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Leveraging on fabrication and making methodologies to support the development of ecological empathy

Silli Saverio[a]; Valsecchi Francesca[*b]

[a] Tongji University, College of Design and Innovation, Shanghai, P.R. China

[b] Tongji University, College of Design and Innovation, Shanghai, P.R. China

* francesca@tongji.edu.cn

In this pictorial, the authors describe how fabrication and making methodologies have been used within the scope of a design studio to support concept development in a more embodied and sensory oriented way. We also describe how such a way is very relevant for the studio brief: reconnecting citizens and Nature. The images included in the pictorial offer details of the methodology and the fabrication techniques proposed to the students, and reflect on their impact on the relevance and maturity of the final projects. Finally, we argue that hands-on techniques may offer better support in addressing not-anthropocentric design projects, thus opening the reflection for how research and teaching of design may look like in a post-human design era.

Keywords: fabrication; thinking through making; nature exploration, ecological empathy

1 Introduction

Fabrication and making methodologies have been extensively applied in design practices to stimulate and acquire tacit (and explicit) knowledge (Groth, C., 2017). In some cases, crafting practices and tacit knowledge generation with a thinking-through-making approach have been used by designers in the research and analysis phase of the design process (Nimkulrat, N., 2012), but more commonly they are adopted in the later stages of the process, to stimulate concept ideation or produce prototypes (Lande, M. and Leifer, L., 2009).

While this approach is valid when dealing with human-centred design, the specific case of the course "Urban Nature and Fabrication" posed a new challenge. In this course, third year's undergraduate students of Tongji University's College of Design and Innovation in Shanghai, P.R. China, were given the task to investigate the relations between citizens and the manifestations of Nature in an urban context, and then propose a design intervention that addresses an aspect of that relation. The course offered a way to deal with Nature not as the mere theatrical stage of human actions but as an active player of this relation, introducing to the student a "nature-centred design" brief.

In HCD, designers usually perform interviews, observations and apply several other methods to cre-

ate an empathic connection to understand the needs and problems of the people they are designing for (or with). Similarly, when the recipient of the design effort is Nature, designers must engage in activities aimed at establishing an empathic connection, without the possibility to rely on verbal communication.

Which methods can be adopted to help designers establish an empathic connection with Nature?

Humans interact with the physical world through their senses, a result of the evolutionary process that shaped Homo Sapiens throughout the generations. Human senses exclusively responded to natural stimuli until our species started a transition to urban life from the first part of the Holocene era to the megacities of the 21st century. With urbanisation increasing the separation of humans from Nature (Turner et al., 2004), an increasing number of humans are born and live most, if not all of their lives in an urban environment. Their senses are constantly calibrated to the overwhelming stimuli of the urban environment (Berman, M. G. et al., 2004) and the manifestations of Nature in the city go unnoticed or are easily overlooked.

1.1 Study Hypothesis

We hypothesised that if designers could re-calibrate their senses and involve them widely in explorations, investigations and creativity tasks aimed at stimulating tacit knowledge throughout all the steps leading to a final proposal, they would be able to create the empathic connection needed to deal with Nature-centered design. In the specific case of the "Urban Nature and Fabrication" course, the value of a human-nature interaction design project would have been more profound and better developed.

Our hypothesis led us to introduce several hands-on fabrication tasks that would require the involvement, stimulation and exercise of all senses. We organised the course in a standard structure of three phases, exploration, analysis, synthesis, each associated with one or more fabrication tasks. We expected that performing experiences that privileged the body's involvement over verbal communication, especially in the research and analysis phase, would facilitate an empathic connection with Nature.

The term "fabrication" includes and describes all those activities related to a product's physical creation, regardless of the techniques (manual or digital), tools, materials, or machinery used. The terminology also embeds a connection with the Fabrication Laboratory, or Fab Lab (Gershenfeld, N., 2012), whose facility contributed to the development of the studio by offering expertise and technical means, materials, tools and machines.

2 Methodology

The experiment took place over three months and involved 16 undergraduate students in their third year of study. We organised two types of activity, one ideation and making exercise named "very rapid prototyping" and a series of instruction workshops on specific fabrication techniques.

2.1 Very rapid prototyping

The first fabrication activity was scheduled at the very beginning of the studio. The concept of "very rapid prototyping" is based on the frame provided by the thinking-through-making approach and consists of an individual ideation task to be performed in a concise amount of time, using limited materials and pre-acquired knowledge.

Prior to the exercise, the students were asked to perform an exploration of the urban environment, a two hours walk in the area surrounding the College, with the objective of observing the manifestation of Nature within the urban environment, bringing with them only a map, a photo camera and a compass.

Figure 1. Materials for Fabrication. Students collect and bring packaging or waste material and share it in the middle of the classroom.

The scope of the very rapid prototyping exercise was to reflect on the difficulties of observing Nature in an urban environment and fabricate a new tool that could be helpful in a second exploration, to be performed in an urban nature context such as a public park. Aside from giving the suggestion that one of the tool's features might be to help the user achieve a change of perspective, we left the students completely free to ideate and make whatever they preferred. The only rule we gave them was to refrain from sketching or taking measurements to avoid a rigid separation between the ideation and fabrication steps: we encouraged them to let the flow of ideas from their brain instantly get translated into movements of their hands. At the same time, we asked them to let the transformed materials inform and actuate their progressive decision making.

We gave the students two hours to complete the "very rapid prototyping" exercise in class. We also provided a basic set of raw materials and simple measuring/cutting/joining tools (for example, rulers, retractable blades, tape and hot glue). We asked them to collect and use materials from the recycle box, such as disposable cups, single-use packaging, etc. (Figure 1). Tools and materials provided the most basic means of manual fabrication to facilitate the ease of translating the ideas into physical shapes without the distractions that more elaborate techniques would introduce.

The tool that the students would fabricate had to be an original invention, fulfilling a particular function, similarly to those highly-specialized tools often found in workshops or household that nobody

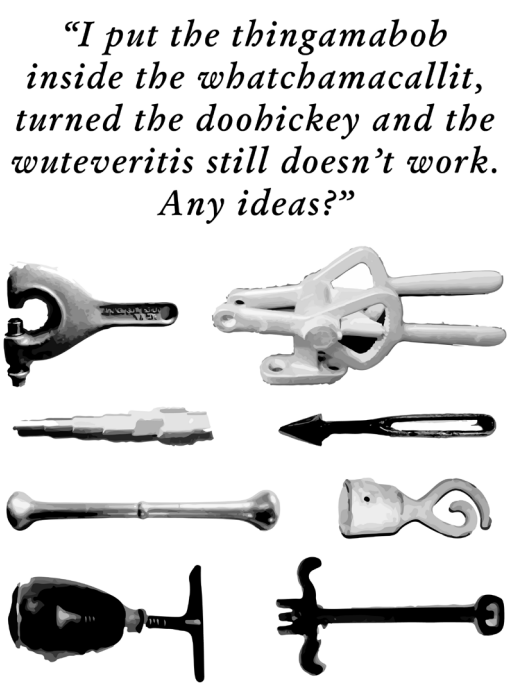

Figure 2. Whatchamacallit definition: one of the slides used to present the concept of tools with a highly specialised function but no obvious name.

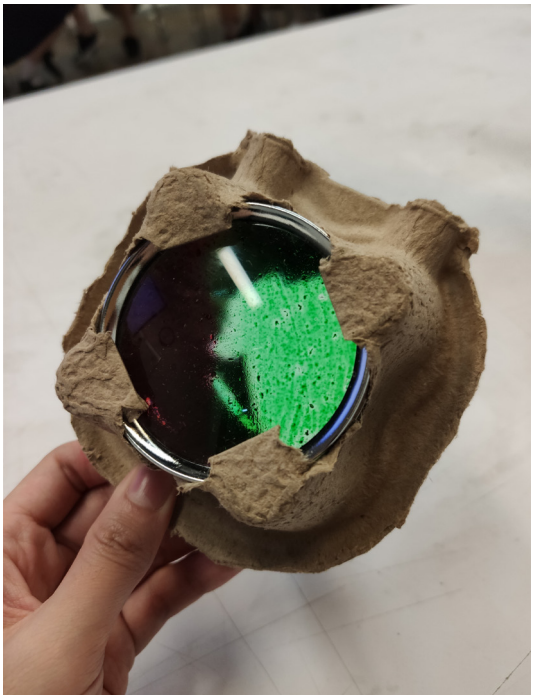

Figure 3. A tool to filter colours. The device combines single-use packaging material (cup rack for delivery) and a magnifying glass. Half of the lens was painted red, and the other half was painted green.

Figure 4. A tool to filter colours. Student Zhu Jiafeng is taking pictures with her phone through the lens of her device.

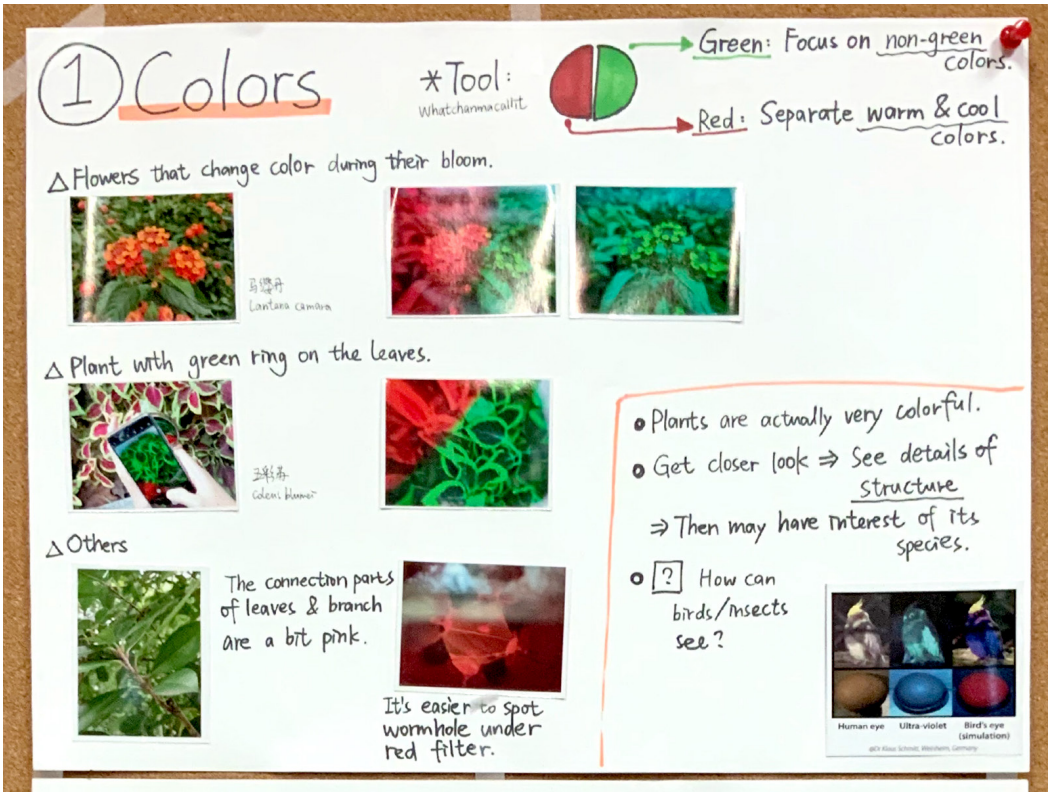

Figure 5. Exploration report. In the field visit report, student Zhu Jiafeng highlights the findings she obtained using her tool.

Figure 6. New Instinct The project is a collection of two wearable devices that use electronic components to let the wearer experience the senses of animals: the first device is a shin piece that mimics the ability of oysters to perceive the sea tides. A series of vibration motors placed inside the piece turns on or off in succession to indicate the variation of sea level.

Figure 7. New Instinct. The second device replicates birds' capacity to navigate using the magnetic field of Earth. A harness holding a stepper motor rotates a visor cap according to the input of a compass sensor. When the wearer moves, the motor rotates to keep the visor cap aligned to the north.

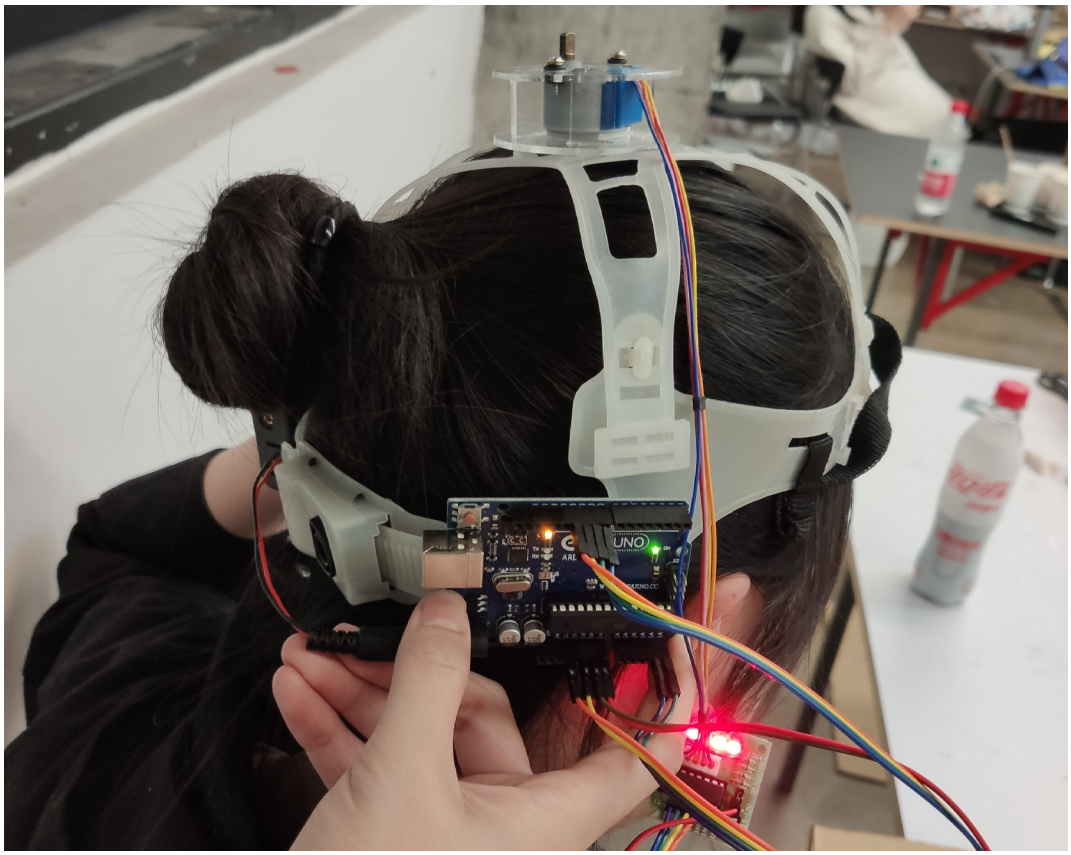

Figure 8. New Instinct. The harness holds the electronics and mechanics of the device.

Figure 9. A tool that turns you into a fly. Student Qian Yilin demonstrates how to hold the device.

Figure 10. A tool that turns you into a fly. The device is a magnifying glass glued with a disposable paper cup and a layer of bubble wrap film.

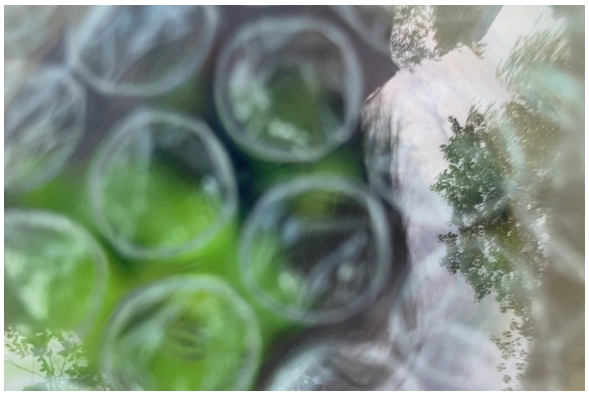

Figure 11. A tool that turns you into a fly. Detail of the "fly's eye effect".

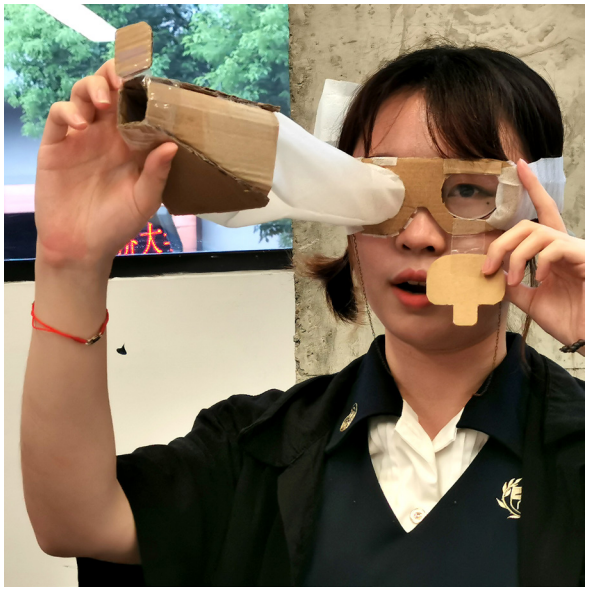

Figure 12. A tool to focus on details. Student Wang Chen is demonstrating how to use her instrument.

can describe with an exact name, and that are colloquially called "gizmos" or "whatchamacallit" (Figure 2). Each student could complete the exercise in the given amount of time, and we requested them to write a paragraph of reflections about the experience.

2.1.1 A tool to filter colours

Zhu Jiafeng created a tool with a coloured lens that can rotate to exclude red or green colour when seen through (Figure 3-4). In her reflections, she writes: "I made this lens as I found myself easily attracted by green stuff when exploring the city, so I'm curious what I'll find when all green colour is filtered away or when all things turn green". In her exploration report, she elaborates the concept of vision and perception of colours introducing the question: "How can birds/insects see?" (Figure 5). This student later joined a group with two other fellow students, and they kept working on the concept of borrowing other species' senses to augment humans' bodies, creating a final project called "New Instincts" (Figure 6-7-8).

2.1.2 A tool that turns you into a fly

Qian Yilin's whatchamacallit is a magnifying lens combined with a disposable coffee cup and a piece of bubble wrap packaging film (Figure 9-10-11). In her report, she describes it as a tool that simulates how flies see the world surrounding them. She specifies that the device's function is not to experience the sight of a fly but to make the user feel like a fly and "observe small creatures from different angles and ways". She adds: "(...) different eyes see different worlds. Therefore, to a certain extent, what we see in the world determines our way of thinking. If I look at the world with the eyes of insects, will I have different ideas? Will I have a new under-

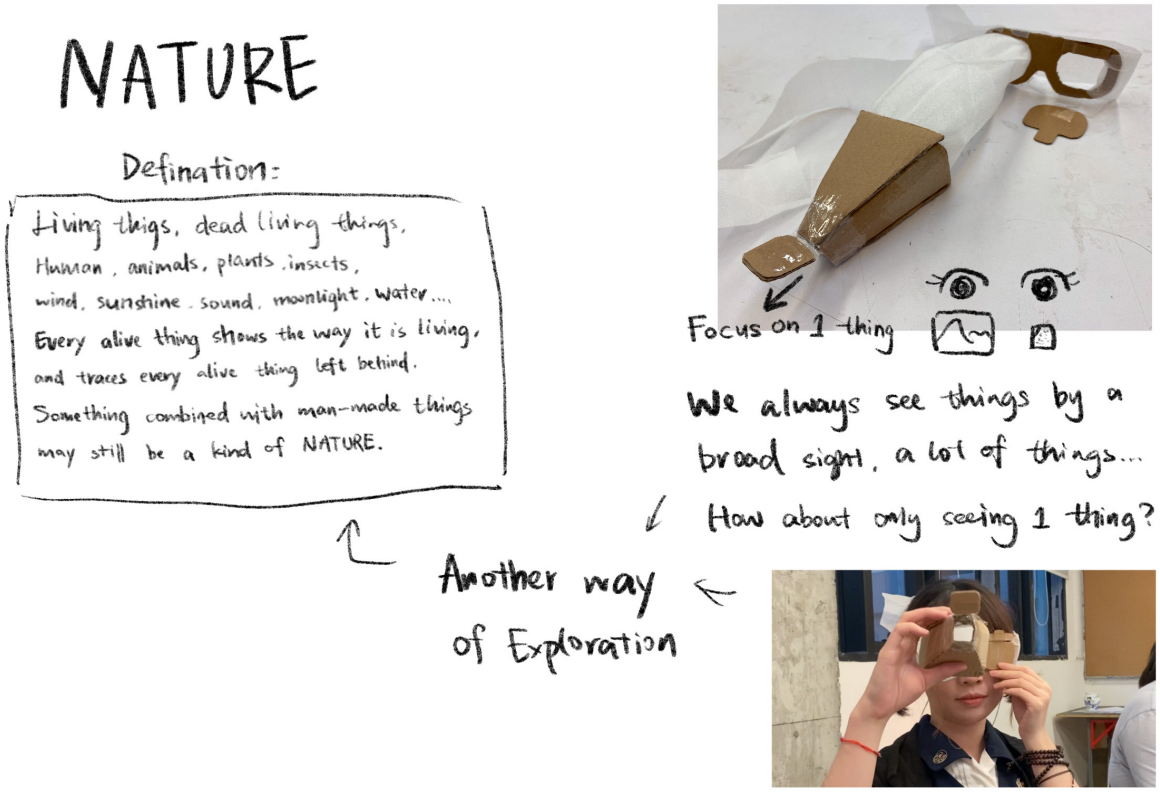

Figure 13. A tool to focus on details. Detail of the field exploration report from student Wang Chen.

Figure 14. A tool to talk to insects. Photo composition by student Luo Yunjing illustrating her device.

Figure 15. Moulding and Casting workshop. Some of the moulds and casts were produced with alginate and plaster using natural elements collected during the field exploration.

standing of the past? Will I see something I have never seen? Will I make contact with flies or other species?”.

2.1.3 A tool to focus on details

Wang Chen created a tool (related to sight as the previous two) whose aim is to disconnect the right and the left eyes’ field of vision (Figure 12). In her visual reflection, she describes that this tool can also help focus on minor elements that would otherwise go unnoticed during an exploration (Figure 13).

2.1.4 A tool to talk to insects

Luo Yunjing describes her tool as a mask that can make her voice weaker so that she can talk with insects without scaring them away (Figure 14). In her report, she writes: “There are many insects in the brushwood, and I am very curious about them. I just want to talk to them, but they are too small, and my voice is too loud for them. I am afraid that I will scare them away easily”.

Figure 16. Exploration report. Collection of photos from student Hu Zihan depicting textured elements discovered during the field exploration.

Figure 17. On-site moulding. A student brought tools and materials on-site to take casts of the elements noticed during the previous exploration.

Figure 18. On-site moulding. The student is applying a mixture of fast curing alginate over a tree branch.

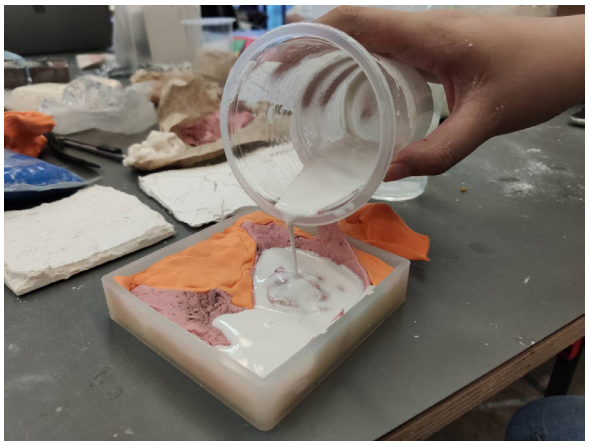

Figure 19. Casting. Plaster casting using the moulds produced on-site.

2.2 Fabrication workshops

These activities are instruction tutorials about a specific technique or material. The topics of the workshops introduced and promoted the use of manual techniques and natural materials. We designed and conducted two tutorials: “moulding and casting techniques using alginate as a mould material and plaster as a cast material” and “casts produced with biomaterials, starch, gelatin, glycerin and agar” (Figure 15).

2.2.1 Feedback collection with the tactile experience

Following the experience made in the two fabrication workshops, a group of students decided to employ moulding and casting in the analysis phase of their design process. They designed a small exhibition in the hallway of the school building as a way to collect feedback from the public about the feelings and emotions transmitted by particular manifestations of Nature in the urban context. For this purpose, they brought the moulding tools and materials to the site of a previous exploration, where they noticed details with a strong material and tactile quality (Figure 16) and created small casts with plaster (Figure 17-18-19). In the exhibition, they placed each tile (Figures 20-21) inside a small box: the visitors could access the inside of the box from a narrow aperture with their fingertips and express what kind of emotion the tactile experience had left on them (Figure 22-23).

3 Conclusions

We believe the use of fabrication activities helped the students to establish an empathic connection with Nature thanks to a deeper engagement of their bodies and senses. The actual function of the “whatchamacallit’’ might be unrealistic, obscure or naive; yet, as an exercise, it is helpful for two critical reasons. First, by making a tool to observe Nature, students make a reflection on the limitation of their senses and discover other ways to connect with Nature. Additionally, by applying fabrication in the early steps of the design process, students used their prototypes not as mere presentation models, but as tools of their design research, interpretation and action.

Figure 20. Plaster tile. Plaster cast of a flooring grate with moss growing between the openings.

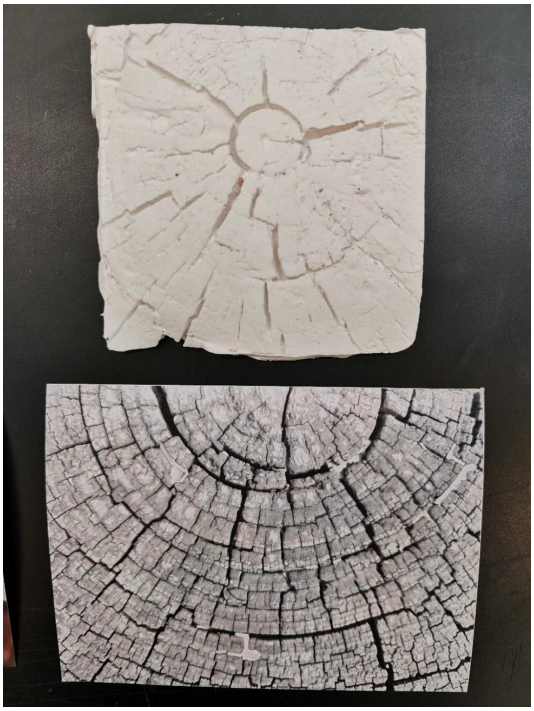

Figure 21. Plaster tile. Plaster cast of a wood log section from a fence.

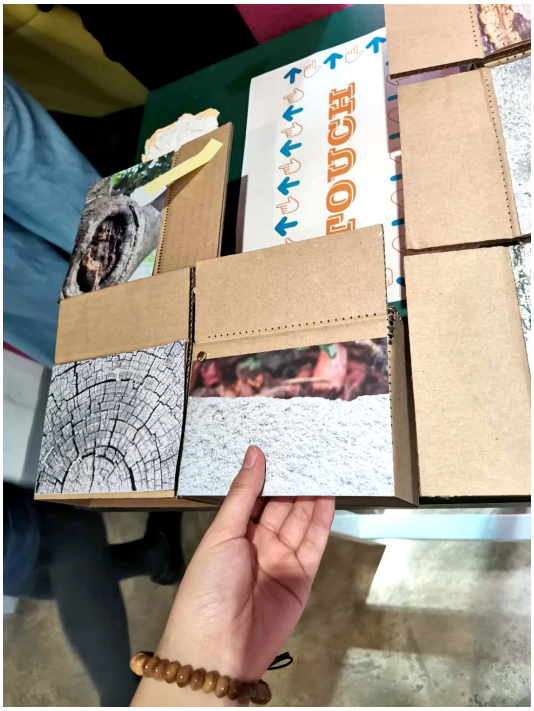

Figure 22. Exhibition set up. Each of these boxes contained one of the plaster tiles. Visitors could insert their fingers and touch the tiles.

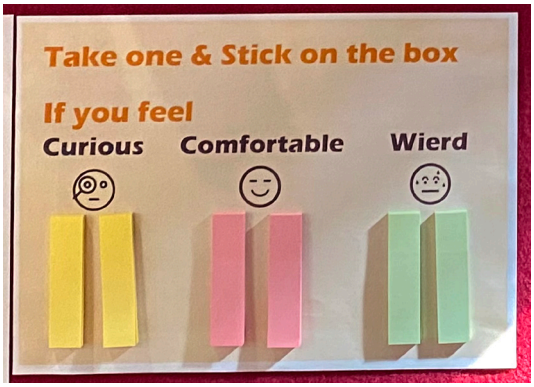

Figure 23. Exhibition set up. After touching the tiles, visitors could leave feedback by sticking on the box a note of the colour corresponding to the feeling perceived.

Acknowledgments.

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