

Underground resistance



**A fungal approach to
material ecologies**

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A fungal approach to material ecologies

Underground resistance is an open-ended, non-linear research project aiming to learn better resource management from fungi - the best resource managers on the planet.

As it is too large to be contained within either a few pages or a 20 minute presentation, the reader is urged to explore any or all topics mentioned here at <https://undergroundresistance.cargo.site/>

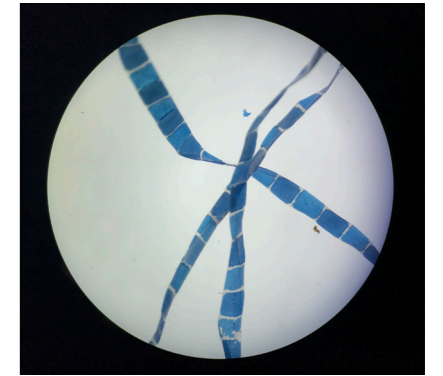
Resource management (waste)

The global phenomena and challenge of waste is common knowledge. Pictures of slums overflowing with trash, rivers polluted by toxic chemicals or dead animals full of cigarette buds and colorful pieces of plastic are commonplace. Well known is the threat of rapid climate change and the mass extinction of plant and animal life. So is the fact that humanity's industrialized, capitalistic, extractivist and consumerist practices are to blame. At humanity's current rate of waste production and its slow rate of change, the future looks destined for ecological (and human) collapse, which is why this project aims to learn better resource management from the non-human rather than the human.

Fungi

The greatest recyclers and resource managers on the planet are the members of the fungal kingdom. Without them, organic matter would just be piling up and humanity would live in strange coral reef-like structures of dead trees and other organic waste just laying around in piles. Because of fungi, waste does not exist in nature.

Fungi are a varied group of species. Some break down and recycle dead organic matter so that their constituent nutrients are ready to be reused once more, while others collaborate with the species around them to ensure the resources are distributed well, such that the entire ecosystem may thrive. They do so by connecting to the roots of plants, aiding their search for nutrients, but also to let them communicate with other plants through their underground fungal network. There are fungi that live in between skin/plant cells and in digestive systems, essentially cohabiting space with their hosts and doing everything they can to protect them from external threats, and there are even fungi that break down living organic matter, effectively testing the resilience of the ecosystem and training it to evolve.



Plastic fished out of the Norwegian Sea under microscope (2021)



Bucket of rusted screws (2023)



Mycelium Chair by Studio Klarenbeek & Droos (2013)

The success of fungal ecosystems become evident when looking at their 850 million year old history of sustainably thriving, expanding and collaborating, as opposed to humanity's meager 250 thousand (of which the last 10 000 years have been increasingly devastating to the planet).

Can we learn resource management from fungi?

Underground Resistance

Underground Resistance is an ongoing research project aiming to critically explore and address the phenomena and challenges of waste, while also searching for better material/resource management by learning from fungi. Through a process of making, re-making, and fungal modes of exploration the project unfolds gradually, expanding outwards in all directions with no clear end goal other than building strong relationships of mutual benefit to the living and non-living entities it encounters.

It is a multifaceted project that constantly takes me to surprising locations: a silent meditation course deep into the Swedish woods, a gourmet mushroom farm North of Bergen, a fungal biomaterial laboratory in Oslo, and into the depths of many many waste containers.

It initiates fascinating conversations with companies and figures breaking new ground in the fields of alternative materials, reuse, circular design and circular economies, like a kombucha brewer in Bergen, a biomaterial developer and designer in Copenhagen, a designer in Oslo melting and reshaping plastic collected from the ocean, and an expert on reusing materials from demolished buildings, also in Oslo.

From the project also springs a novel process of working and learning; a website (under development) where all the research, interviews, books, manuals, articles, logs and experiments are being made publicly available; a growing index of concepts and terminology encountered throughout the process; and a somewhat strange ritualistic fungal inoculation ceremony wearing full PPE.



Natural Material Studio exploring new uses for old crustacean shells (2020)



Norwegian Trash exploring possibilities of re-shaping used snus-boxes (2020)



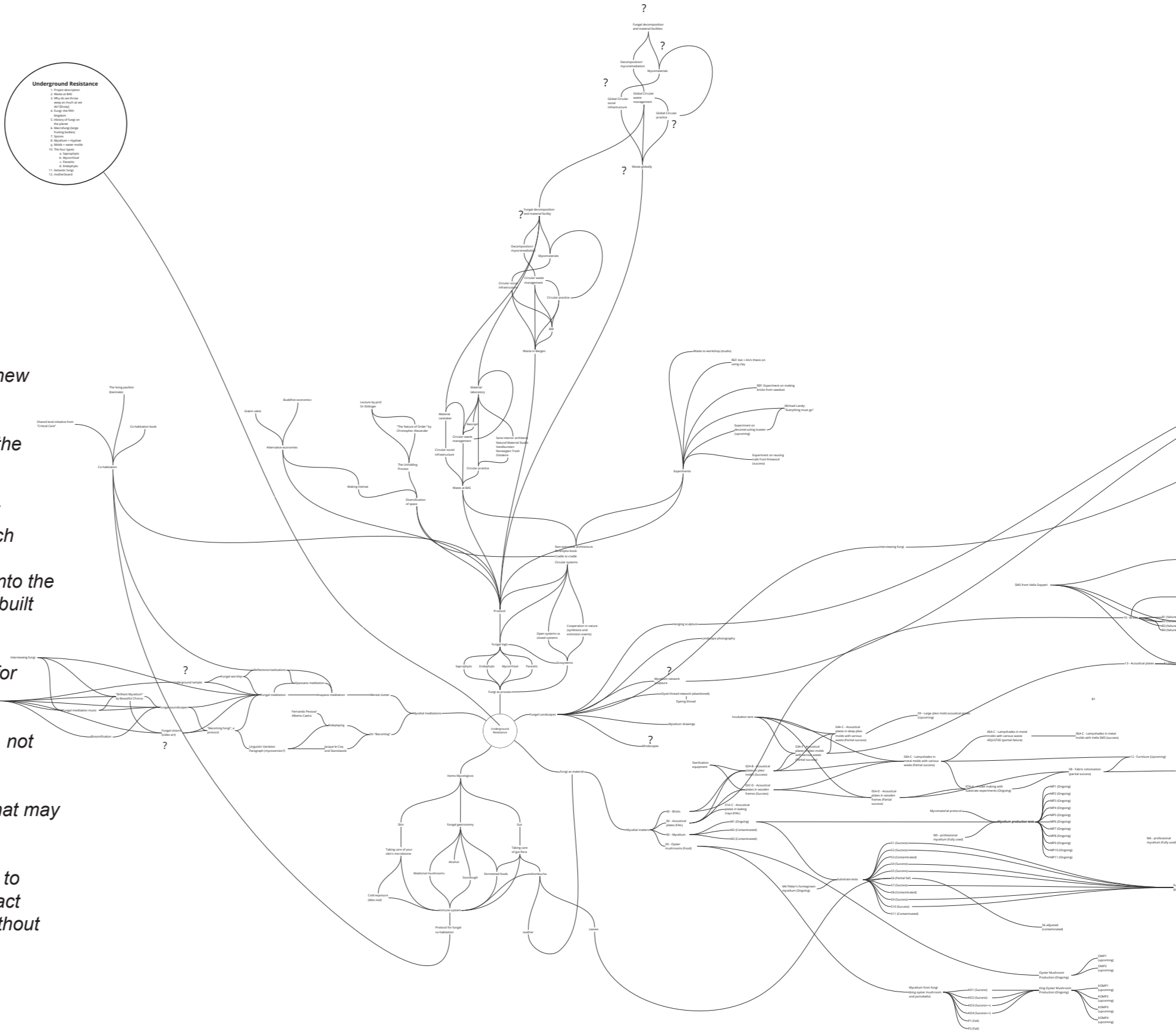
Visit to Hella Sopperi (2023)

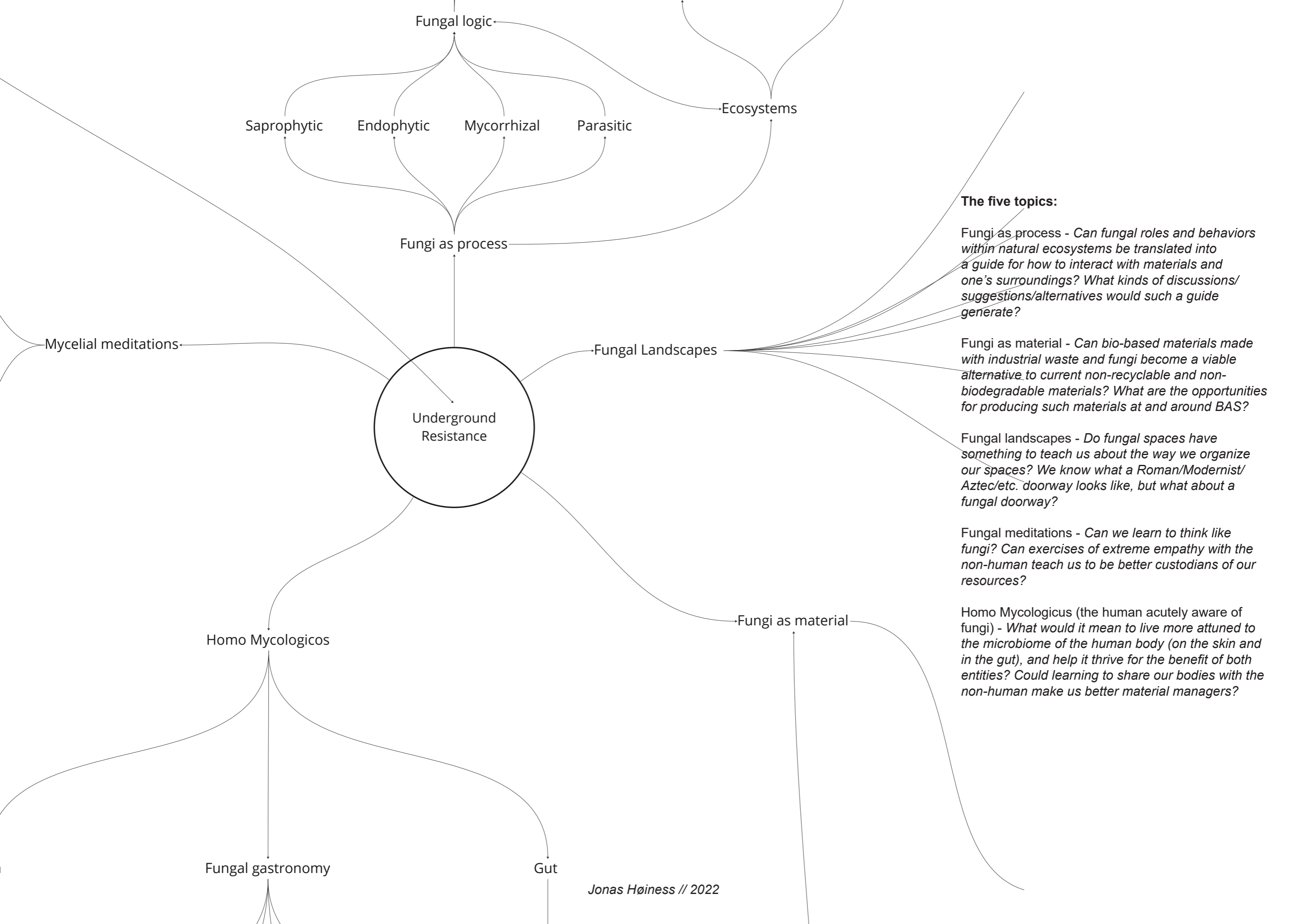


The Underground Process

Early anthropological research into the ways humans produce and deal with waste combined with research into fungal behaviors and roles within their ecosystems provided the foundation that the project grew from. From this early research five widely different topics of interest were generated, that were then explored concurrently following a specific set of rules based on **fungus modes of exploration**:

1. Build on existing knowledge to explore new landscapes
2. Take no ownership. Be the mediator of the process, not the creator
3. Let knowledge discovered in one line of research influence other lines of research
4. All knowledge and materials absorbed into the process must be digested before being built upon
5. All knowledge must be made available for others to build upon later
6. Work non-linearly and process oriented, not linearly and goal oriented.
7. Accept all weird paths and dead ends that may appear
8. Let the process be open-ended. Allow it to unfold and expand indefinitely, and extract interesting results from it as it grows, without stopping it





Fungal logic

Ecosystems

Saprophytic

Endophytic

Mycorrhizal

Parasitic

Fungi as process

The five topics:

Fungi as process - *Can fungal roles and behaviors within natural ecosystems be translated into a guide for how to interact with materials and one's surroundings? What kinds of discussions/suggestions/alternatives would such a guide generate?*

Fungi as material - *Can bio-based materials made with industrial waste and fungi become a viable alternative to current non-recyclable and non-biodegradable materials? What are the opportunities for producing such materials at and around BAS?*

Fungal landscapes - *Do fungal spaces have something to teach us about the way we organize our spaces? We know what a Roman/Modernist/Aztec/etc. doorway looks like, but what about a fungal doorway?*

Fungal meditations - *Can we learn to think like fungi? Can exercises of extreme empathy with the non-human teach us to be better custodians of our resources?*

Homo Mycologicus (the human acutely aware of fungi) - *What would it mean to live more attuned to the microbiome of the human body (on the skin and in the gut), and help it thrive for the benefit of both entities? Could learning to share our bodies with the non-human make us better material managers?*

Underground Resistance

Fungal Landscapes

Fungi as material

Homo Mycologicos

Fungal gastronomy

Gut



*Mycelium brick using SMS
(2023)*

Provisional results of the Underground Process

Translating fungal roles and behaviors within natural ecosystems into principles for resource/material management and how to approach the world, opens up interesting discussions on co-production, cooperative ownership, co-housing, diversification of society, self-organization, deregulation/re-regulation of economies and the need for a circular economy.

Combining local waste materials and mycelium (the root system of fungi) as a binder, produces a new type of biomaterial. This material has great acoustical, insulation, and fire resistant properties. It is non-toxic, odorless, fully compostable, lightweight and durable. If treated right, individual pieces can fuse together, eliminating the need for mortar or screws, which also makes decomposition easier at the end of its lifecycle. During the project the material has been explored, experimented with, and shaped into bricks, bowls, acoustical plates, large scale structures and lampshades.



Accoustical plates grown with different substrates.

*Above: sawdust and coffee grounds. Right: parts of a broken umbrella
(2023)*



*Structure made with mycelium slate
(2023)*



“Expand outwards and into every niche, while staying connected to the rest of the system

Adapt to your environment

Operate without bureaucratic systems. Make local decisions with the knowledge of the whole

Intelligence is found at the edges of the unknown, not in the well established

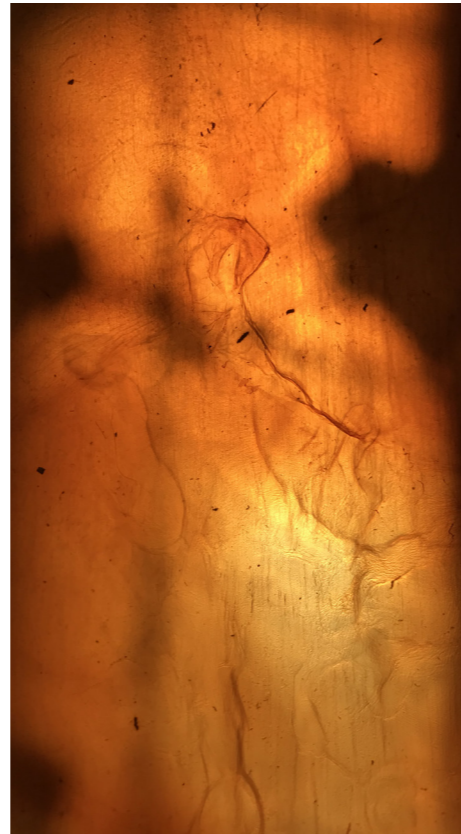
Diversify your communities, spaces, resources and relationships

Work in the background for the good of all beings

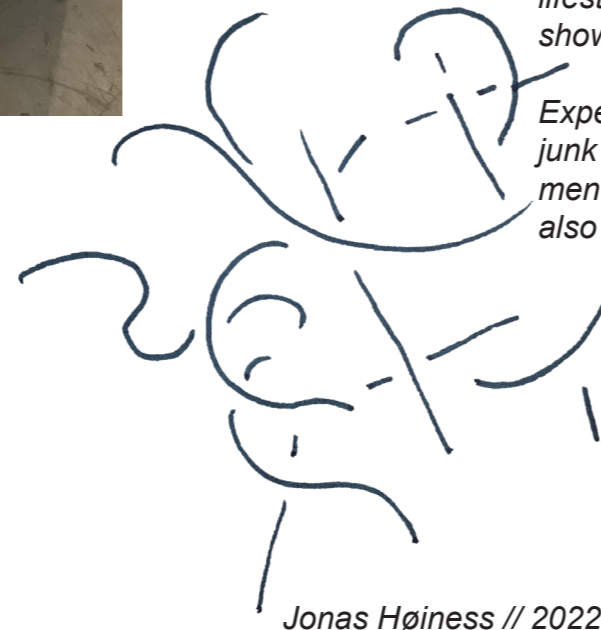
Convert, but do not consume”

*An excerpt from the Underground Protocol
(2023)*

*Kombucha leather
(2023)*



*Mycelium bicks in the
making, using spent
mushroom substrate
(2023)*



Jonas Høiness // 2022

About 1.2 tonnes of Spent Mushroom Substrate (SMS), a waste product of the aforementioned mushroom farm, is successfully used in building large mycelium structures. As far as the literature goes, it's an innovation of the project.

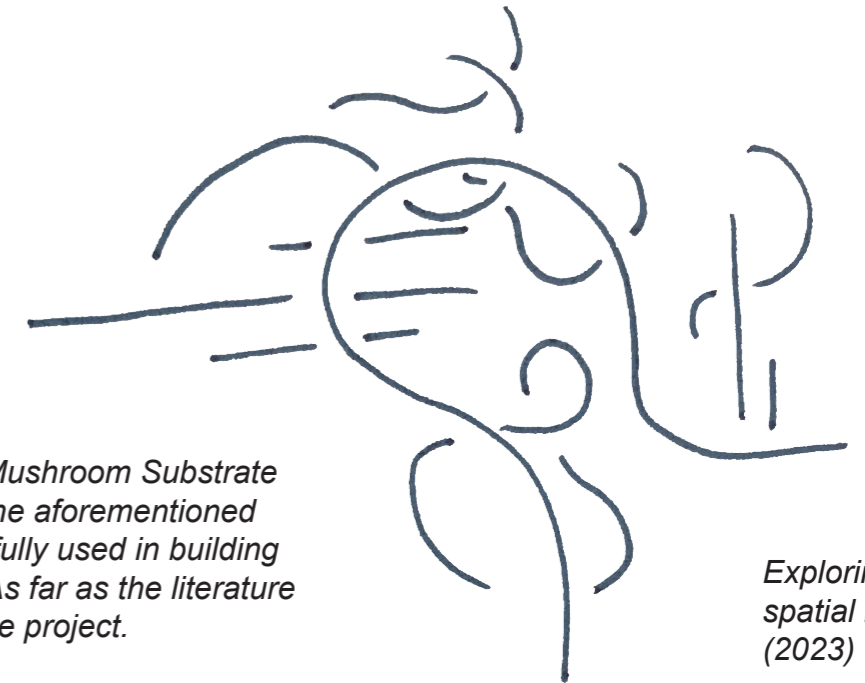
A strong, translucent, biobased leather-like material is produced as a byproduct of Kombucha, a fermented tea that is beneficial for human gut health.

Edible oyster mushrooms grow from non-recyclable cardboard waste.

Empathetic exercises and meditation experiments lead to the creation of fungal design principles used to shape the exhibition space.

Experiments in improving the human microbiome lead to a stronger immune system and healthier lifestyle based on fermented foods and cold showers, which support all other processes.

Experiments in meditation and cleaning information junk from the mind has proven to improve focus, mental capacity, better sleep and less stress, which also supports all other processes.



*Exploring fungal
spatial relationships
(2023)*



*About 370kg of Spent
Mushroom Substrate
(2023)*

*A bowl made from
hollowed-out SMS
(2022)*



And an understanding of resource management,
both intuitive and technical, is deepening