Past to future – Preserving vernacular building traditions

SUMMERSCHOOL

20 24 BUKOWINA

Technische Hochschule Augsburg

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Introduction

Main topics

Field trip

Once again, students and professors from Augsburg university of applied sciences travelled to the romanian region of Bukowina to attend a workshop to understand and document the traditional building methods of the region and even apply them to a traditional building on site. As construction techniques are closely linked to building culture, the excursion was not limited to the technical aspects. On various excursions, we were able to get a picture of the culture, the people, their traditions and the landscape of the region. Therefore, in this brochure we first want to present our short round trip before going into detail about the construction techniques we learnt in the main section. To put the technical aspects into context at the end, we present our impressions in the form of sketches, photos and videos.

Field trip

We arrived in Suceava and were welcomed by Carmen from the Stefan cel Mare University. We started our program with a campus tour and were given some interesting background information about our project and an introduction to our workshops for the following days. We also met the students from Quebec, Poland and Romania, with whom we had the pleasure of working together. Our stay in Suceava also included an excursion to the Village Museum Suceava about the vernacular architecture of the Bucovina region and the Bucovina Citadel, as well as a visit to the Art Farm. We got to know the history and culture of the region by visiting the UNESCO Monastery, learned about the production of linen at the local Bucovina Brunch, saw the art of handmade wooden shingles in Bilca and tasted local food in Horodnic.

Field trip

Our next stop was the town of Cacica in the northern Bucovina region, where we had time for our hands-on workshop on the traditional building methods of the region. We first got to know the town by visiting the salt mine and taking a walk through the centre of the village, which led us to the construction site where our workshop would take place. In the evening we started preparing the clay to be ready for the next day. During our workshop days we got active and tried our hand at making wooden shingles, learned about clay plaster for inside and outside and the secret traditional recipes that include horse dung. After some fun and exhausting days we ended with a presentation of our work to the other students of the BIP program and had a party in the evening.

Field trip

After the successful workshop days, we had time to travel to Vatra Dornei on the mountainside, where we could experience the landscape by horseback riding or hiking. We also used the time to gather information and prepare the presentation for the final presentation in front of the Cacica salt mine. After a homemade Romanian dinner we returned to Cacica. At the local event in Cacica town the next day, we had the opportunity to present our work to the people of the village as well as to the other students. We ended our stay in Cacica with a last round of swimming in the salt pool before everyone started their journey back home, full of new memories and inspiration from the last week!

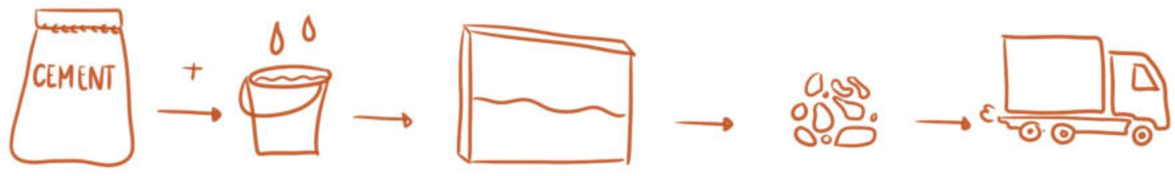
WHY USE CLAY AS A BUILDING MATERIAL?

Clay is a mixture of loam and different textures of sand. It is a natural building material which can be used as a plaster on walls and ceilings, but also as a floor.

Depending on the function, water and straw must be added. The advantage of using only natural materials is that the clay can be returned to nature when it is demolished. This creates a natural cycle.

As a building material it also has good properties for the indoor climate. Clay ensures good indoor air, it regulates the room temperature, room humidity and stores heat. It therefore makes sense to build with clay both for ecological reasons and in terms of comfort.

LINEAR: Industrial product



CIRCULAR: Clay

Wooden shingle

Tim Feinauer, Franziska Mytzka, & Sara Plaß

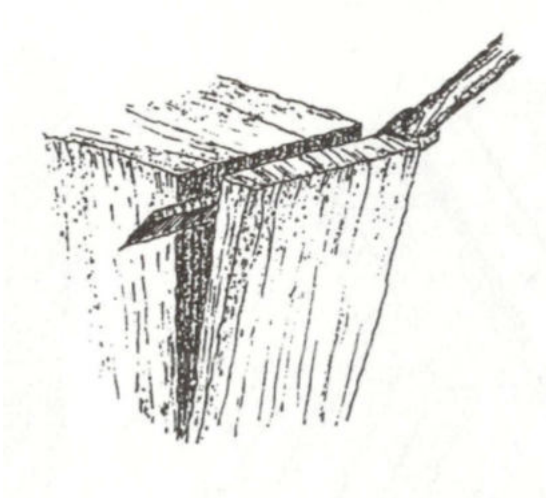
1

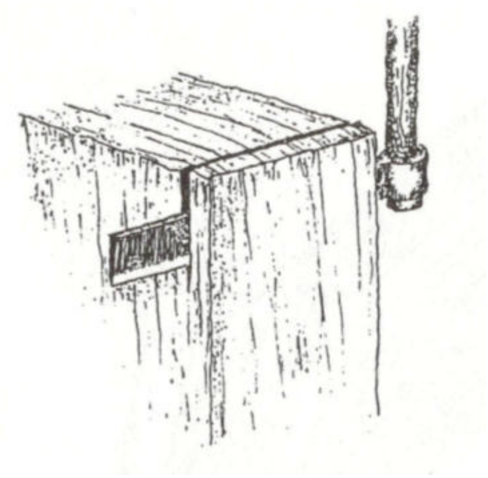
preconditions/process

Most suitable wood is chosen by knocking against the tree trunk, the resulting sound indicates the eligibility

- cut down in the winter months during full moon
- slow in growth, closely spaced growth rings

Straight wood, not twisted, without branches
- wood from a local source
-> fir, larch, spruce, oak, pine





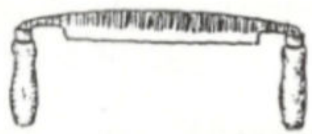
1

Split the wood with an axe

Benefits compared to machine made:
- greater durability
- greater compressive strength

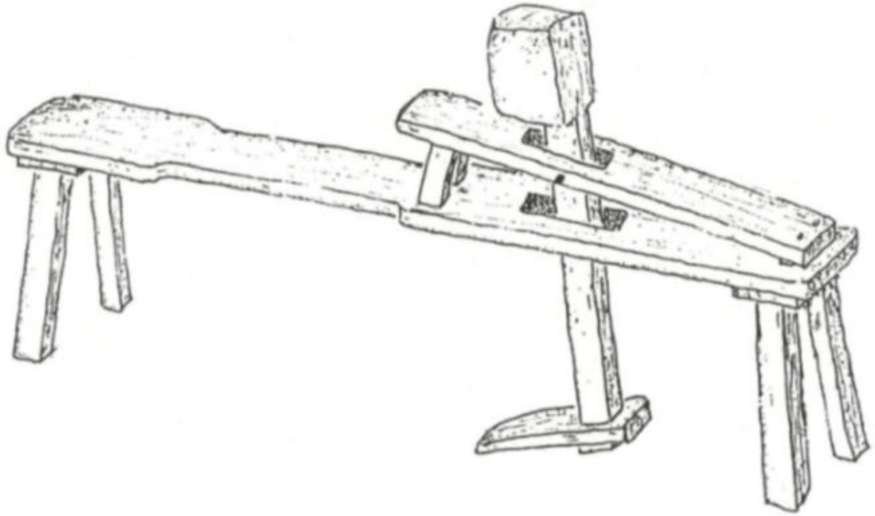
process

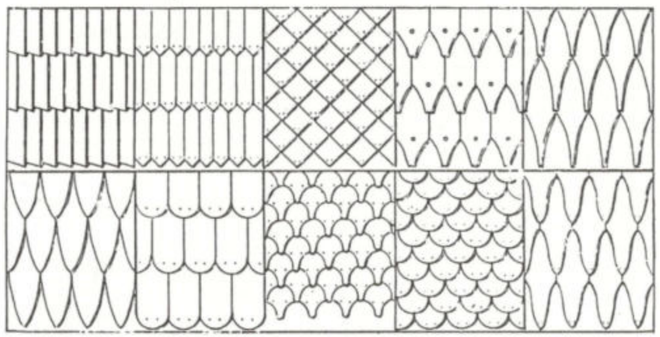
2 postprocessing by hand on a drawbench

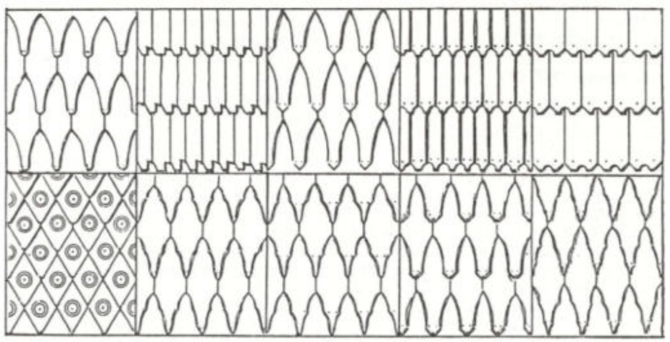


-cleaning

-getting rid of unevenness and irregularities in thickness







3 Tone the shingles with the drawknife

-different scope for design

usage

roof

- ideal roof: 15° - 25°
- can be used for every type of roof,
- installation varied
- the shingle foot should be skewed, so that the water can run off optimal

facade

- protection against humidity penetration
- protection against high outside temperature
- noise protection
- protection against condensed water

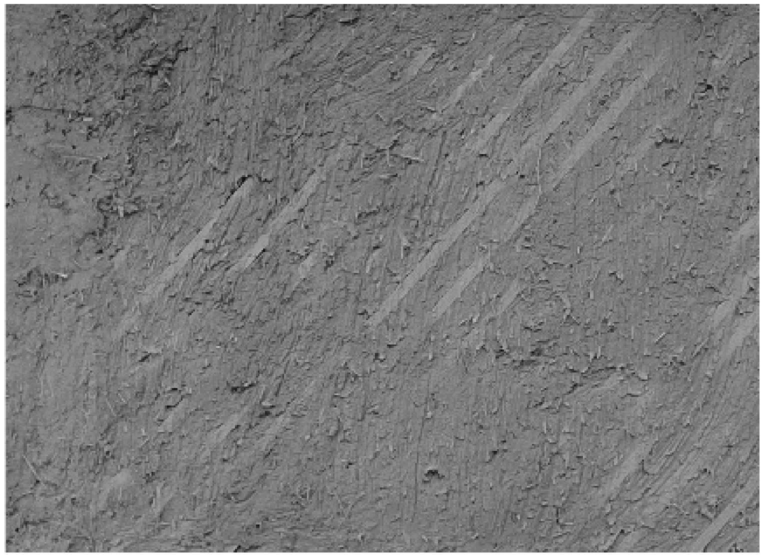
Plaster

Interior & exterior

Pia Jürgens & Rebecca Strickmann

2






Requirements & composition

	Clay/ loam	water	straw	sand	Horse dung	Lime / chalk
Exterior & interior plaster 1. Layer	○ With a high quantity of sand	○	○ Chopped in max. 30 cm length	○ optional, depends on the loam		
Exterior plaster 2. Layer	○	○			○	○
interior plaster 2. Layer	○	○			○	○ Optional
Finishing layer		○		○		○

The composition of clay plaster varies greatly from place to place. There are recipes with long and short lance fibers, the use of wool and lime. The recipe shown here was applied with the help of local construction workers during the workshop.

Process results

Plastering base

First layer plaster

Second layer plaster

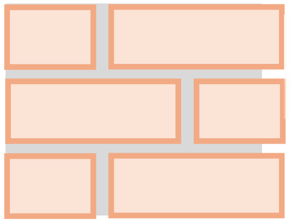
finishing layer lime paint

process

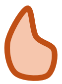
1 preparing wall

Preparation depending on material and surface. The surface must be frost-free, clean, rough, stable and absorbent.

Brick wall



Scrape out joints for more grip

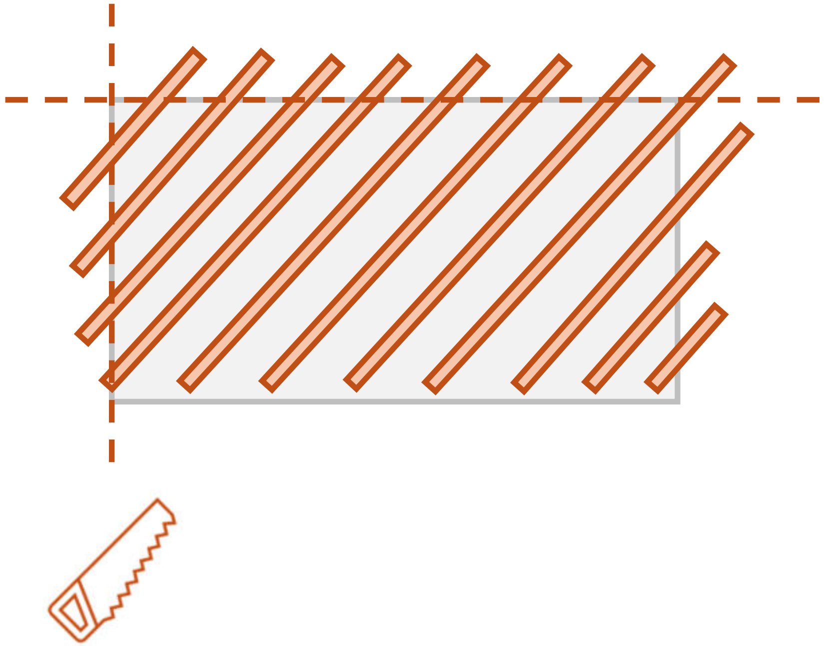


Water the surface

Concrete wall

Solid wood wall

Wooden battens



2 preparing the plaster base

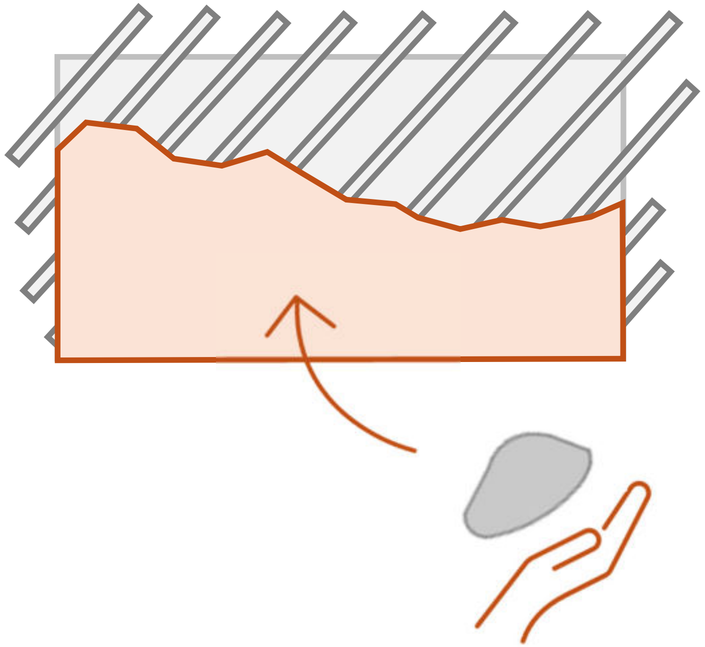
the wooden battens are nailed into the wall at a 45° angle with a spacing of approx. 5 - 10 cm

process

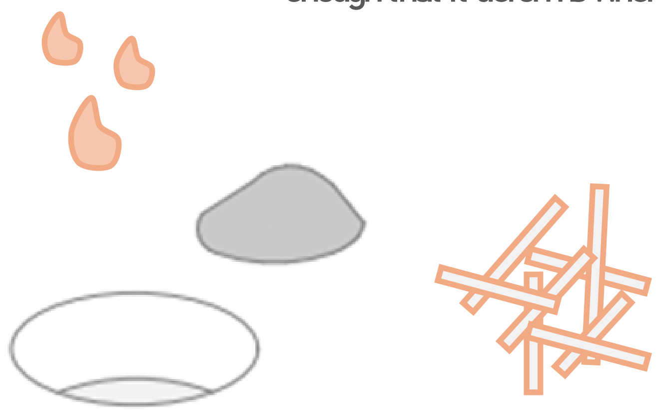
3 mixing plaster
Base Layer

First, dig up the soil in a circle with a spade or shovel. Plants, weeds and roots must be removed. Then spread the clay in the middle of the circle of earth, form a hollow and pour in water. Next, the clay is tamped until the water has combined with the clay. The consistency should be as liquid as a cake batter. Then a lot of straw is spread evenly over the pile of clay. Tamping causes the straw fibers to bond with the clay.

Shape a ball with your hands: The plaster should be firm enough that the ball is easy to shape but fluid enough that it deforms when you put it down.



water



Chopped straw
Length: max. 30 cm

Clay
with a high quantity of sand

4 application

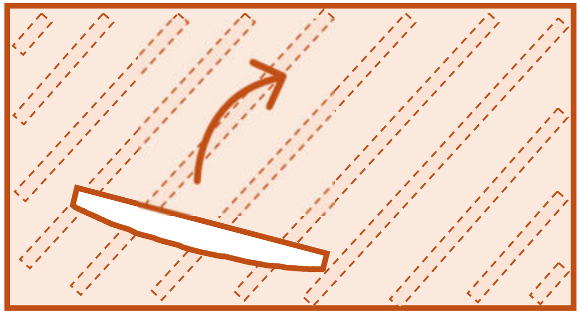
The plaster is applied by hand. The clay plaster is thrown against the wall with a lot of force and gets stuck between the wooden battens. This process is repeated until the entire wall is covered.

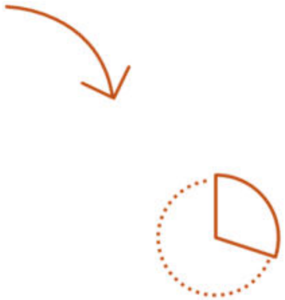
process

5

smoothing

As the clay plaster is now applied very unevenly to the wall, it now needs to be smoothed. Here, the excess clay plaster is removed from bottom to top using a wet wooden tool (similar to a wooden moulding). The finished base plaster now has a thickness of approx. 2 cm



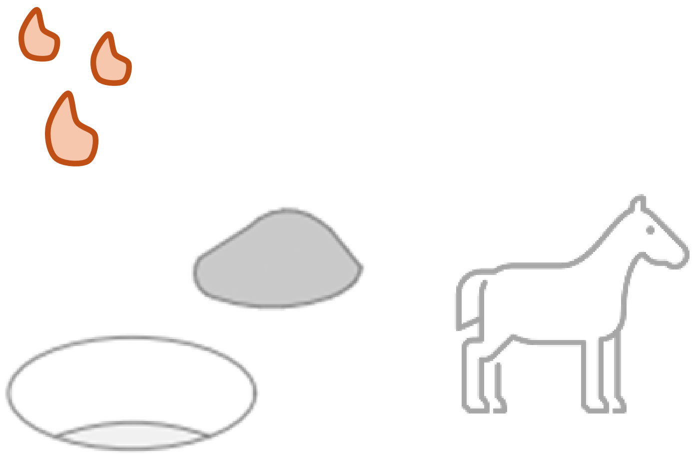


Let it dry for
3 months

6

mixing finishing Layer

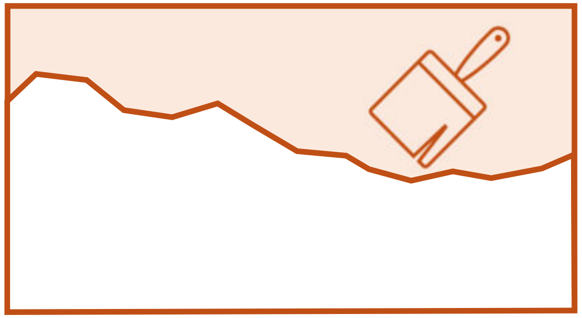
A second layer of plaster is required to achieve an even and weather-resistant finish. The plaster for the exterior consists of clay (with high quantaty of sand), water, horse manure and lime.The horse manure and the make the plaster more resistant to moisture. Lime can therefore be dispensed with in the interior.

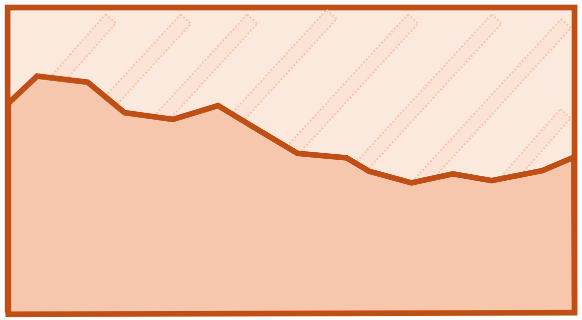


7

application & smoothing

The finishing layer is applied with a plastering trowel to achieve an even result. The plaster is applied approximately 0.5 cm thin to avoid cracks



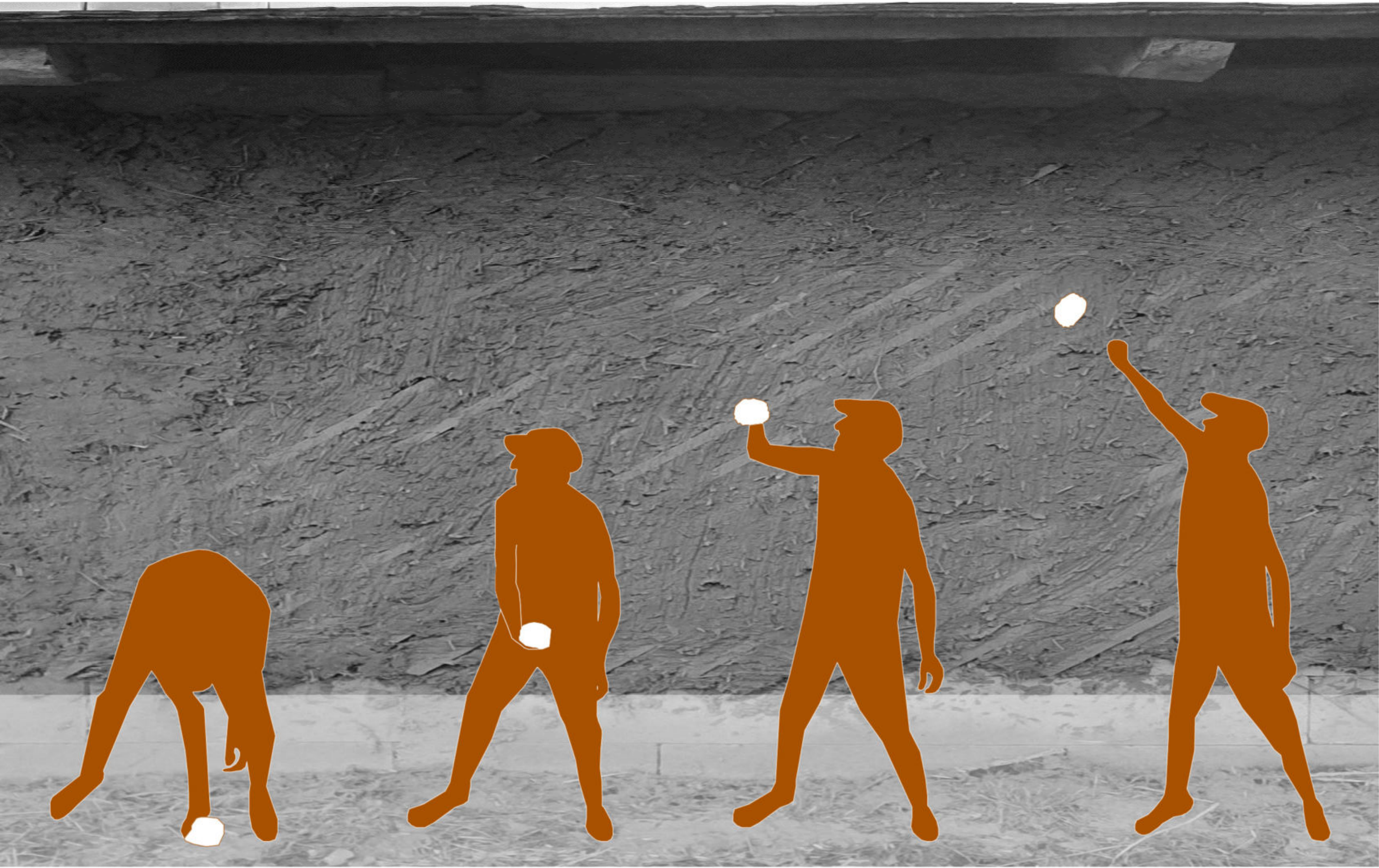


8

lime paint

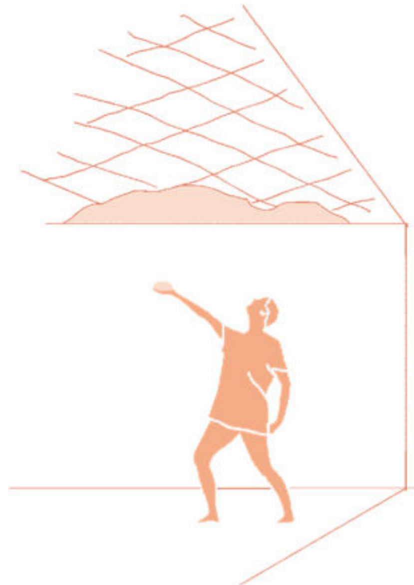
The Bukowina houses are traditionally painted with lime paint. Lime paint is a natural colour and is made from lime, water and sand (depending on the desired surface). Lime paint is very diffusive and has a moisture-regulating effect, especially in interior rooms.

Throwing technique

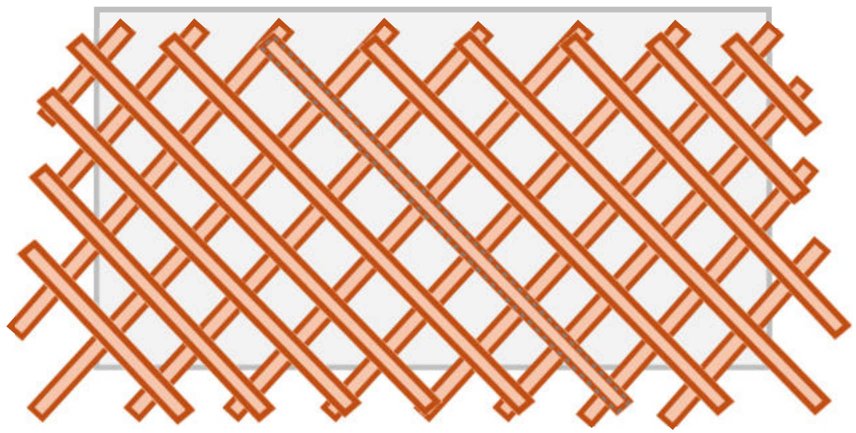


Ceiling

The ceilings are plastered in the same steps as the walls. The only difference is that the wooden battens are crossed over to ensure better adhesion of the clay to the ceiling.



1 - preparing the ceiling
2 - preparing the plaster base
(wooden battens – crossed)
3 - mixing plaster –base layer
4 - application
5 - smoothing
6 - mixing finishing layer
7 - application & smoothing
8 - lime paint



(Ceiling: Carolina Beratz, Lucy Grasmick, Marie Schütz, Theresa Brinkmann)

3

Rammed earth flooring

Carolina Beratz, Lucy Grasmick, Marie Schütz, Theresa Brinkmann

Requirements & composition

Gravel

Sand

Loam

Straw/Hay

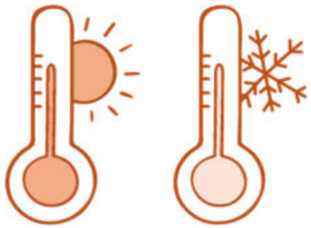
Water

Cow dung

Requirements & composition

- No minus degrees at best not too hot, otherwise the clay will set too quickly

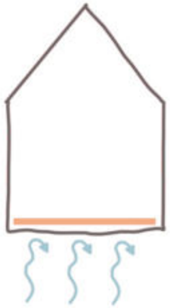
  → processing is made more difficult



- Drying time depends on: layer thickness, temperature, ventilation, air humidity

- No fixed regulations: depending on the region, person, other compositions of the mixing rations

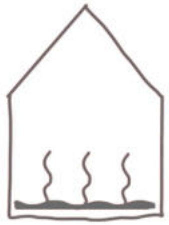
Properties



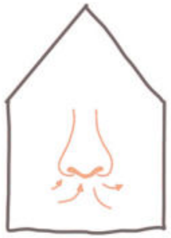
Protection against rising damp

Flat, resilient floor

Thermal insulation through hay



Clay regulates moisture



Absorbs odors

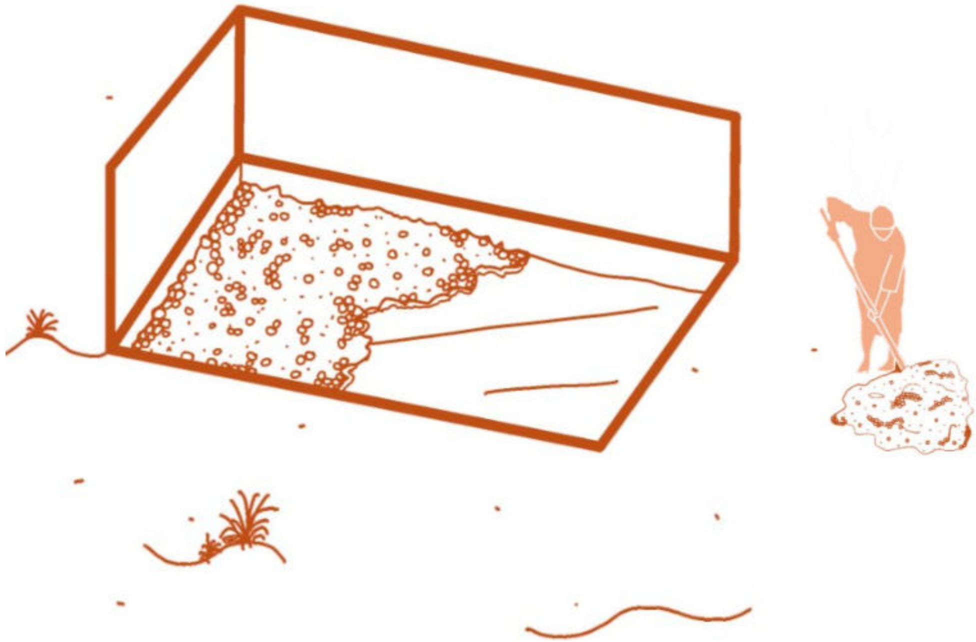
Pleasant room climate

process

1

Plain the ground

remove unevenness, remove large stones or roots, level the ground and tamp with your feet.



2

Preparing the floor

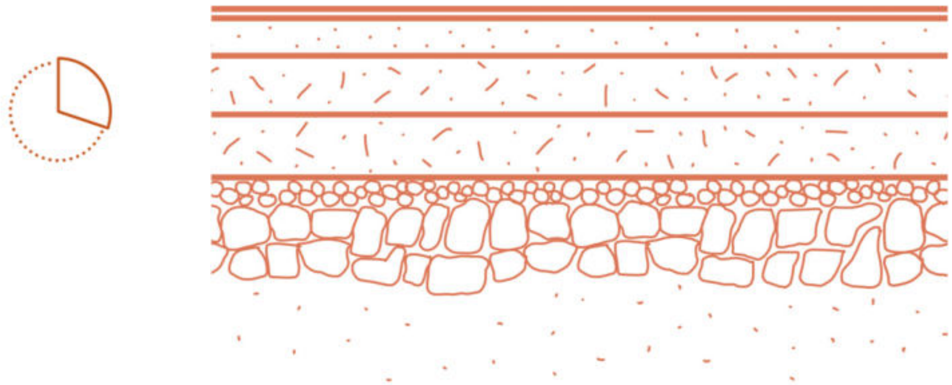
first a layer of coarse gravel is spread evenly, followed by a layer of finer gravel.

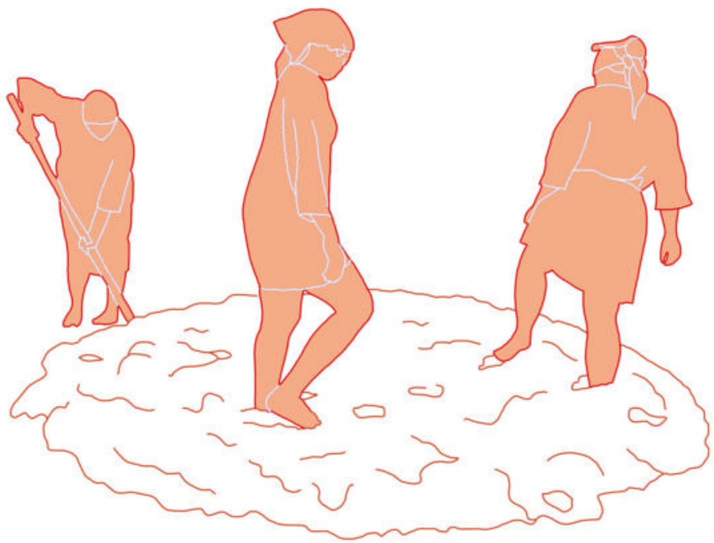
process

3

Mixing plaster

loam, straw, hay and sand are mixed with water and stirred with the feet to form a uniform mass.





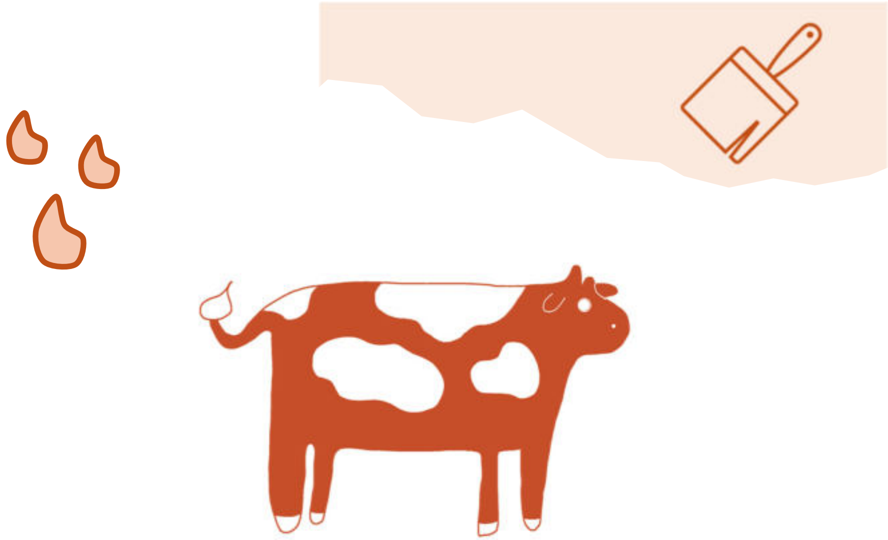
4

Application

the mixture is transported into the house and evenly distributed and tamped down by hand and feet

the process is repeated 2 to 3 times. The individual layers must first dry first.

process



6

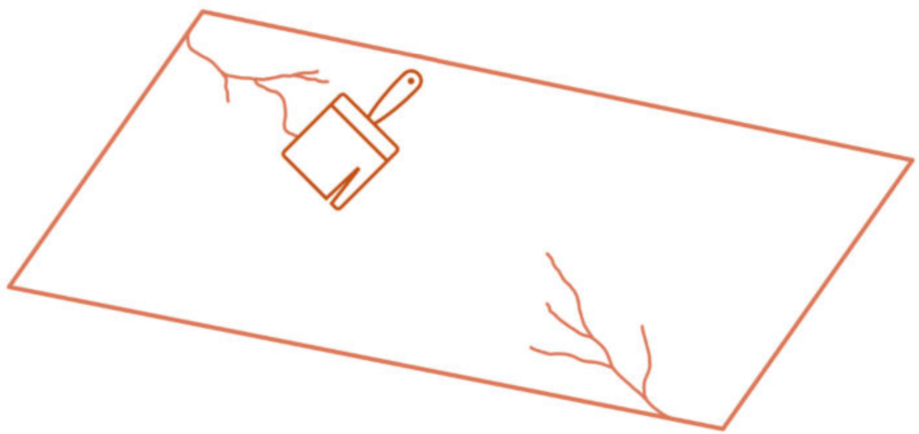
Maintenance

with the water-cow dung mixture, the floor can also be subsequently maintained or repaired

5

Finish

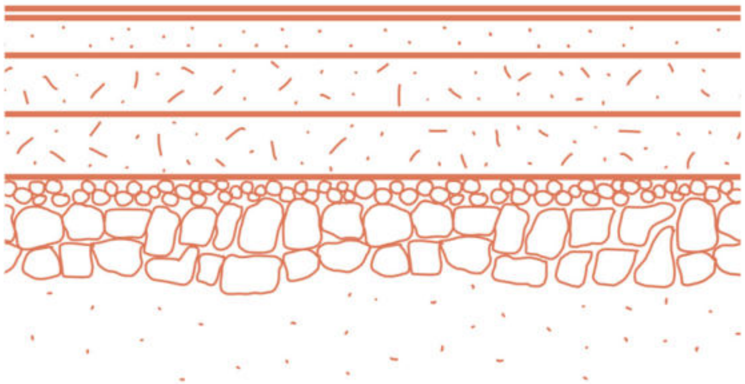
a mixture of water and cow dung is applied as a finish to smooth the floor and close any cracks that have formed.



floor structures

traditional

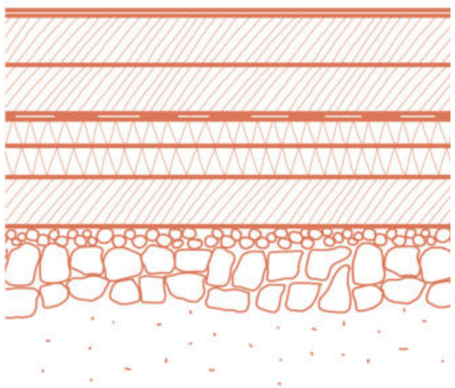
water/cowdung
loam/sand
loam/hay/sand
loam/hay/sand
gravel



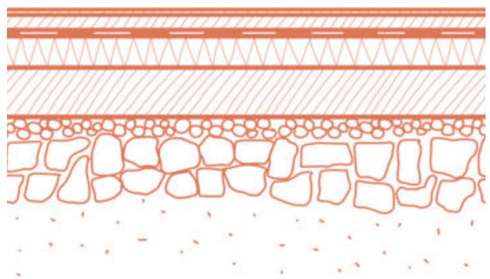
*Tests have shown that an additional layer of clay between the layer of gravel and the layer of loam can provide an improved level of protection against raising damp.

modern alternatives

lineseed oil seeling
loam/sand
clay-croc-trass mixture
pe-foil
reed insulation
reed insulation
fat loam/sand
gravel



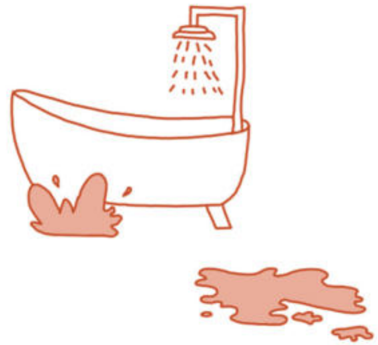
lineseed oil seeling
clay-horse manure mixture
pe-foil
reed insulation
loam/hay/sand
fine gravel
coarse gravel



Problems + solutions

- Complex manufacturing process
  → modern technologies (exavator, mixing machines, Vibrating plate)

- Permanent high humidity can lead to weathering damage
  → not for use in sanitary areas



- Permanent, light layer of dust that can´t be cleaned with water
  → new sealing techniques, for example with lineseed oil

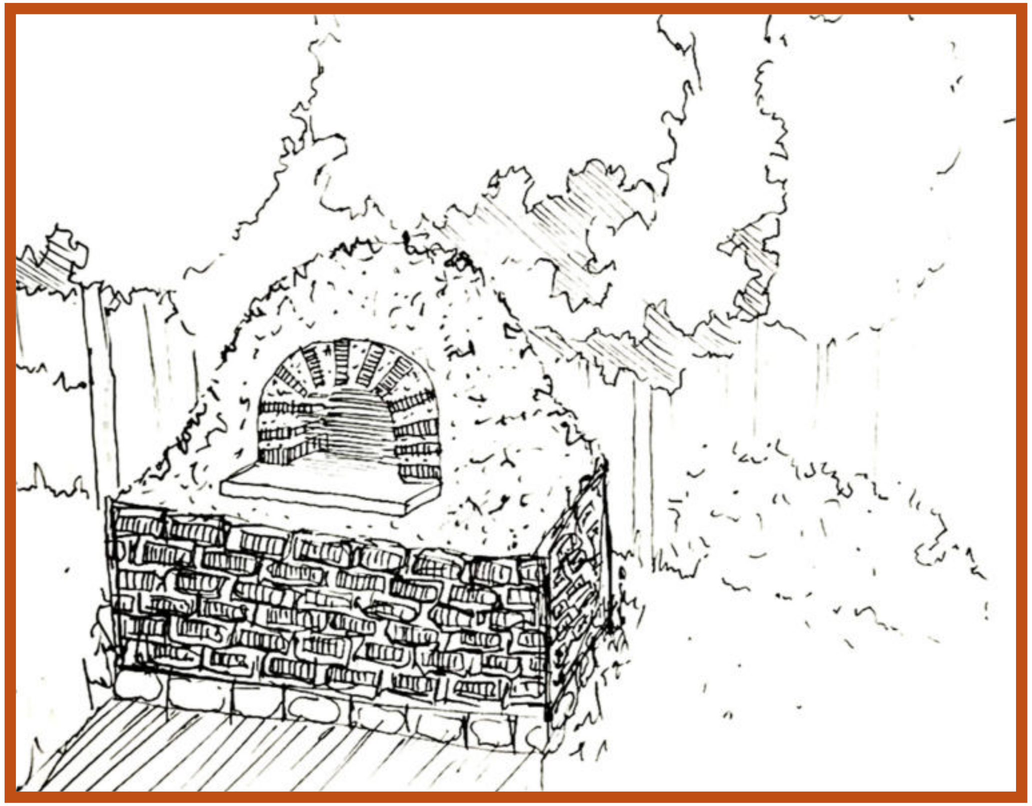
Clay oven

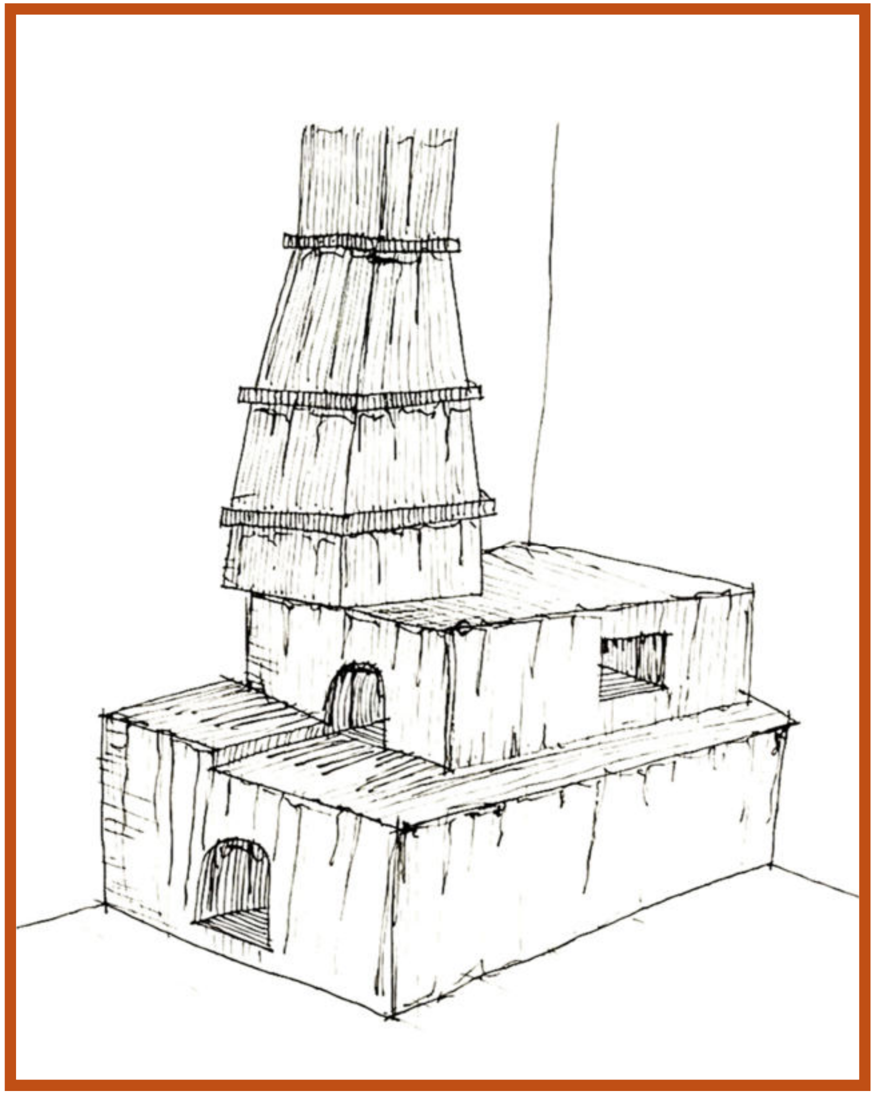
Isabella Hehl, Amelie Kitz

4

benefits

The clay oven is an important part of the traditionell Bukowina house. Heating the house is just one of many other functions. There are two different types, the indoor oven and the outdoor oven. The ovens differ in their function as well as in their structure.





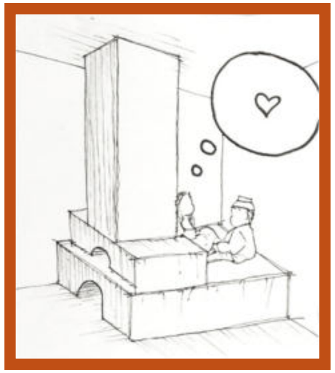
benefits

1

On the one hand the inner oven serves as a stove and on the other hand it is also used for baking. Often there is a metal plate on top of the stove which is used for cooking. Some of the baking is done in the outside oven as well.

2

Another important aspect is the connection. The clay oven is the heart of the house, where people sit together in the evenings and spent time together. In the cold months, the children sleep on the oven to have a warm place.



As many Bukovina houses does not have a chimney, the smoke spreads to the attic. The residents take advantage of this and hang up food (especially meat) to smoke. From the attic, the smoke escapes from the house through the bat dormers.

3

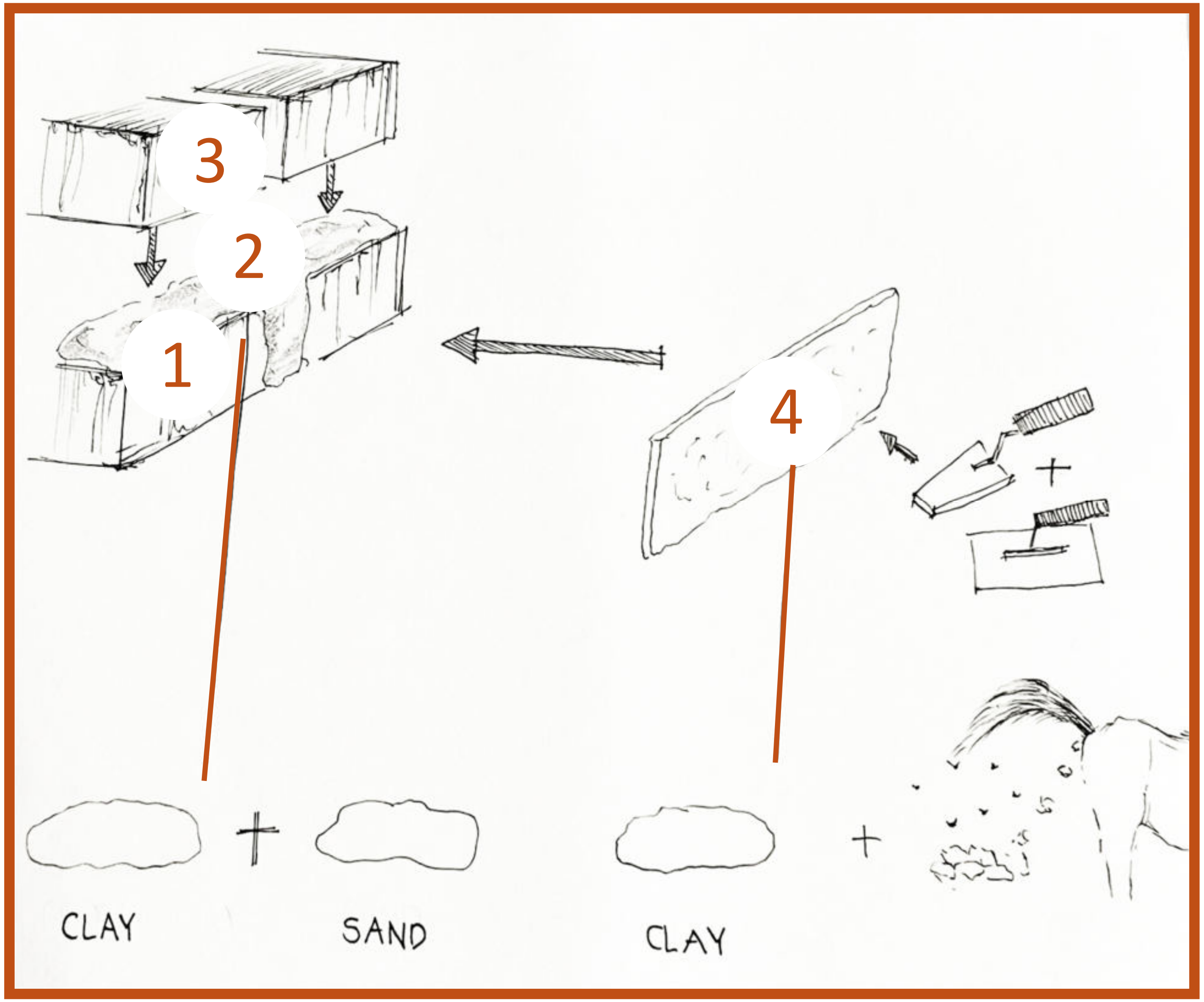
Side Fact

The bat dormers were used as a **smoke distributor** that it didn't look like all the smoke is coming out from the chimney.

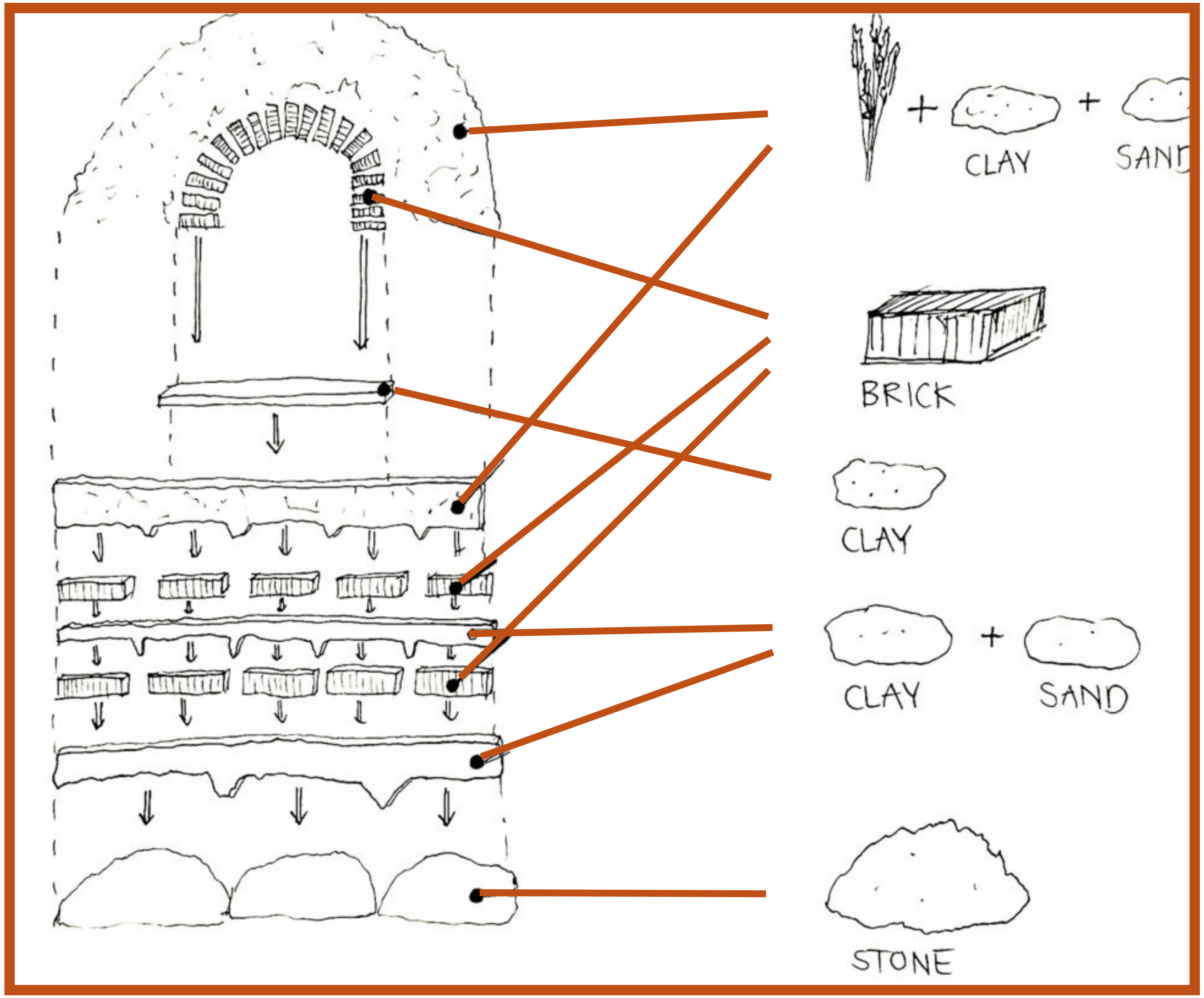
In the early days they had to **pay fees** if there was much smoke, because it meant that there were a lot of people inside the house.

interior oven

Different layers are applied to the inner oven. The base is made of large clay bricks that are stacked on top of each other with a mortar made of clay and sand. Finally, the oven is plastered with a mixture of clay and horse manure.



exterior oven



The basis of the oven is made of large stones. Smaller bricks are then layered on top of these. The separating layer is also a mixture of clay and sand. A layer of clay, sand and straw forms the top and the dome. Bricks decorate the opening.

5

Composting Toilet

Anne Wicklein, Christian Fickler

current situation

45% of the population in Romania is living on the countryside

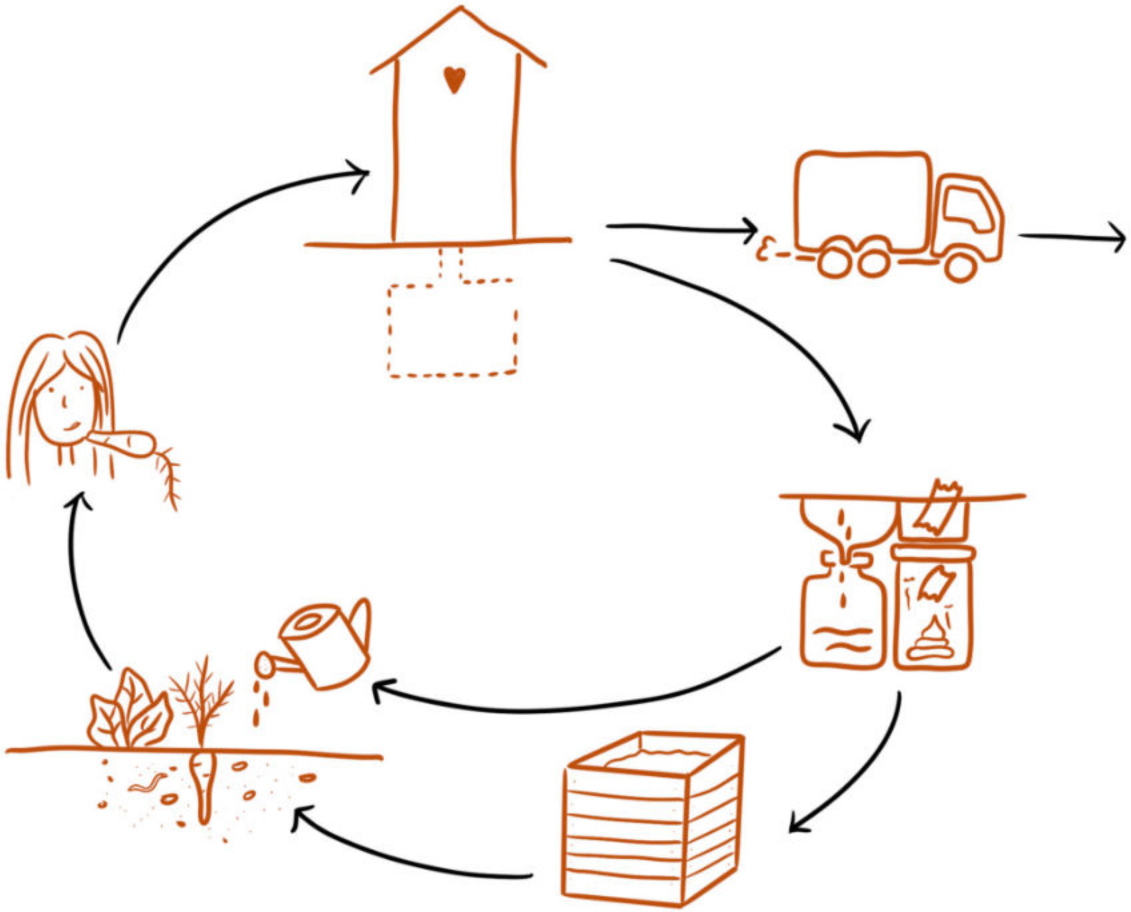
23% of the population doesn't have a bathroom, toilet or shower in the building

46% of the population doesn't have access to a sewage system

Rural areas in Romania are particularly challenged by sanitation issues. Many rural areas lack centralised sewage systems, relying instead on individual septic tanks or rudimentary pit latrines. These systems are often poorly maintained, leading to leaks and contamination of local water sources. In some cases, raw sewage is discharged directly into the environment, causing significant health risks and environmental damage. Composting toilets can be a simple and inexpensive way to improve the situation in rural areas, as they don't require large investments in sanitation infrastructure.

Sources: M. Raicov et al, 2018; C. Bumbac et al, 2023;

closed cycle



Using a composting toilet can transform sewage waste management from a linear to a circular system, providing several benefits over traditional septic tanks. Composting toilets separate liquid and solid waste. The solid waste is stored and periodically stirred to enhance the composting process, turning it into safe compost over time. This compost can then be used to enrich soil, creating a closed-loop system where waste is recycled back into the environment as a beneficial resource.

Sources: compostingtoilet.eu

benefits

Benefits of Composting Toilets

- **Water Conservation:** Unlike septic tanks, composting toilets do not require water for flushing, significantly reducing water usage. This is particularly beneficial in areas with limited water resources
- **Reduced Pollution:** By composting human waste on-site, composting toilets prevent the contamination of groundwater and surface water, a common issue with septic tanks that can leak or overflow
- **Nutrient Recycling:** The compost produced from human waste can be used to fertilize non-edible plants, returning nutrients to the soil and reducing the need for chemical fertilizers
- **Cost-Effective:** Composting toilets are often more affordable to install and maintain compared to septic systems, especially in rural or off-grid areas where connecting to a sewage system is not feasible

Sources: homebiogas.com; compostingtoilet.eu

types

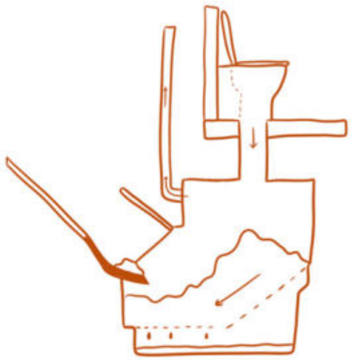
Self-contained composting toilet

The single, self-contained unit is located in the bathroom itself

- ⊕ Easier to install and more affordable
- ⊕ Can be retrofitted into existing bathrooms
- ⊕ Don't require underfloor space

- ⊖ Smaller capacity, requiring more frequent emptying
- ⊖ May result in incomplete decomposition with frequent use
- ⊖ Can lead to liquid accumulation if overused

Central or split composting toilet systems



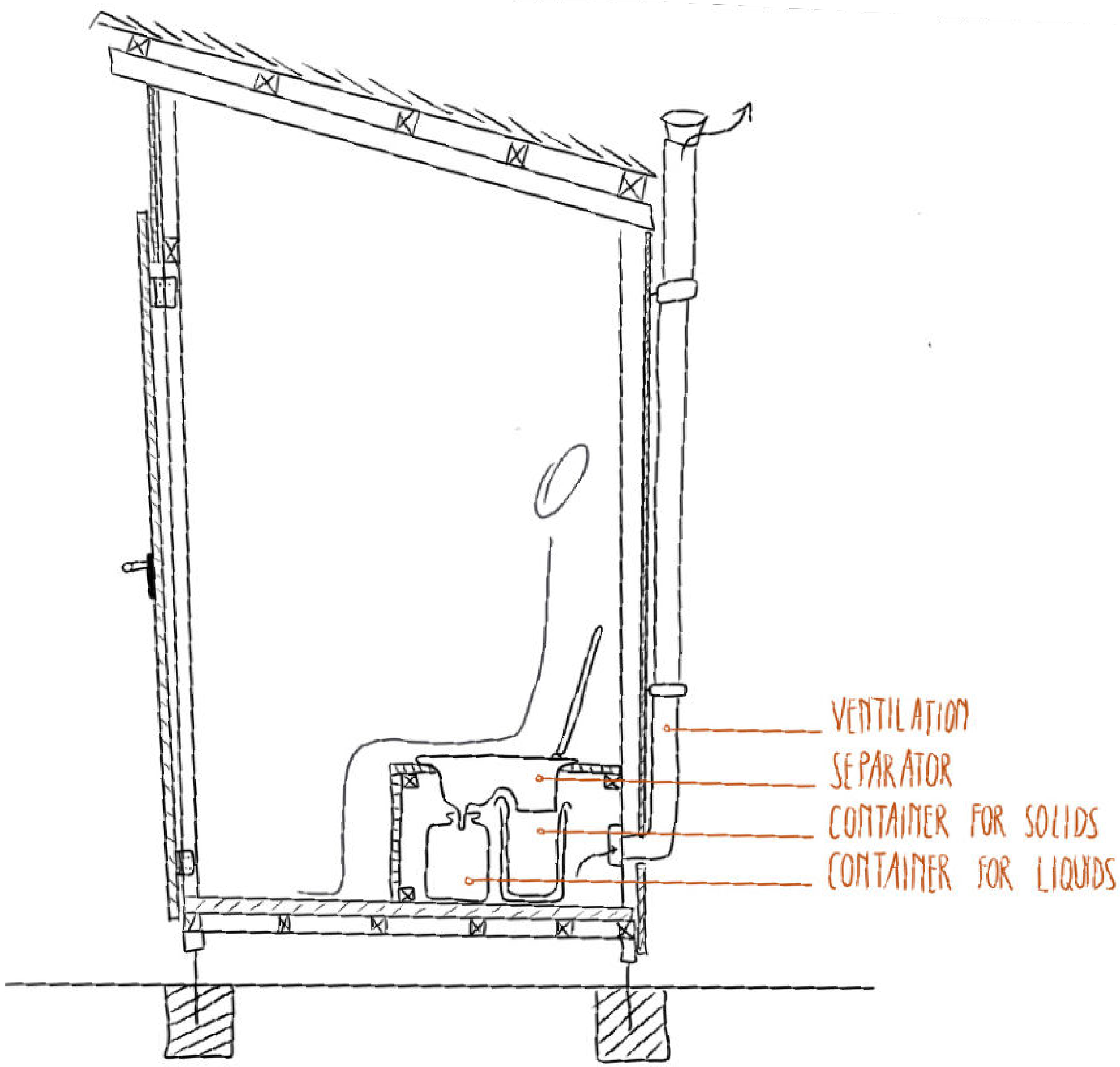
Chutes are attached to connect the toilet to the composting unit that is usually located in the basement

- ⊕ Larger composting capacity
- ⊕ Better at handling peak loads and intermittent use
- ⊕ More stable composting process due to larger volume
- ⊕ Can be emptied less frequently (once a year or every other year)

- ⊖ Requires underfloor space for the composting chamber
- ⊖ More expensive to install and purchase
- ⊖ Each toilet needs its own chamber, making multiple toilets challenging

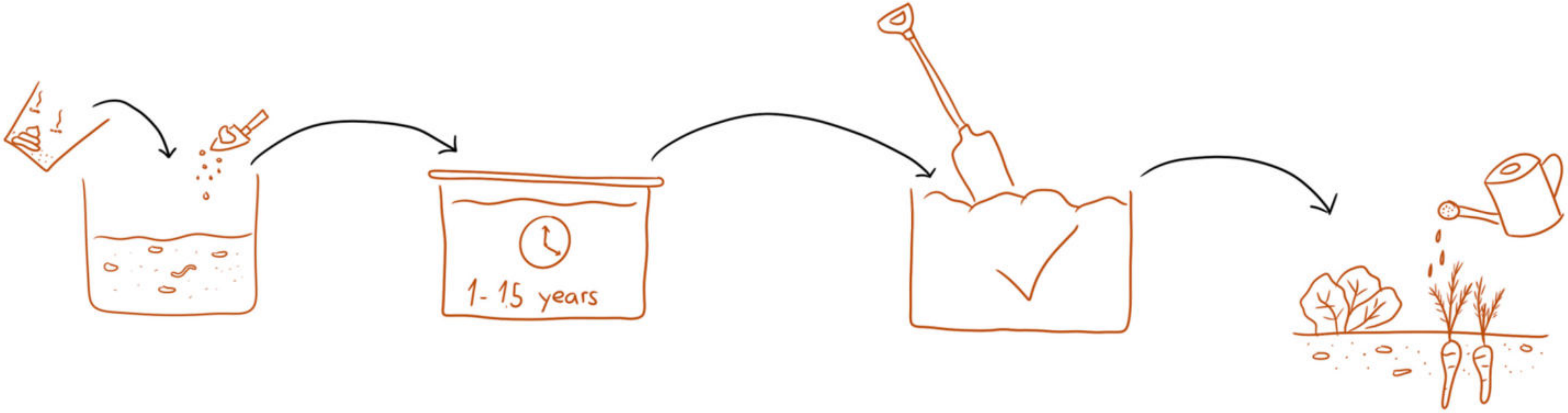
Sources: microbialogic.com; planetnatural.com; level.org.nz

Example of a self-contained composting toilet



As an all-in-one unit, the self-contained composting toilet is very easy to install, whether it is a new building or an existing toilet. All you need is a separator and a unit for solids and liquids. In order to reduce odours, a ventilation system is required, which can be powered by an electric fan. As the system doesn't require plumbing, it can be installed in existing homes without toilets. The composting process can take place outside the house (e.g. using the 3-Box-System for composting). In this way, the system could even fit into traditional houses to adapt them to modern needs.

3-Box-System for composting



Box 1 – Filling

The collection container for solids is emptied from the toilet into Box 1. The contents are mixed with the existing material and filling material (e.g. sawdust, lime, primary rock flour) each time it is emptied.

Box 2 – Maturing

When box 1 is full, the contents are filled into box 2 for maturing and mixed regularly. Water is added if necessary. Once the right consistency has been reached (not too crumbly), the maturing process is complete.

Box 3 – Storage

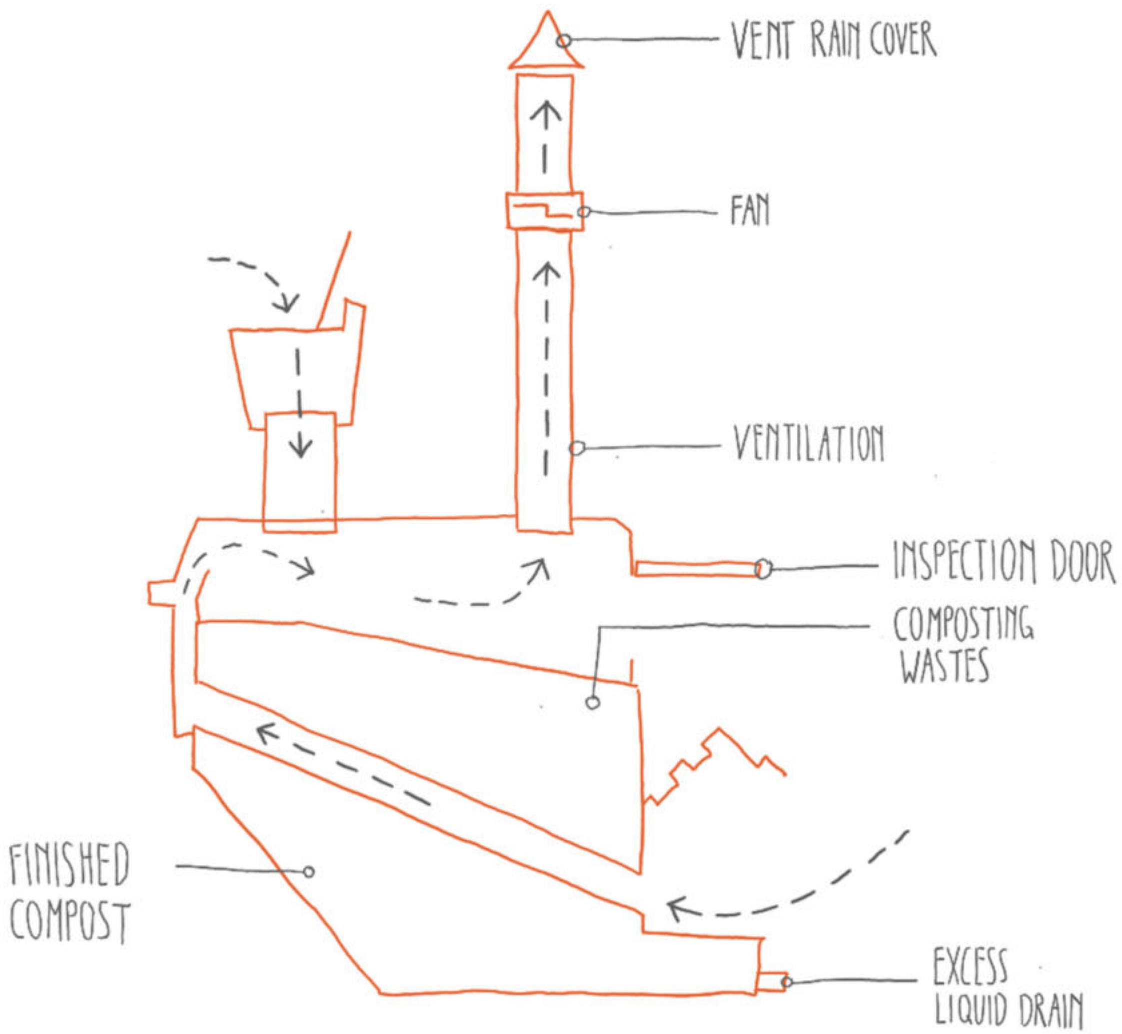
The finished, dark black, fertile soil is stored in the third box and can be used as required.

Application

In addition to the soil, urine can be used as a liquid fertilizer concentrate for plants. Depending on the plants' nutrient requirements, it is mixed with water in a ratio of 1:10 to 1:20

Sources: trobolo.com

Example of a split composting toilet



The split composting toilet requires an underground space where the waste is collected, composted and stored. The toilet itself looks similar to a conventional toilet or one with a septic tank underneath. Urine can be separated either in the toilet or in the composter. The chamber usually has a mechanism for aerating and mixing the compost, which can be manual or automated. This helps to maintain the aerobic conditions necessary for proper composting. The finished compost can be removed from the bottom, usually once or twice a year. This makes split toilets more convenient to use. The system can be a good alternative to septic tanks, which produce odours and require regular emptying.

Sources: ecolet.com.au

Sketches

6

Tim Feinauer, Isabella Hehl, Amelie Kitz

CACICA

DIFFERENT CULTURES

ORTHODOX
KATHOLIC

GLUE IT TOGETHER

SALTMINE

ORTHODOX CURCH

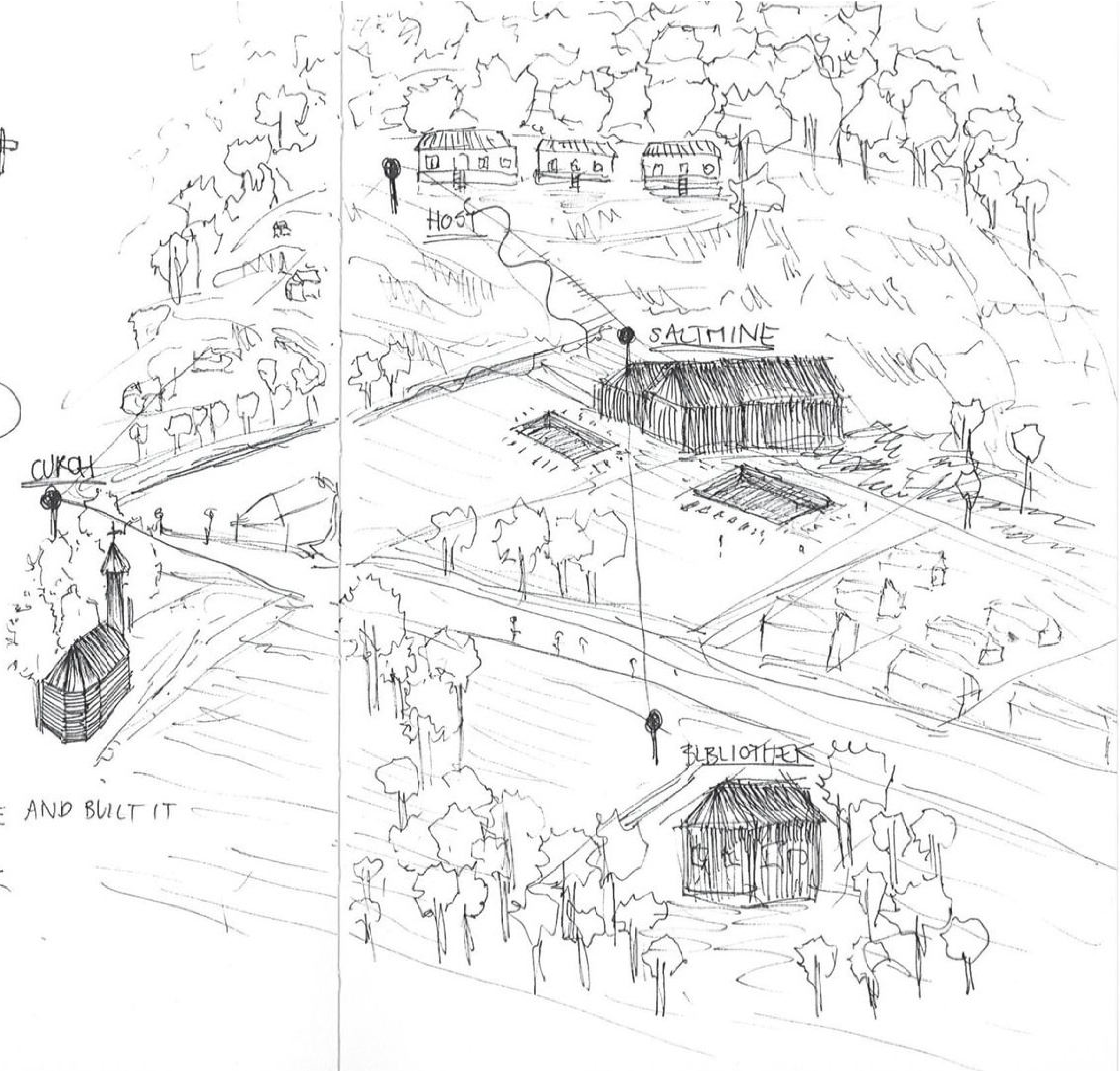
„PARTY ROOM"

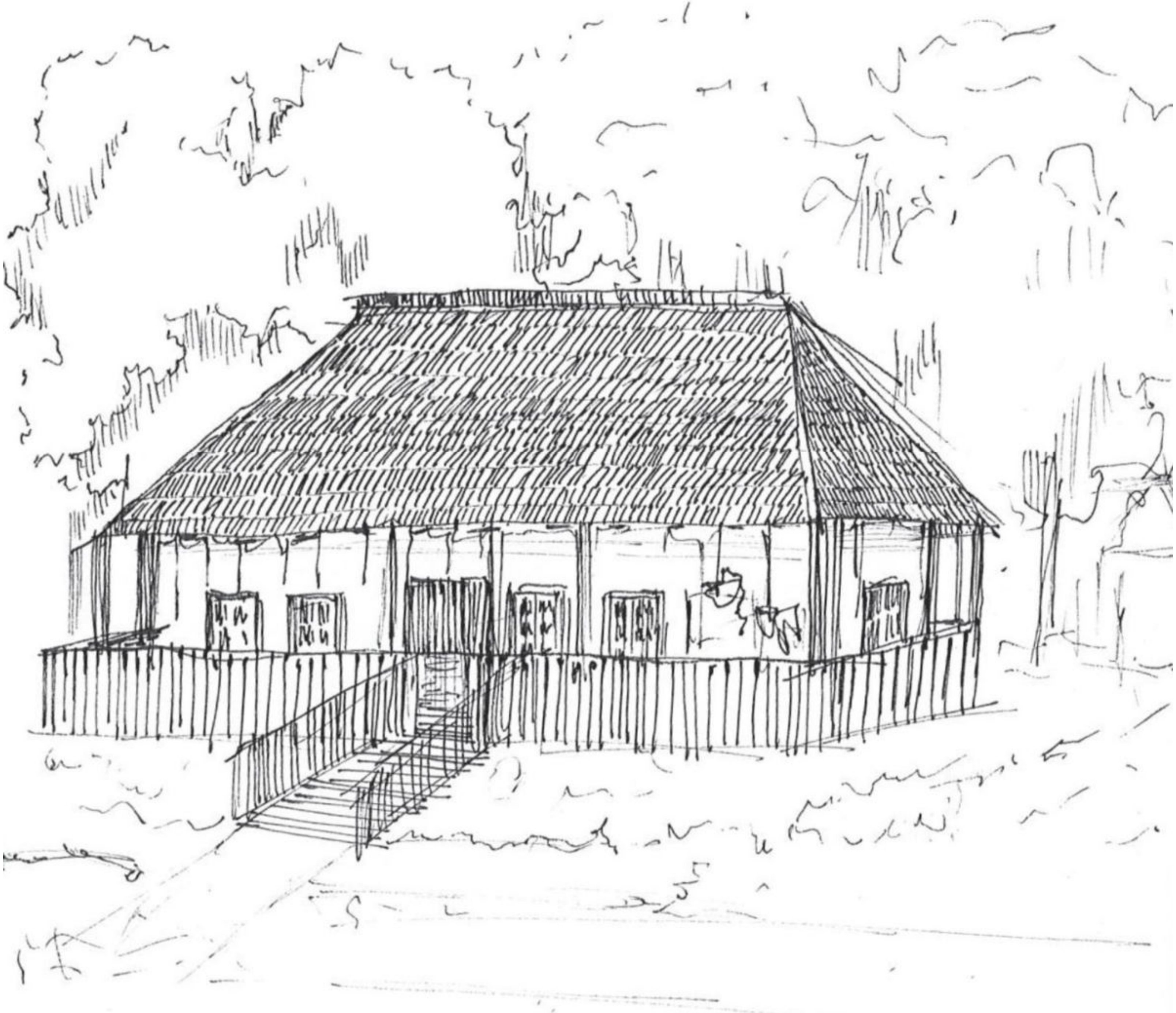
KATHOLIC ANOTHER CURCH

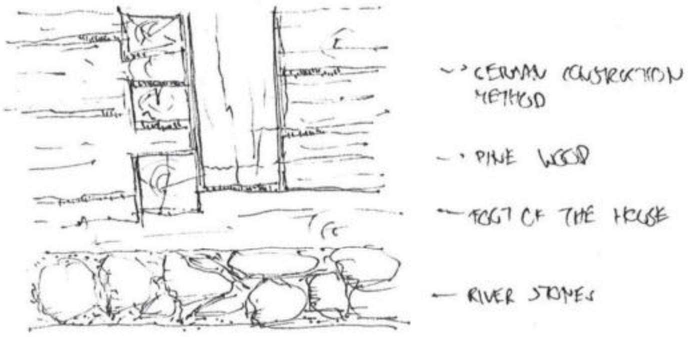
⇓

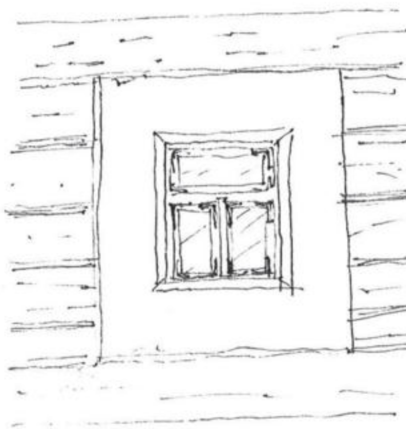
BIGGER ONE
BECAUSE POLISH PEOPLE
CAME TO CACICA FIRST TIME AND BUILT IT

CACICA = DUCK

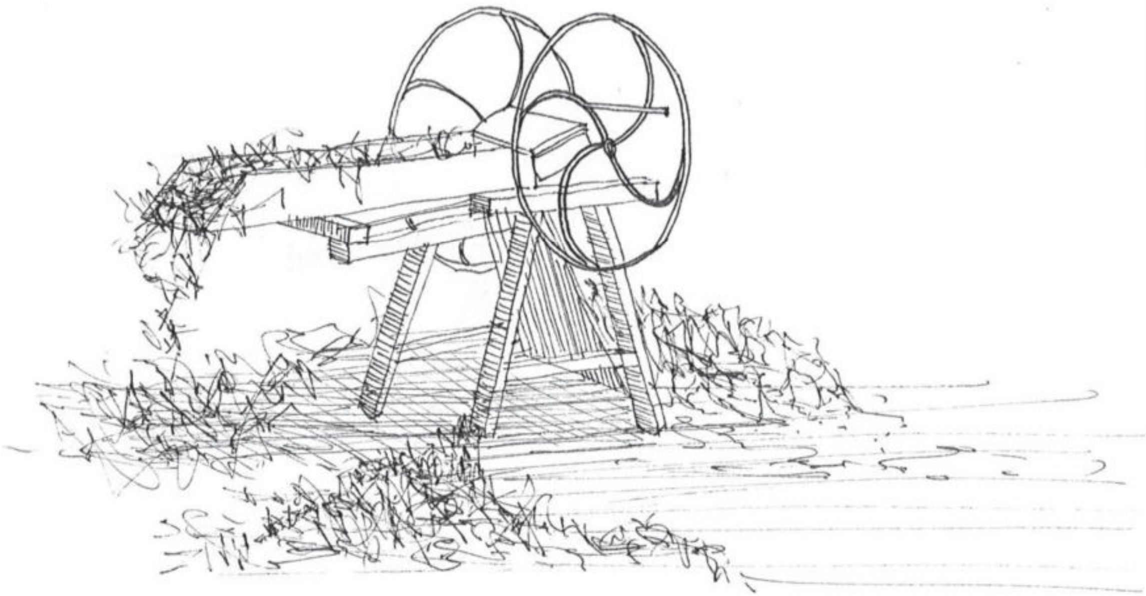


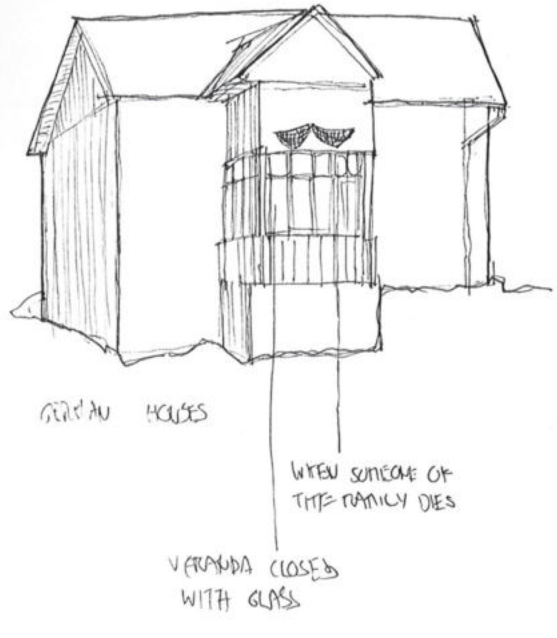


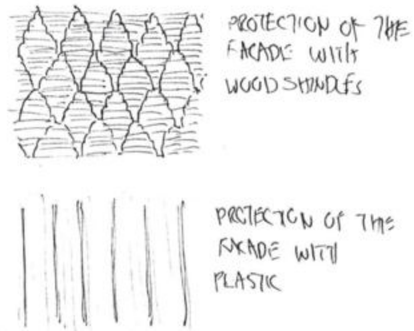




VILLAGE MUSEUM SUCEAVA







7

Pictures

Tim Feinauer, Isabella Hehl, Amelie Kitz


tradition


culture


heritage

community

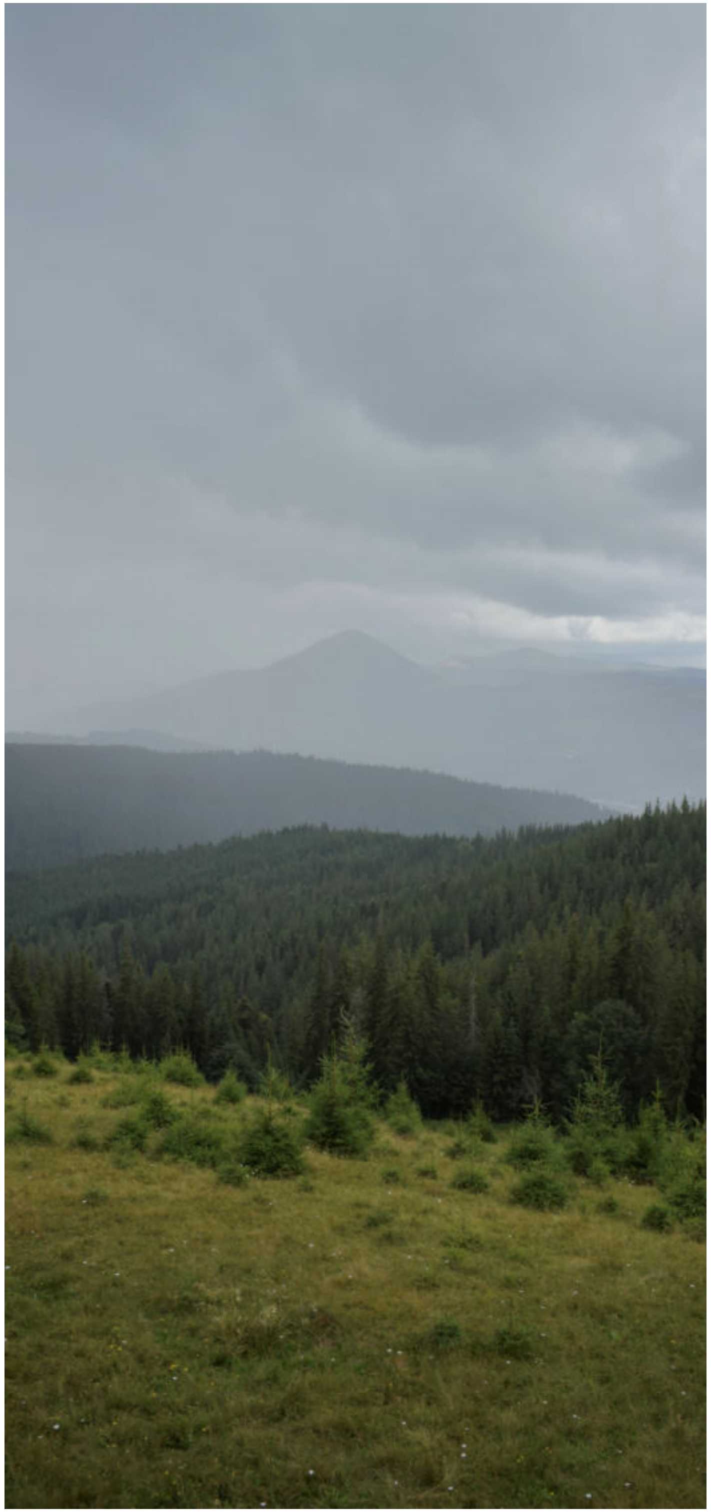

PUT
history


workshops

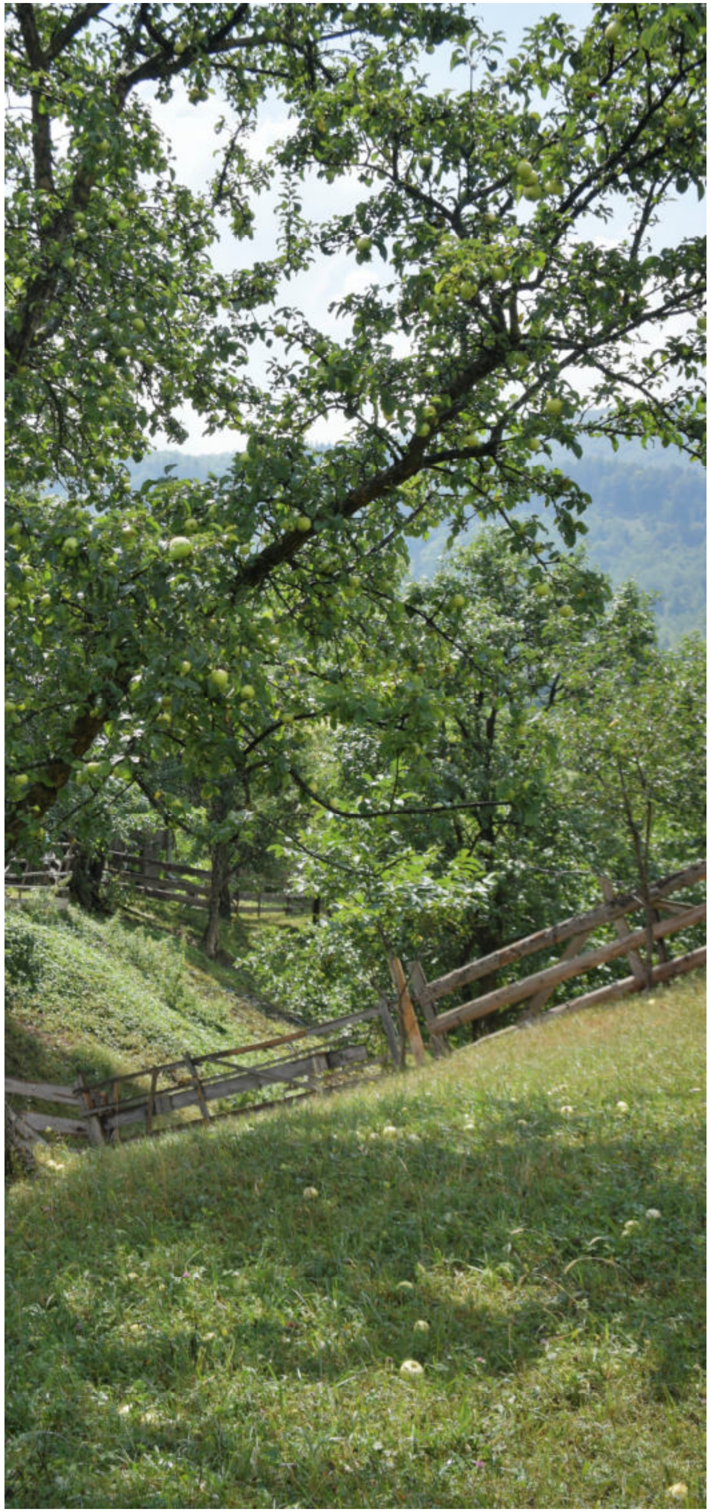

workshops


workshops


workshops



activities




Videos

Theresa Brinkmann, Lucy Grasmick, Carolina Beratz, Marie Schütz

8

workflow

culture

leisure time

Fakultät: Architektur & Bauwesen

Leitung: Prof. Dipl.-Ing. Susanne Runkel

& MA Sabina Marhao, MA Michael Sedlmeier