"Ett trämanifest & sökandet efter bois-brut"
"A manifesto for wood & the search for bois-brut"

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Wood is often perceived as a flawed material. When painted, technologically treated or sealed, in a pursuit to make it more predictable and durable, some of its most important qualities are mislaid.

This project explores the aesthetic, material and constructional possibilities of wood, and suggests the possibility of a wood brutalism architecture.

The project includes a written manifesto for the benefits of wood in the human habitat, proposes a CO₂ based economic strategy for our built environment and promotes massive wood buildings as our carbon savings account.

To find out what a wood brutalism of today might be, the project includes an analysis of the relationship between the material concrete, Beton-brut and the zeitgeist of the 60’s and 70’s.

In the application of the manifesto and Bois-brut on a case study housing project in Österåga, Stockholm, the Trellick tower has acted as a brutalist mirror reference. Vernacular timber buildings have provided clues in the search for the essence of wood.

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WOOD IN THE HUMAN HABITAT

Research shows that the tactile and visual qualities of wooden surfaces has a stress reducing effect and improve wellbeing and mental health, in a similar way as closeness to nature as a whole does. Wood is recognizable as a natural element because the patterns in the wood grain have natural shapes and forms, knots and a colour spectrum. (1)

The wood surface is perceived in a positive way, especially when it is smooth and uncoated. The low rate of heat flow in wood makes it feel warmer than materials with higher conductivity, and its ability to store heat also adds to the thermal comfort. The perceived warmth of a wooden surface can save energy as it feels warmer at a lower temperature than mineral based materials. (2)

The hygroscopic wood tissue has the ability to hold and release moisture and can be used to our advantage in living spaces as it evens out variations in relative air humidity. Maintaining a constant level of humidity increases the living comfort and makes us less ill and prevents allergies. (3)

The hygroscopic ability can also have a cooling effect during the hot season, as the evaporation of water in the wood consumes heat energy, an effect comparable to sweating.

A large amount of wood tissue can function as a passive climate control system that regulates the indoor climate naturally and might lower the energy demand for heating, cooling and air conditioning.

The hygroscopic effect is highest in sapwood, especially in the cross cut surface. (4)

HUMANS & MATTER

The perceived separation between humans and nature may have implications for environmental values, attitudes, and behavior. A description of “civilization” includes “separation from and domination over the natural environment”. (5)

The idea of human separation from nature came with the development of western civilization. Indigenous cultures had lived resiliently, for thousands of years, as members of nature rather than its master. Their materials were obtained and returned to the circular matter flow, while leaving little trace. Matter was regarded a loan from future generations. After dismissing these cultures as primitive, forcibly pushing them away from their land, western civilization, claimed ownership of matter and started exploiting resources for economic gain. Today it is apparent that this is an unsustainable way of life and that future generations will pay the price for our wasteful way of living. (6)

Timeline for Sami culture & industrialized culture of Kiruna

1890

1000BC 0 1000AD

Peak oil 2006
ADAPT THE SYSTEM

The building industries’ preference for materials that are easily mastered, predictable and permanent relates to the assumption of human domination over nature.

Wood have long been shunned for not performing as well as modern materials when it comes to: durability, predictability, form stability, strength, fire resistance, moisture resistance and cost efficiency. (7)

Attempts to alter the performance of wood to make it more suitable in the rational building-systems usually include ecologically questionable use of chemicals, heavy metals and energy-consuming processing.

There are sustainable ways of using wood that address the lower performance of the material. It does, however require knowledge about the material, and an adjustment to the production systems and may not be economically rational in a shorter perspective. However, by not insisting on pushing wood into being an acceptable member of the assembly line, we may benefit from some of the unique aspects of wood that are beneficial to the environment and to create healthy living environments for ourselves.

When it comes to durability, there is an assumption that the permanent, is the ideal norm. But the system, in which that norm exists, is flawed. It is, to current date, not possible to make a permanent material that do not result in an overuse of resources. Instead of adapting wood to function in a flawed system, we need to adapt the system and norm to the prerequisites of wood.

FORESTRY FOR QUALITY

Wood was the most common building material in Sweden for thousands of years and houses lasted for many generations by smart building techniques and maintenance. We should humbly search for vernacular knowledge to find clever wood building strategies. Just as the windmill has been resurrected to replace fossil energy, we should resurrect methods of vernacular wood building to replace energy consuming and toxic methods of the building industry today.

When wood building became industrialized, less effort was put into selecting specified wood tissue. Trees were harvested earlier, before they developed enough heartwood. To compensate for the lower quality, the industry impregnated the sapwood with toxic substances to make it more durable. (8)

Producers of massive wood products generally use tissue from both mature and adolescent trees. The lack of distinction between the properties of tissue qualities is wasteful. A mature tree has more narrow growth rings and a higher portion of heartwood which could be utilized for weather exposed facades and windows. The climate beneficial harvesting of tissue from younger trees, can be used for the structure, indoor paneling and massive wood elements.

To utilize the full potential of wood we should make forestry more particular in what type of tissue is grown, and focus on taking advantage of their intrinsic qualities and specific properties.
FORESTRY FOR CARBON

Globally averaged concentration of CO₂ in the atmosphere reached the symbolic milestone of 400 parts per million in 2015. (9) The safe level is 350 parts per million. To return to safe levels we must immediately transition from fossil fuels into renewable energy, energy efficiency, and sustainable land use. (10)

Sustainable forestry can help mitigate the high CO₂ levels. When trees grow, they remove CO₂ from the atmosphere and store large quantities of carbon in their tissues. The carbon stored in wood is kept there throughout its life, until it is either burned or biodegraded. It is therefore particularly advantageous to use wood for large and long-lived products, such as massive wood buildings. The buildings are our carbon savings account. (11)

Young trees have high growth rates, and high carbon sequestration rates. From a climate perspective, it is therefore better to harvest the tree when it has reached its peak in carbon sequestration, use the tissue in buildings and plant a new tree.

The substitution effect (12)
In addition to emitting less CO₂ during its lifecycle than concrete buildings, massive wood buildings also provide a long term storage of 9 tons of CO₂ per m² of wood tissue. This effect is not included in the current life cycle analysis (LCA) which would be desirable from a climate perspective. (13)

Emissions from an eight story building, incl. building process in tons of CO₂ (incl. carbon storage in wood) (18)

If we apply this modestly set cost related taxation of 1.12kr per kg CO₂ on two eight story buildings, one in concrete and one in wood, including emissions from a lifecycle analysis and carbon storage in wood we get this result:

The concrete building has a taxation cost of 1.3 million kr.
The massive wood building gets a subsidy of 1.1 million kr.

This model would create a financial incentive for bringing down emissions in the building industry. It would also make it economically viable to use thick massive wood walls as they store more carbon than wood based insulation of the same volume.

It is necessary to ensure sustainable forestry, so the short-term outtake of wood does not affect the long-term supply of wood. We also need a sustainable strategy for land use and find ways for forestry to coexist with food and energy production.
The atomic fear of the cold war era and the space-age technology is manifested in the possibilities of concrete as a building material.

**BETON-BRÛT**

Brutalism of the 60’s/70’s

The distinctive modernism subtype “Brutalism” was the reaction of the younger generations modernists towards the steel - skeleton - and - glass - skin buildings of profit-oriented modernism. It offered depth and social awareness instead of the lightness and frivolity of the post-war version of the “International style”.

Buildings where powerful monuments, of the future through the essence of concrete.

Brutalist buildings where honest in expression and in its unapologetic claiming of physical space.

The design showed the technical possibilities of the future. Service systems and mechanical systems where thought into the design.

Rational, geometric, stripped of ornamentation, and predominantly composed of concrete.

The expression of materials was clear, creating meaning through careful detailing. Repetition of form in the mechanical sense, made room for experience of perspective and light.

**CONCRETE**

**BOIS-BRÛT**

Brutalism of the future

The environmental beneficial use of wood motivates a frivolous use of the material.

The biodegradability of wood encourages temporary building solutions, allowing ever changing spaces adjusting to the needs of the user.

The design is informed by vernacular knowledge of wood building. Eco systems and human participation in them are thought into the design.

The graceful aging of wood and the collecting of wear, is encouraged by the design.

Clarity in how pieces are fit together, promoting repair instead of replace, replace pieces instead of complete removal.

Bois-brût is a reaction to the application of wood as a cosmetic way of eco-branding, while insufficiently addressing the ecological crisis by using carbon intense materials and methods. The benefits of wood as a carbon sink is manifested in the massive, solid wood volume.

The fear of climate change manifests in new green technology, and in the use of wood as a carbon sink and renewable building material.

**WOOD**

The climate change manifests in massive, solid wood as a carbon sink and renewable building material.

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Clarity in how pieces are fit together, promoting repair instead of replace, replace pieces instead of complete removal.
The brutalist utopian drive to build for a better world is connected to the essence of concrete through what it represents; its plasticity, durability and strength enabes these visions.

Believes in the control of nature and human superiority. People adapt to machines, and the home is "a machine for living in".

Building methods are rational and the materials produced are predictable and effective.

Geometric organization of form, with sharp, precise and definite shapes and edges.

Mannmade materials that needs to be well-maintained.

Purity and flawlessness makes its expression richer.

An intentional strive for economic and social justice is sought by the architects.

Distribution of wealth enables personal consumption of products.

Durable, heavy and non renewable: claims space in a long-term linear time manner.

The ambition is to celebrate the circular matter flow of the material. The recognition of the strengths and weaknesses of wood informs the design and are used to benefit humans and the ecosystem.

Believes in the fundamental uncontrollability of nature and that humans are a part of it. People adapt to nature and their homes are a part if it.

Building methods are adjusted to the prerequisites of the material, the forest and the ecosystem to ensure a sustainable, resilient and toxin free built environment.

Organic organization of form, with soft, vague shapes and edges.

Natural materials that accommodates to degradation and attrition.

Corrosion and contamination makes its expression richer.

A strive for material justice between generations is sought by the architects.

Consumption mainly of services. Products and utilities are shared and reused.

Short durability, light and renewable: de-/recomposes in a cyclical time manner.
Three layer timber wall

By using 200 mm wide square timber in three layers, the 600mm deep wall has a U-value around 0.22 W/m²K. The volumetric heat capacity of wood is said to reduce the energy consumption by up to 15%. The timber is assembled on site and the layers are sealed with a loose tongue. Wood tissue will expand in the winter and shrink in the summer which must be addressed in the design of other building parts.

Interior timber wall

Stacked timber blocks with the end grain facing the room, regulates humidity and heat and has comfort and health benefits. Different depth and shape creates visual effects, through patterns and light. It diffuses sound and may create built in spaces for seating and storage. With a flexible mounting system the wall can be moved, change with time and user.

Dowelled timberwall element

Element utilizing the hygroscopic, thermal and health benefits of wood. Interior side: the crosscut sapwood -high hygroscopic capacity- regulates humidity and heat. Exterior side: radial cut heartwood -repels moisture and skews less. Internally: solid and perforated layers for increased insulation. By replacing glue with dowels, there is a for movement tolerance within the element, making it less sensitive to moisture and free from toxic chemicals. (19)
APPLYING MANIFESTO ON HOUSING IN ÖSTBERGA
APPLYING MANIFESTO ON HOUSING

Load bearing glulam post and beam structure carries housing units in solid timber logs from each level in the glulam structure. The floors are separated to allow movement in timber structure and to prevent flanking transmission.

Exterior corridor and balcony are hollow concrete planter boxes, hung by rope wire from top layers in the timber structure to weigh down the timber layers to seal it, mimicking the heavy sedum roofs of the traditional timber house.

The sail on the exterior corridor and balcony and the massive timber walls compensates the lightness of the wood, to stabilize the structure against wind loads. Braces and side staircases stabilize the structure and the concrete foundation is an anchor for the building.

Railings, openings and walking paths on exterior corridor are made from flattened expanded weathering steel mesh.

The walls are held together with timber frame joints, and are sealed with a lose wooden tongue in grooves between the horizontal layers. One wall between the units contains storage, vertical installations and glulam columns. The other wall has the cross cut surface facing the room.

The bath is placed in the middle of the space, with wood shingle shower walls. The humidity from the shower is absorbed by the wood tissue in the unit, especially the cross cut surface, regulating humidity and heat. The bath is made of steel to transfer the heat from the water into the living space.

The toilet and sink is built into a steel bathroom pod, making it easy to clean and recycle.

Kitchen and bathroom installations are placed under the stair, behind the metal mesh, including the kitchen extraction fan. The metal mesh behind the kitchen counter top holds movable brackets/shelves.

The exterior corridor makes maintenance easier.

The interior wood surfaces may be painted in color types such as egg tempera or distemper, which lets the surface of the wood shine through and does not effect the diffusion negatively. Wallpaper is not recommended as the movement in the timber wall will make it crack. If the wood surface needs to be refurbished, the surface can be planed or sanded down.
Vernacular/wood references:

Wood kintsugi, wooden inlays in Tokyo bridge (photo by Chris Liljeholm)

Loftbod "Olalofet" dated 1630

"Enkelstuga" mid 18th century "Spele-Bengts stuga" Björsågårds, Holland