Harmonizing Nature, Engineering and Creativity

An Interdisciplinary Exploration of Engineered Living Materials, Artistry, and Sustainability in Collaborative Mycelium Brick Construction.

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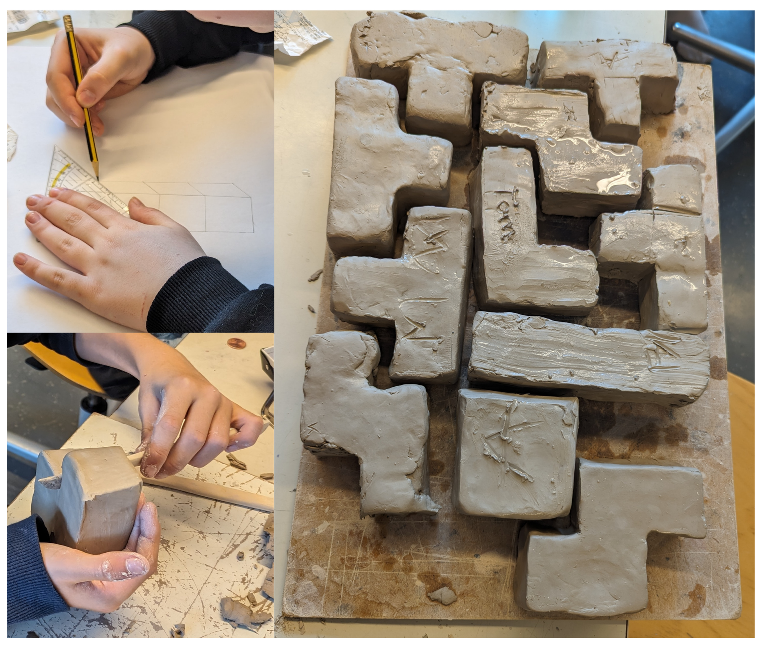
Introduction

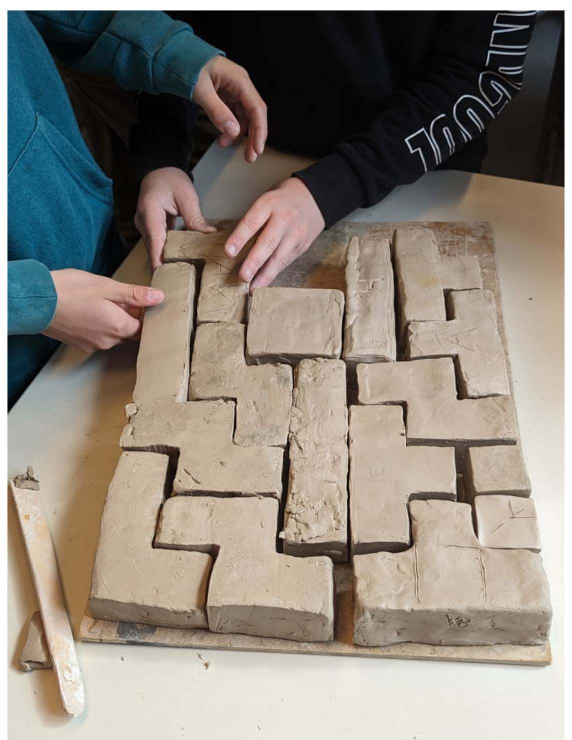
A collaborative initiative at the University of Applied Arts Vienna explored integrating art and science within undergraduate education, focusing on **biomimetics** and **sustainability**. Through a curated course syllabus, students aged 11 to 12 were guided to create artworks using **mycelium-based Engineered Living Materials (ELMs)** chosen for their established research foundation and sustainable attributes. There is a rising interest in mycelium materials, particularly in packaging and construction. These materials offer inherent sustainability, adaptability, and educational value, fostering **interdisciplinary engagement** and nurturing students' **creativity** and **critical thinking** skills. This poster provides educators with practical methodologies for incorporating mycelium materials into undergraduate science education, stimulating **active participation** and sustaining student interest.

Modeling (day 1)



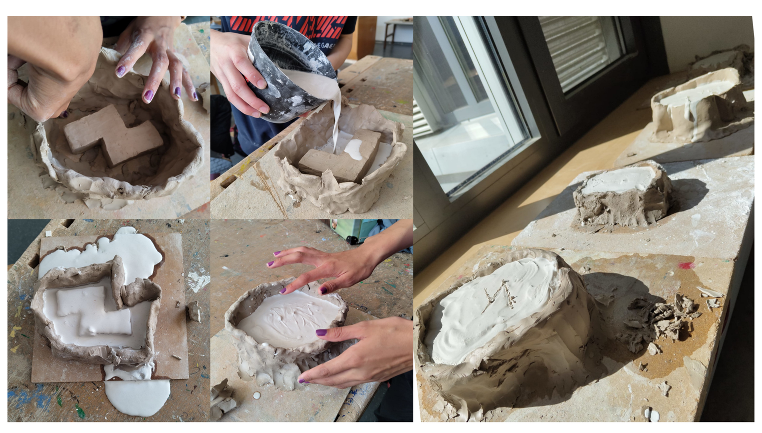
The students are tasked with **designing** a flat form using four square blocks (4cm sides), resulting in **three possible 3D forms**. The initial session aims to illustrate the equivalence of individual forms through spatial rearrangement and teaches participants to **think in three dimensions**, expressing their ideas on paper. Despite initial scepticism about working with fungi, students quickly understood the concept by comparing it to Tetris. Each student then creates a scaled **3D sketch** of a Tetris block shape, leading to the moulding of clay positives. **Challenges** arise in replicating the **precise dimensions**, requiring further refinement in the subsequent sessions.

Precise Positive Forms (day 2)



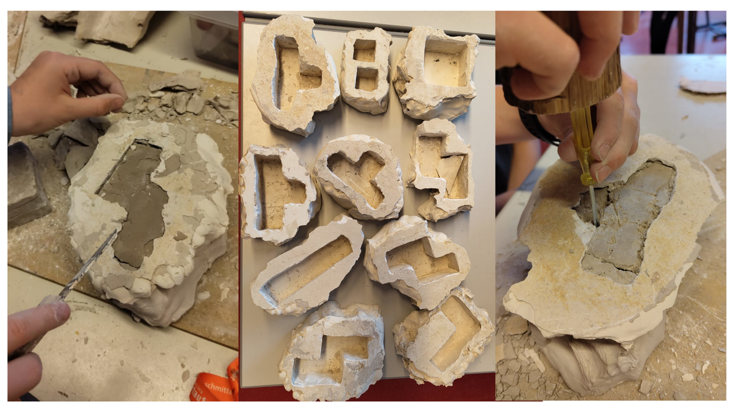
The students shape their designed forms in clay, guided by the teachers to ensure that proportions align with the designs. Markings are added using a scraper to identify the forms later. Students are encouraged to consider different ways of connecting individual pieces as they work. The second session focuses on **refining the dimensions** of the clay Tetris blocks to **precisely 4 cm squares**, with challenges arising from absent students and varying **motivation** levels. Despite difficulties, all Tetris blocks meet the criteria, with teachers creating additional cubes to foster **group cohesion**. Students **spontaneously engaging** in piecing together the blocks and demonstrating a eagerness to participate.

Casting the Negative Form (day 3)

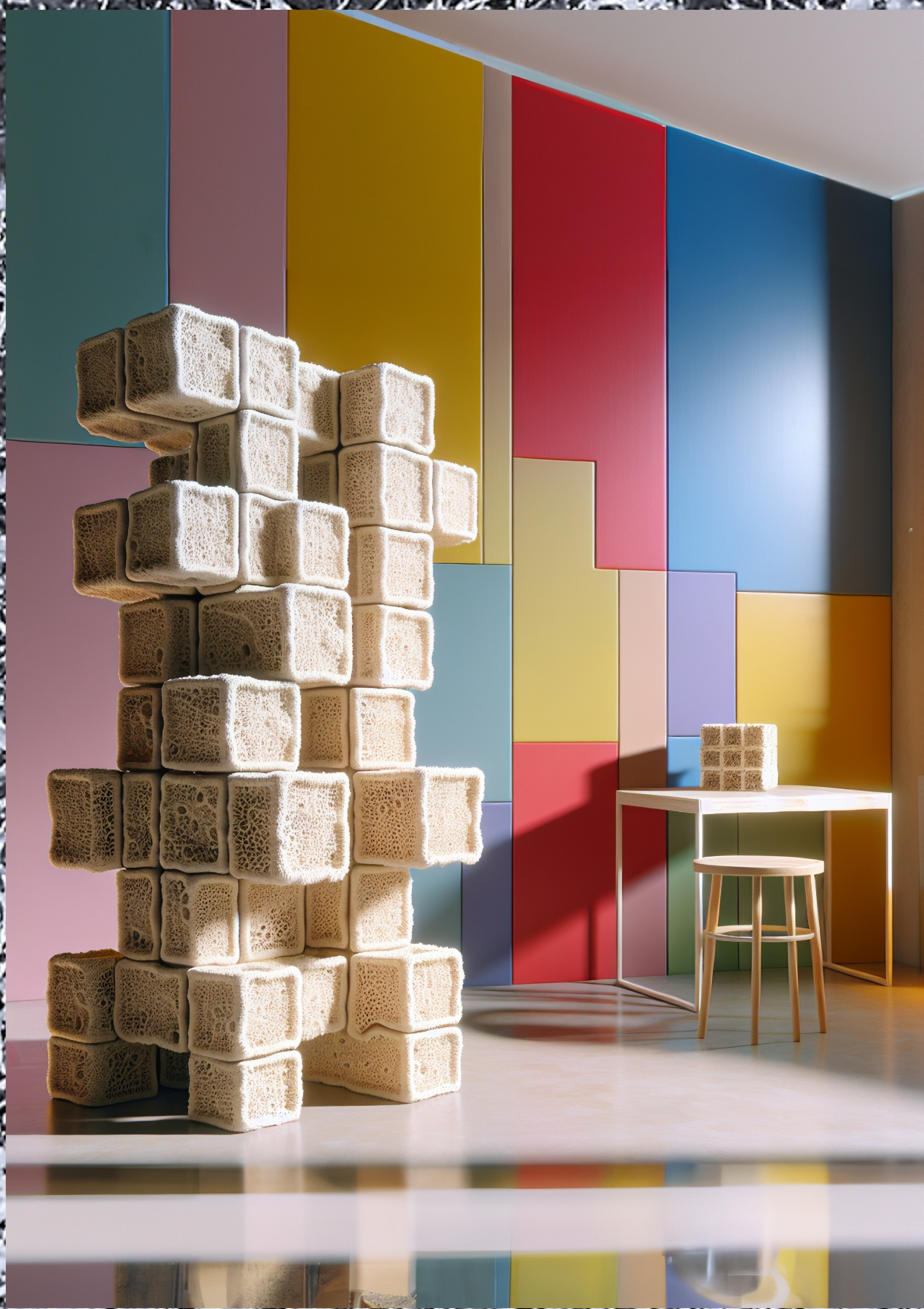


The third task involves creating a **negative** of the clay form using **casting gypsum**. The students build **a water-tight clay wall** around the form, leaving a one cm gap for plaster pouring. They mixed the gypsum and poured it into the form around the structure, allowing it to dry according to specifications and especially addressing leaks with excitement and challenge. Cleaning procedures follow, with the hardened gypsum mould demonstrating the principle of using a positive to create a negative. This session showed the students' **understanding and enthusiasm** for the project.

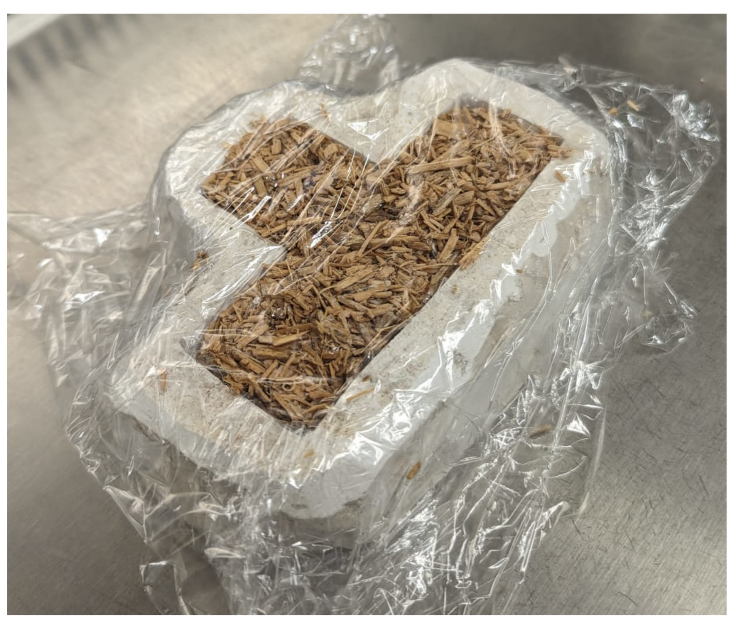
Cleaning the Mold (day 4)



Despite the deviation from the original plan due to external circumstances, the extended interval led to the **clay hardening** more than anticipated. Surprisingly, this resulted in unexpected **engagement and excitement** among the students, particularly during removal. Using tools like hammers and chisels to remove the hardened clay added an element of fun to the session, which was especially surprising given that the students were from **another group**. As the students tried removing the inner clay structure without damaging it, their excitement and concentration levels rose, fostering a **dynamic and immersive learning environment**. Although two forms suffered minor damage due to thin walls, this allowed students to learn repair techniques using small quantities of clay. Overall, the unexpected time delay and the resulting challenges added an element of excitement and **problem-solving** to the session, enriching the learning experience for the students.

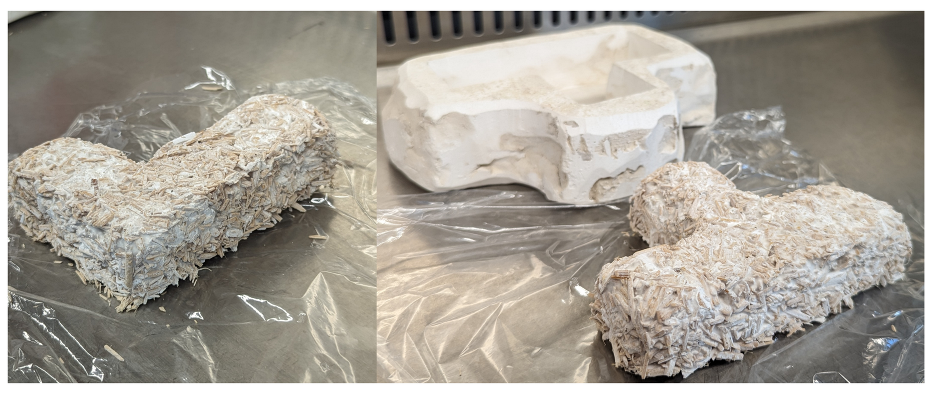


Mycelium Filling (day 5)



The external circumstances delayed the schedule, so this and the subsequent sessions illustrate the plan of operation. The students must proceed cautiously, ensuring **sterile handling** by wearing lab gloves and avoiding direct contact between their gloves and the Negative. They carefully fill the plaster form with **cling film** using the provided utensils. Flower and **mycelium-impregnated wood spans** are thoroughly combined in a sterilized container [1]. Participants then fill the Negative form with the mixture, pressing each centimetre layer firmly into the edges of the form with glove-covered fingers. To aid understanding, the teacher demonstrates the procedure with a prepared sample. Once the Negative is filled, it will be covered with a second cling film perforated every 3 cm using toothpicks. This meticulous process ensures the integrity of the **mycelium culture** and maintains sterile enough conditions throughout the procedure. The mycelium-filled negatives will be stored in a **humidity-controlled tent** in the oven room.

Incubation (day 5 to 6)



The mycelium filled Negatives of all participants are now left to **incubate for one week** at an incubation temperature of around **24 degrees** centigrade (next to the clay oven) and a **high humidity** (an open water container will be placed in the incubation tent). Five days normally suffice for incubation of the mycelium, but that would not fit the student's schedule. It will be arranged for the students interested to visit the incubation tent halfway through the week.

All together (day 6)

The mycelium should be grown to cover the wood spans with a **whitish-like texture**. The **cling film** allows easy extraction from the Negative. Before extraction, the participants must decide on the three-dimensional shared form to be built from the individual bricks. Again, gloves with disinfection procedures must be performed. Disinfected **toothpicks** will be utilized to **connect** the **mycelium Teris blocks**. Two additional days of incubation at the same place will allow the individual Tetris blocks to **grow together**. Note that this only transpires with high humidity.

Conclusion - Outlook

References and Online:

The project is halfway through, with **overwhelmingly positive responses** indicating a high likelihood of the seminar being repeated next year. This Poster will **evolve** alongside the seminar's progress and be accessible through the **QR code** for real-time updates. Of particular interest is the students' forthcoming decision regarding the future of the **shared art work**. We propose two intriguing options: allowing it to naturally degrade over time, symbolizing the **cycle of life and death**, or applying heat to kill the mycelium and preserve the shared artwork by halting mycelium growth. This project promises to be a provoking exploration of art, sustainability, and the intersection of natural processes with human intervention.

It was and is an **exiting project** for the involved **Teachers** and **Scientists** as well, experiencing the responses of the students to the individual stages enables us to **connect current science and art to the next generation**.

References

[1] Jan Berbee. *Innovative Mycelium Packaging for All Kinds of Products — grown.bio.* www.grown.bio. [Accessed 08-05-2024]. 2024.

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