic interiors, houses, and greenhouses. Finally, what makes a good house for you?

Peter Gygax
It's hard to define, but for me it's a kind of beautiful, coherent whole. A balance between function and design. A harmony of means and the arrangement of the elements.

Jeannette Gygax
Yes, that is essentially what it is. Nothing complicated. I could live in a concrete house, but I could also live in a wooden house. I could not even say it has to be one or the other. But there should definitely be no unnecessary "Schnickschnack".



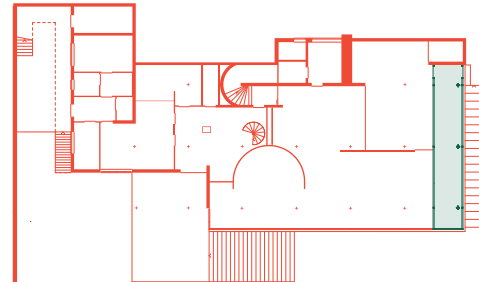


Mies van der Rohe
Brno, Czech Republic

Villa Tugendhat
1928–1930

Originally designed and built for Fritz and Greta Tugendhat, the owners were only able to use the house for a few years before it was seized by the Gestapo in 1939. In the post-war socialist era, it was used as a dance school and as a physiotherapy clinic. Widely regarded as an iconic work of modernist architecture, Villa Tugendhat is now an official UNESCO World Heritage Site. The house is the only one of Mies van der Rohe's modern designs for private residences to incorporate a greenhouse. Situated on the southeast façade, the conservatory is an elongated glazed space measuring 12.3×2.1 meters that adjoins the main living area and has an entirely glazed south façade. It includes a water source, a heating system and a single opening to the outdoors. Despite the extensive documentation available about the house, the existence of this green space is often forgotten, and its qualities as a winter garden are rarely mentioned in publications. In fact, the space accounts for a thirtieth of the floor area of the residence. The winter garden is most apparent when the glazing of the living area on the first floor is retracted into the basement. Its primary purpose was to act as a transition between indoors and outdoors, creating a link between the residential interior and the immediate surroundings of the garden.

1:250



Footprint of the building	Gross floor area	Volume of the greenhouse	Proportional volume of the greenhouse
881 m²	907 m²	67 m³	2.8 %
Footprint of the greenhouse	Volume of the building	Gross volume	
26 m²	2290 m³	2358 m³	

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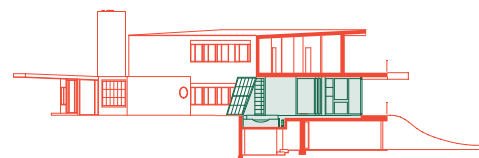
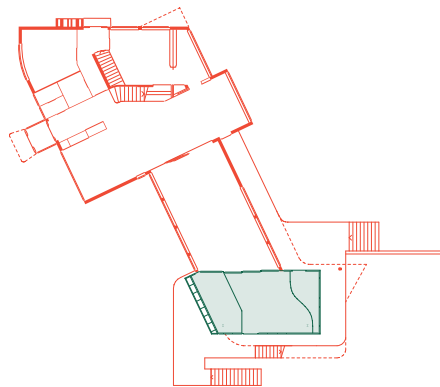
Hans Scharoun
Löbau, Germany

Schminke House
1930–1933

The German architect Hans Scharoun was commissioned to build a house for the industrialist Fritz Schminke on a plot of land next to the owners' pasta factory. As is often the case with so-called organic architecture, form follows function. The Schminke's had a clear vision of what they wanted for their home and also the means to envision something that showcased their own modernity. The house includes a Frankfurt kitchen, extensive glazing and a heating system for an indoor tropical garden.

The house extends along an axis that begins with supporting functions such as the kitchen, storage areas and circulation, and transitions into the open and spacious domestic spaces. At the east end of the house, this culminates in a large, glazed and heated winter garden from which one has an expansive view over the remainder of the plot and the large garden on the north side of the building.

1:250



Footprint of the building	Gross floor area	Volume of the greenhouse	Proportional volume of the greenhouse
302.5 m²	345.6 m²	1074 m³	4.98 %
Footprint of the greenhouse	Volume of the building	Gross volume	
43.2 m²	2240.3 m³	2357.8 m³	

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