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HOW COULD REGENERATIVE FRAMEWORKS STIMULATE STUDENT'S CREATIVITY: A CASE STUDY OF A WORKSHOP ON ORAL HYGIENE

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ABSTRACT
In this paper, we investigate the potential of regenerative frameworks as a starting point for students to explore diverse futures within the context of design development. We review related works on regeneration, environmentally responsible design, and enlivenment to come up with seven regenerative frameworks in the context of product design. To test the frameworks, we conduct a case study reflecting on a two-day design workshop with students from the product design department at the Academy of Fine Arts in Sarajevo. The goal of this workshop is to design a "regenerative toothbrush". The students worked in groups and explored concepts of regenerative design within each theme. Through the workshop, we found that students' approach towards design differs: Human-nature reorientation and embedded experiences activate the possibility for inner exploration. Students are inspired to formulate unconventional approaches to the possible role design can have in enabling futures for common good.

Keywords: Regenerative design, transition, design framework, future design, design education

1 INTRODUCTION
Regenerative design is an emerging research field addressing the global ecological crisis, following sustainability and circularity. It aims to replenish and restore, rather than doing less harm (sustainability) or designing out waste (circularity) [1]. The concept of regeneration has its origin in agricultural practices such as permaculture, which recognises patterns in natural and human systems to weave them together as a dynamic whole [2]. It focuses on the natural metabolism of the ground and seeks a partnership with nature where we could achieve a diversified and holistic harmonious state. In the context of architecture, regeneration is linked to the concept of living systems thinking by Steve Larrick and is capable of resisting entropy increasement, capturing energy and resources from the environment to facilitate further growth and development [3]. Within the field the concept developed further to be applied as "placemaking" strategy looking to foster the interactions among people; their consciousness, habitat, infrastructure, etc., all aspects contained within a "place". Regeneration acts as a storyline revealing the narratives behind a place, where it becomes a living organism [4]. In architectural practices, a number of strategies have been put forward. While the implementation of regenerative building practices on a big scale has not reached its full potential yet, multiple visions have been formulated.
Within the field of product design, the question of how to achieve harmony both in ecology and society utilizing regenerative thinking, however, is not yet clearly formulated. One direction is to rethink and reframe the bond and relationship between human and non-human species, the environment, the planet, for example, the pioneering exhibitions *Broken Nature* (Triennial Milan, Italy, 2019) and *Eco-Visionaries* (Royal Academy of Art, UK, 2019). In the latest design exhibition at the Museum of Modern Arts New York *Life Cycle* (2023), the material circulation in the ecosystem is highlighted, shifting the focus of design towards a more collaborative relationship with nature. This wave of regenerative thinking continues in education. The University of the Arts London opened a new department named *Regenerative Design* exploring design in a more-than-human world. Also, the Systemic Design Lab at ETH Zurich opened an advanced study program in 2023, aiming to hybridize science, design, and transformative practices. This shows that universities are contributing to the discourse on regenerative

design. Another direction is calling for locality, searching for design vernaculars (materials, techniques, etc.) as the exhibition BIO27 (Ljubljana, 2022) proposed. Moreover, curators explore aspects of regeneration in different areas of people's everyday lives, like consumption (*Critical Consumption*, MAK, 2023), clothing and housing (*Planetary Boundaries*, Royal Danish Academy, 2023), contextualising human lifestyles as part of the problem, while suggesting the tools towards regeneration be accessible to everyone, so that small actions can gather to create change. Aiming at reorienting design in a world marked by numerous crises, Institute of Design Research Vienna (IDRV) interprets the definitions and principles of regenerative design from Andreas Weber, Daniel Christian Wahl and Regenesis Group [5-8] and curated the "learning travelling" exhibition *Imagine Coral Reef: Regenerative Design*. As a part of the exhibition, IDRV organized a regenerative design workshop collaborating with a local university. During the workshop, the students were encouraged to discuss definitions of regenerative design and the related concepts.

In this paper, we present the potential of the seven regenerative frameworks to inspire a different understanding of our embeddedness in natural systems and of the design process and outcome when working with students. Our hypothesis is that by presenting students with an approach to design thinking that proposes an engagement with the ecosystem in which they as designers and the objects they create are embedded, new visions for the future of design will emerge.

2 REGENERATIVE FRAMEWORKS

We position the regenerative frameworks as the roadmap, leading designers and students to reflect on their current position and envision a path to move on in order to achieve the next step of design for all, i.e., environment, other species, and future generations. We reference the trajectory of environmentally responsible design from Bill Reed [9], where he points out that environmental rating systems and other mechanisms entitled sustainability could only solve the problem of efficiency at best. Herein, Reed called for a holistic, living systemic thinking in the reconciliation and regeneration level, asking the ultimate purpose of sustainability. In his tone-setting paper, he defined the trajectory into five phases: Conventional, Green, Sustainable, Restorative, and Regenerative. The five-phase diagram from conventional to regenerative is widely referenced in further developments of regenerative design, where the definition of each phase is continuously reformulated (see Table 1). In order to generate a regenerative vision for the field of product design, we formulated each phase specifically in relation to this context.

Table 1. Explanations of five phases in trajectory of environmentally responsible design

authors	**Conventional**	**Green**	**Sustainable**	**Restorative**	**Regenerative**
B. Reed [9]	"one step better than breaking the law"	relative improvement. eco-efficient design	neutral, 100% less bad	humans doing things to nature – assisting the evolution of sub-systems	humans are an integral part of nature, participating as nature – co-evolution of the whole system
D. C. Wahl [6]	compliance to avoid legal action	relative improvement	neutral point of not doing things to nature	humans doing things to nature	appropriate participation and design as nature
W. Craft [10]	achieving minimum standards	performance improvement sustainability ratings	towards net-zero carbon neutral	reversal to pre-development environmental conditions	human and natural systems actively co-evolving as one

In our process of exploring these strategies, coral reefs serve as inspirational metaphor to create a bridge towards product design. Coral reefs are referred to as the rainforest of the ocean. The symbiotic relationship between corals and zooxanthellae (algae) makes the ecosystem vibrant even in waters with only few nutrients available. We consider the coral as one of the "products and infrastructures" shaped by nature, and we start to question: If *Regenerative* is the phase when humans can co-evolve with nature, then how could the logic of nature apply to principles of product design?

In his text *Enlivenment* Andreas Weber calls for economic commoning, "Besides producing and distributing resources, economic commoning is about constructing meaningful relationships with a place, with the Earth, and with one another [5]." There is no separation between humans and nature. Everything is connected, and only a mutually dependent relationship can support continuity of life [12]. He listed seven guidelines of reciprocal productivity: Local rules, Interbeing, You are the commons, Resources

are meaning, Reciprocity, No copyright, and Gift exchange [5]. We use the coral reef to help us illustrate the philosophical meanings behind each of the seven principles (see Figure 1).

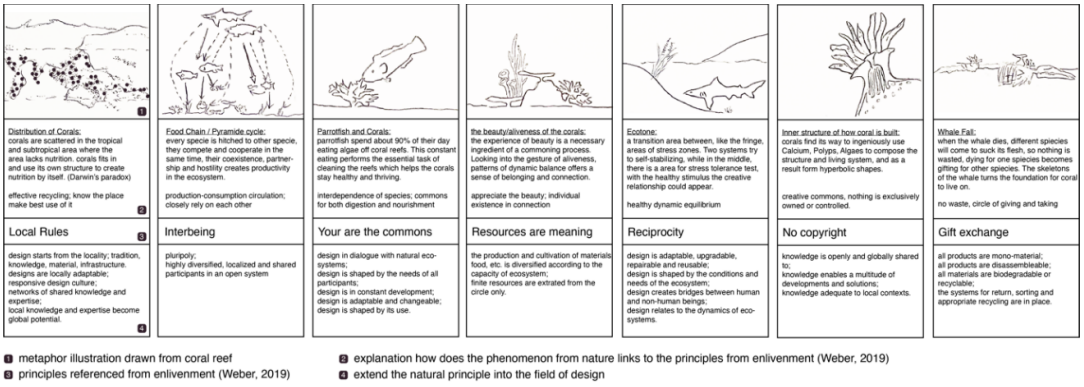

Figure 1. Each card represents a theme drawn from Andreas Weber's seven principles[1]. Image source: IDRV, 2023

In a future where regenerative becomes the minimum standard for every product design, all seven aspects need to be fully considered so that the design responds to the complex network it is situated in. Every principle works as a theme for later navigation (see Figure 2). The cumulative as well as iterative process show the evolution of design practices from conventional to regenerative[2]. For example, in conventional practices, design is driven by standardization and globalization. Numerous problems appear, like homogenous products, the mismatch in production and consumption, and vanishing local production. With Local Rules, the regenerative framework explores paths articulating how product design could be practiced as place-based (see Figure 2), embedded in local cultures, traditions, and resources; how the distribution between local and global could be optimized, making systems adaptable. Also, local rules consist of place-based knowledge and techniques existing in memories and folk stories passed down through generations.

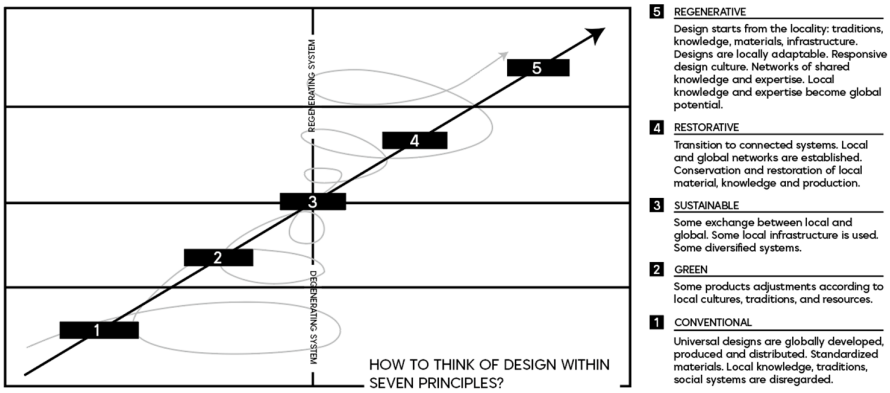

Figure 2. Left: regenerative framework trajectory format; right: interpretation of Local Rules (one of the seven regenerative frameworks), image source: IDRV, 2023

We perceive the seven regenerative frameworks as a tool to expand the paths students explore during their design process, creating the space to explore with whom [6] and with what to work with. The frameworks offer a different perspective to examine current and potential metabolisms surrounding design objects to then implement design (system) functioning as a living organism, as part of nature. In Plumwood's words, "all bodies are food, all food is souls, and all souls get recycled, so all of nature and life are thought of in gift exchange terms [13]."

[1] Seven theme card explaining the adaptive process from biology and philosophy to design © 2023 by IDRV is licensed under CC BY-NC-SA 4.0. Attached with corresponding design examples used as exhibits in Imagine Coral Reef: Regenerative Design in Tirana, Albania (2024.3.12-4.1).
[2] Seven regenerative frameworks in product design © 2023 by IDRV is licensed under CC BY-NC-SA 4.0.

3 THE WORKSHOP ON ORAL HYGIENE

Within the context of the exhibition *Imagine Coral Reef: Regenerative Design*, we conducted a workshop on oral hygiene and the prototyping of a "regenerative toothbrush" at the University of Fine Arts, Sarajevo, allowing us to test the potential of the regenerative frameworks. The toothbrush as an everyday object offers us a wide network of relations. In the Middle East, Africa, and India, for example, a natural toothbrush called miswak is used. The miswak comes from the roots of the tree (Salvadora Persica), which, according to scientific research [14], could suppress the bacterial redox system. This place-based toothbrush has its unique way of "production" – growing, gathering, and harvesting, which harmonizes with the cycles of nature.

In the workshop, the participating students were mostly from the product design department, two students were majoring in architecture. The workshop consisted of a lecture on our previous research on regenerative design and the seven regenerative frameworks, inputs from a local entrepreneur, group discussion and collaboration, tutoring, prototyping and an oral presentation. Students were randomly divided into seven groups corresponding with the seven principles. Due to time limitations, every group focused on one of the principles as their steppingstone, to find the unique as well as the overlapping perspectives in the process. Before the workshop, we encouraged the students to see the exhibition and engage with the reading materials[3] to better understand the context of regenerative design.

We took this workshop as the testing ground for the regenerative frameworks, the research questions we aimed to explore are as follows: (a) How do the regenerative frameworks resonate with the students? (b) How do they interpret the key concepts of the frameworks and further develop their design proposals? (c) Which aspects of the regenerative frameworks enable the students in their thought process? We used participatory observation to document the group discussions, tutoring, and presentation. We also took on-site notes to help us better reflect on the workshop.

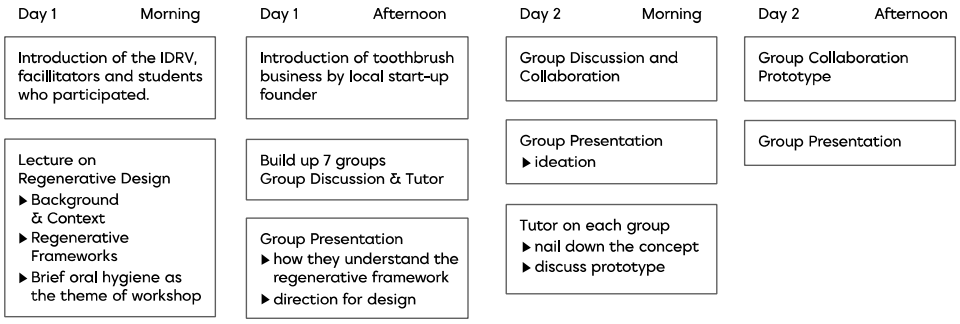

Figure 3. Schedule of the regenerative toothbrush workshop in Sarajevo. Image source: IDRV, 2023

After the lecture on regenerative design, we opened the room up to a discussion during which a student critiqued *"I don't think design can solve the problems we are facing now, it's more like the business for economists, politicians."* Other students argued back focusing on two main topics: (1) The possibilities of what design is capable of. (2) Why they think regenerative design could differentiate from green, sustainable, and circular design. The spontaneous open discussion among students made the understanding towards regenerative more concrete and accessible. Students found common ground in the perception that the current state of design is conventional, or green at most; that regenerative design is bonded with future design centred on the issue of how we imagine a future that could achieve human living as part of nature. We challenged students to think how design could work as part of nature. How can design processes, actions, practices be thought to imagine a productive (non-extractive) practice of making together with multi-species living systems? Each of the group brainstormed departure from the one of the seven regenerative themes, in the other day, each group managed to use the local materials they could access to prototype and give an open presentation to the whole class. From theory to real practices, students kept reflecting on the regenerative theme and found their own approach to build logic and complete prototyping.

[3] Regenerative Reading Materials © 2023 by IDRV is licensed under CC BY-NC-SA 4.0.

4 RESULTS AND DISCUSSION

In the end of the intensive two-day workshop, every group presented their "final" toothbrush prototype, introducing their iterative process of developing with mind maps and sketches. More than half of the prototypes went beyond form, function, material, and involved other participants in their concept for the future of oral hygiene. Proposal included: Local Rules – A "chewing gum" made from woollen fibres, utilizing left over materials from local sheep farmers, different textures could be achieved employing local knitting, crocheting and felting techniques. Gift Exchange – A gummy brush with a bio-chemical process which dissolved in user's mouths after use. You are the Commons - A toothbrush using natural materials (sand, clay, limestones) from the local river, involving algae and spores to complete the hygienic purification at the same time.

One of the interesting phenomena we saw is how students use the premise of "there is no waste in nature". One supportive quotation asserts that: "*One of the biggest problems we are facing today is that humans are not incorporated in the ecosystem. … We use sand, clay, or limestones to make the toothbrush, after our use, we could throw it back to the river, creating more nutrition and oxygen.*" Another group resonated with this: "*You can bury it (the toothbrush) in your backyard, in your closest park… make an aquarium out of it.*" Here, the proposal involves communal herbal plant patches as participants in the circulation of the design. The students demonstrate how they leverage nature from private to public spaces and from ecosystems on land to those in the water.

Also, the meaning of key terms shifted. Like in this context, "waste" had multiple ways of understanding: (1) our input: there is no waste in nature. (2) interpretation to "less waste, less design". focused on the core issue of "*how to design life after use*". They came up with the idea of replacing the bristles with composite hygiene gummy (the third image, Figure 4) with a chemical effect on the teeth, the gummy will dissolve eventually in the mouth. (3) As in the group You are the Commons, they started to involve disconnected sub-ecosystem, to turn the "waste" in one system (toothbrush) to the sparkling part of another system (riverbed).

Throughout the workshop students were referencing their own and others' experiences as inspiration for their creative ideas on reimagining oral hygiene. One member from Resources are Meanings shared an observation: "*children chew things because they want to understand surroundings. I think in a philosophical way, it links with regenerative design. We design society because we want to understand our position in nature*." This group also shared: "*(My grandpa) uses salt to clean the teeth, he rubs his teeth with the salt*", "*(Brushing the teeth is) like smoking, people smoke in their head out of habits*." The students started to reflect on their environments and to rethink the everyday routines they're used to (see Figure 4 far left for the chewing kit from the group Resources are Meanings) The group working on Reciprocity expanded the participants to the fringes between bacteria and mouth, trying to engage all different life forms and to achieve zero waste on a molecular level. They envision their oral hygiene device could function as a container gathering bacteria which help the mouth get cleaned. Taking the human metabolism as one part of the hygiene system, the pomegranate (see right in Figure 4) enables production and use at the same time.

Figure 4. Selected prototypes from students. From left to right: Group of You are the commons, Resources are meaning, Gift exchange, and Reciprocity. Image source: IDRV, 2023

5 CONCLUSIONS

Based on the research on regeneration, environmentally responsible design, and enlivenment, we use coral reefs as metaphors to come up with seven regenerative frameworks for product design. They specify the characteristics each stage has and the trajectory towards regenerative design. At the same time, they unify our vision for the future of design and the ecosystems we are living in. The workshop in Sarajevo field tested the effect of the regenerative design frameworks in an educational context. The immediate resonation students react to our inputs is learning from nature, thinking in the phase of

regenerative, where design functions as part of nature. They used key concepts in natural systems to expand their ideas. The references and expansion of key concepts put design thinking in a connected position, where neglected relationships are enabled. In this paper, we used the keyword "waste" to showcase the expansion process, how students start from our input, "there is no waste in nature", and develop their multiple directions for interpretations. The intuitive response of the students to the frameworks allowed them to freely imagine a design, which involves not only humans as active agents. The students used their prior experiences and knowledge to relink the relationship between humans and nature, bringing new entities into the design ecosystem. The focus on locality, natural resources, and the logic of mutual exchange pushed the students to create unconventional understandings and imagine diverse futures for design.

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