In transition: material knowledge, commons, and design education

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Abstract

In reflecting on two teaching units, this paper analyses the relation of design to environmental awareness, thus gaining arguments to combine speculative approaches with designerly material knowledge and the social practice of commoning in design education. Criticising the linear paradigm of existing design programmes, it argues for redefining design education as an agent for change furthering transformation in the design field.

Starting from the perception of the current socio-ecological crises, condensed in the disputable term Anthropocene, the paper discusses how to open new ways of conceptualising design education through redescribing the situation, adapting a critical notion of design history, and reevaluating the speculative heuristics of design in a MA Design programme.

The second part discusses combining circular design strategies with 'designerly material knowledge' in the same educative setting. As an explorative approach, designerly material knowledge is based on the findings of material sciences integrating a historical and cultural understanding of materiality. Assuming design unlocks and redefines materiality through experimental, creative, and prototyping approaches, the question arises of how to validate this knowledge in the design process and pass it down to future students. Inscribed with the urgent need to counter «de-futuring» practices of unsustainable design (Fry, 2020), we should speculate about «futuring» design education. Thus, conceiving a material-based design methodology of circular design practices and processes could lead to a revision of design education and practice and a deeper understanding of the role of materiality in the design process.

The third part builds on the assumption that design education should heighten the experience of the social embeddedness of each design task in place and time. Instead of designing discrete objects, design students learn to conceive relationships, interactions, and experiences for and within complex social systems to achieve potential systems-level change (Irwin, 2015). Therefore, design is best described and trained as a co-design activity involving various actors (Manzini, 2015). Understanding any short and long-term ramifications of using resources could benefit from a closer reading of commoning as a social practice, as discussed in a Bachelor's teaching unit. Commons are historically contingent (Ostrom, 1990). How Commons are organised signifies how societies understand their embeddedness in any (natural, social, planetary) environment. Thus, a historical perspective on commoning as a social practice could help students acknowledge that environmental issues and eco-conscious practices always form part of socially regulated and therefore designed systems.

In conclusion, the paper discusses the ramifications of those two specific teaching experiences on their potential to transform design education into a more circular practice of educating.

Author keywords

Transition design; Design education; Materiality; Commoning

Introduction

The human-caused altering of the chemical composition of the Earth's atmosphere, the unfolding climate change, the dramatic loss of biodiversity, melting glaciers, or continuing acidification of the oceans is threatening the critical zone, i.e., the thin layer allowing all life forms to live on the planet (Latour, 2018). These crises threaten societies and environments, mainly caused by the Global North (United Nations, 2015). As an inextricable part of the history of industrialisation, design finds itself in the middle of the debate and, with it, the crucial role of design education.

Witnessing such crises is no longer just a matter of scientists. 'Eco-anxiety', the chronic fear of environmental doom, despite not yet being considered a diagnosable condition, gained recognition, as was its disproportionate impact on children and young people (Rao & Powell, 2021). Fueled by debates in mass media and illustrated by memes on social media, the feeling of loss hits people from all backgrounds. Teenagers and young adults brought the fight against climate change to the streets in Western societies and into the highest governmental institutions in the late 2010s thanks to social movements like Fridays for Future or, on a more desperate urge, Extinction Rebellion, Last Generation, or Renovate. Design students are particularly concerned by this. According to a traditional understanding that still widely grounds design education, its methodology remains defined by the linear approaches of industrial production and consumption patterns. Therefore, design holds responsible for the damage caused, as Victor Papanek summed up famously when he decried designers as "creating whole new species of permanent garbage to clutter up the landscape, and choosing materials and processes that pollute the air we breathe." (1971, p. XXI) Hence, design does not create the future, according to its distorted but cherished self-image; it takes our future away, as Tony Fry (et al., 2015, p. 9) denounced: "In particular, industrial society has brought these, and a myriad other defuturing things and forces, into

being."

How can we, as design educators react to this situation? Even more so, we are affected by the same feeling of profound loss and confronted with losing credibility as part of an older generation that could have known better, at least since the 1980ies. Transforming design education entails a thorough self-assessment of educators, questioning the intensely linear paradigm of prevailing design programmes and coming up with alternatives. Thus, in reflecting on the debates with students during two teaching units on BA and MA levels at Basel Academy of Art and Design, this paper argues for combining speculative approaches with designerly material knowledge and the social practice of commoning in design education.

Starting from the perception of the all-encompassing socio-ecological crises, condensed in the disputable term Anthropocene, the first part of the paper discusses how to open new ways of conceptualising design education in a project-based teaching unit at MA levels. The need for this is twofold: First, as educators, we are often confronted by students asking about design's social and environmental responsibility. Such questions gain acuteness at the end of their basic studies when they have learned designing skills and methodological principles. Thus, their unease relates to the foundations of the professional field for which they are being trained. How can design education help to transform a professional field perceived as not future-proof? Second, if we define design as mediating technology, resources, and policies, our practice indirectly affects existing and creates new environments. Therefore, design is deeply integrated into sustainable and unsustainable everyday living, defining behaviour, access, or norms defining design as always political (Mazé et al., 2013). Given this entanglement, the question arises if and how the policies of design education can contribute to resolving the crisis.

The second part discusses how the same MA students combined circular design strategies with 'designerly material knowledge' in the project-based teaching unit. Conceiving a material-based design methodology could lead to a revision of design education and practice and a deeper understanding of the role of materiality in the design process.

The third part of the paper builds on the assumption that design education should heighten the experience of the social embeddedness of each design task in place and time. Understanding any short and long-term ramifications of using resources could benefit from a closer reading of commoning as a social practice, as discussed in an interdisciplinary theoretical BA teaching unit. In conclusion, the paper discusses the ramifications of those two specific teaching experiences on their potential to transform design education into a more circular practice of educating.

Positioning design education in relation to environmental crises

As Latour (2018) reflected, it is high time to define our situation in what he considers a fundamental crisis of modernity detached from its material constraints. Beyond the much-needed political activism (in which design educators could take a much more active part), the crises urge us to redefine where we are in temporal and spatial terms. To discuss the situation on a planetary level without nurturing deeply disturbing perspectives and prevailing feelings of helplessness and doom, Latour's notion of *atterissage* is of great help. If included at the beginning of a teaching unit, this opens an ongoing debate about making meaning in times of uncertainty.

We thus collectively developed a project-based teaching unit at the master's level led by Evelyne Roth, Jörg Wiesel, and the author. The interdisciplinary teaching unit 'Thinking and acting in circles' collaborated with a Swiss outdoor sports company to develop circular design propositions in the Autumn Semester of 2022. The 15 master students with an international background and BAs in Industrial Design, Textile Design, Fashion Design or Scenography worked in groups. They aimed to research on how design propositions can help transform a linear methodology into circular processes and practices. Together, we structured the teaching unit according to a standard design process and integrated theoretical inputs on debating definitions, historical perspectives, and the heuristics of speculation. We started with an explorative investigation of the company's products and objects. We immediately integrated practical design experiences and reading, open questions and knowledge gaps into the discourse. Not all students were familiar with the debate on the Anthropocene or had read the founding texts on circularity. Nonetheless, they reacted positively to the opportunity to ask wide-ranging questions about the current crises, the difficulties in describing them, and how this affects their positioning in design.

It is no easy task to subject the canon of designing to critical revision, i.e. to solve or address in a still very linear way clearly defined problems. The underlying rationale of design education is still governed by the belief that creation is exclusive to humans and a means of self-expression for the better of other humans. Reworking such definitions by learning to describe the planetary situation otherwise and looking back to find inspiration in counter-narratives of design history presupposes a cognitive level only reached in the MA programme. Here, it is no longer about understanding design-related terms, methodologies and theories but about critically examining the underlying notions, even if this may deconstruct long-held beliefs.

What words? Relearning to describe the current situation

Perceiving a crisis calls for new terms describing the situation in its singularity. From a geological perspective, there are good reasons to rename the current epoch in which significant changes to the structure and functioning of the Earth System, including the climate system, are to be observed. Naming this still disputed new geological epoch 'Anthropocene' refers to the realisation that human beings have become a global geophysical force.

Besides terminology, beginnings are much debated in historiography, even more so in geological time frames. The ratification process is still ongoing, and thus the beginning of this epoch remains to be decided definitively by the experts. Of higher interest, though, is the fact that in the meantime, the term Anthropocene has become an environmental buzzword coined by the late atmospheric chemist and Nobel laureate Paul Crutzen in 2000. In his view, the outcompeting of natural processes started "about two centuries ago, coinciding with James Watt's design of the steam engine in 1784", linking the beginning of the Anthropocene with the industrial revolution. (Crutzen, 2006). In an equally influential later publication, he and his co-authors proposed dividing the Anthropocene into three stages. The Industrial Age 1800-1945, the Great Acceleration since 1945, followed by a future phase to gain joint responsibility for the Earth's system by the global community in

2015 (Steffen et al., 2007).

Alternatively, the beginnings of the Anthropocene are traced back to the Great Acceleration period after the Second World War and the advent of the nuclear age (McNeill & Engelke, 2014). This hypothesis will probably prevail as the stratigraphic and Earth System approaches assess this period as crucial. Since then, geologists have detected the increasing worldwide use of synthesised fertilisers in strata, as well as aluminium, heavy metals and techno-fossils. Microplastics, which pollute regional waters and oceans, are entering the food chain and will probably still be detectable in sediments thousands of years from now (Waters et al., 2016)

Altering the Earth's system will inadvertently affect us with all other living species and non-living entities. Thus, 'Anthropocene' has vast philosophical and historiographical implications beyond its geological significance. It designates a shift of perspective from living in the "new world" and being dependent on it (Holocene) to adopting an active role in (re-)designing or even creating a "human-made new world" (Anthropocene).

Thus, reflecting critically on the term Anthropocene with the MA students entailed two propositions, as we collectively worked out in one of the theoretical inputs during the project-based teaching unit. First, the hubris engraved in the term forcibly leads – especially Western thinking – to a turning point in the definition and perception of the relation between the environment and human beings, acknowledging that humans are more deeply entangled with it on a factual and epistemological level. Therefore, as Donna Haraway points out, alternatives to describe the situation are much needed. She proposed another definition for this new age and coined the term 'Chthulucene' (from the Greek *chthonos*, meaning "of the earth"), describing it as an age "made up of ongoing multi-species stories and practices of becoming-with in times", an age in which we must decenter humans from their adopted central place: "We are at stake to each other." (Haraway, 2016). It is urgent to deconstruct the historiographical implications of the term Anthropocene, suggesting that human beings are still moving forward in their conquest of space and (geological) times, according to Crist (2013, p. 132). More so, the term wrongly suggests that humans are controlled by fundamental biological and geological processes or even creating them.

Second, we need to understand better how the present crises are related to their political and historical causes. We live amidst a full-fledged ecological and socio-political crisis unfolding unfolding as massive global inequity. Such inequity forcibly leads to reflecting on the discursive aspects of the rather generic term 'Anthropocene' as it tends to blur causes and effects. Sociologists, therefore, oppose it, arguing that the current environmental crises derive from overshooting the capitalist economy rather than the mere fact of being human. (Malm & Hornborg, 2014). The term wrongly reduces "the mosaic of human activity in the web of life" to an abstract "homogeneous acting unit", essentially removing "inequality, commodification, imperialism, patriarchy, racial formations, and much more" from consideration, as Jason W. Moore criticised (2015, p. 170). Thus, using the term 'Anthropocene' in non-geological contexts bears the potential to de-politicising the ongoing crises. Therefore, Latour (2018) urges us to redefine how and with whom we can sustainably live in what he describes as the 'critical zone', i.e. the fragile layer allowing all life forms to live on the planet. He suggests that we must shift our focus to sustain this critical zone and become 'terrestrial', a status he explicitly links to a fundamental critique of modernity, its underlying paradigm of progress, and contemporary politics. He further extends this notion to a critical, participatory relationship to our living world in unprecedented danger, defining the worldwide situation as the 'new climate regime'. This regime is not limited to ecological crises but touches on questions of politics, cultural history, and ethical and epistemological perspective changes. Scrutinising design's role in this process is vital to reformulating a new ontology of design (Fry, 2020). Design gained critical attention through the sense of hubris in the term Anthropocene's meaning and its oppressed question of liability.

Counter-narratives of design and its history

The debate on the Anthropocene was further contextualized during theoretical inputs by a thorough reflection on the historical roots and the canonized, predominantly western understanding of 'design'. As an inextricable part of industrialisation, design – defined as an 'interface' to make technology available (Bonsiepe, 1999) – finds itself in the middle of the debate. Crutzen's reference to James Watt's invention of the steam engine in 1784 underlines the crucial role of technology at the root of the current environmental crises. With the invention of steam power, the change from agrarian to industrial societies in Europe and North America soon made itself visible in many areas, including the landscape. Before industrialisation, people used natural forces – wind, running water, or gravity. With the steam engine, the releasing of chemically bound energy began, and the new machines were driven from within, for which they needed fuel, be it wood, coal, or coke. Energy consumption massively increased starting the era of extractive industries intricately connected to colonialism, which today puts the primary responsibility of urgent decarbonisation on the Global North.

The need to protect the forests through sustainable silviculture concerned not only foresters but broader sections of the public (Radkau, 2011). A hitherto unprecedented burden of pollutants on the environment became apparent in the 19th century. In the big cities, people could hardly breathe; the air was full of smoke, and toxic sulphur dioxide compounds led to forest dieback on a larger scale. However, as in the Middle Ages, technical and legal protective measures were still limited to containing visible and malodorous substances. The belief in the almost unlimited self-purifying power of nature continued to dominate. Thus, according to a traditional understanding that still widely grounds design education, 'design' is seen as primarily defined by the processes of industrialisation and therefore held co-responsible for the damage caused by it.

Still, there is a counter-narrative to the role of industrialisation in design. Besides debating the role of design history in design education, such alternatives open a different grasp on the potentialities of design in the current situation. The social and environmental costs of mass production did not go unnoticed by design itself, from William Morris's utopia News from Nowhere, published in 1890 (Morris & Kumar, 1995), critical systemic thinking (Fuller, 1969); (Rittel & Webber, 1973) to socially integrative (Papanek, 1971), feminist (Buckley, 1986), or decolonial (Escobar, 2018) approaches that all define alternative design methodologies considering environments of all sorts. In the last two decades, criticism of design in the service of an industry that externalises environmental damage and privatises profits intensified, lately propagating approaches

like Transition Design (Irwin, 2015).

The role of the prototype:
Making potentialities tangible

It turned out to be crucial embedding both discursive undertakings – redescribing where we are and re-writing the history of design on the model of existing counter-narratives – in non-linear, openly discursive didactical settings integrating them in the ongoing practical explorations of circular design practices in a predefined and real situation. In this setting, the MA students were invited to activate their design skills in re-formulating longtime undisputed design practices and thus free themselves of the negative and unproductive feelings of 'being ashamed' as designers.

On a theoretical level, this led to rethinking the defining problem-solving paradigm. Design entails the promise not only to create solutions to existing problems but to undo or redo the effects of decisions taken in the past. Thus, the current and much debated hopes for technical approaches like geoengineering to deal with the devastating effects of Global North's overconsumption on the climate. In a crisis, however, the problem-solving paradigm of design concedes to designers the invidious role of coming after the shock: They seem obliged to repair the debris and thus save the world. Should we, therefore, compare design to the Red Cross, treating but "a few wounds that capitalism inflicts" and therefore "prolongs capitalism like the Red Cross prolongs war", as German sociologist Wolfgang Fritz Haug (1970) criticised design as serving the needs of a capitalist society. His unfair and blatantly wrong comparison is just one of many criticisms of design-as-embellishment of capitalist interests in the 1970ies. The most salient aspect is the basic notion of timing that undergirds Haug's critique: If we limit the scope of action for design to mending what has gone wrong, we miss one of the central heuristics of design of opening possible futures. We should better conceive of design as a vital resource for transformation. Such a notion relies on attributing design with an intrinsically speculative potential.

Speculative methodologies extend to multiple disciplines linking art, design, technology, or strategic thinking. An epistemological axis of the unconstrained connects them to the constrained (Montgomery, n.d.). Speculative design makes potential futures tangible and, therefore, negotiable, shown amongst others in the work of Anthony Dunne and Fiona Raby. Their impact in the early 2000s was liberating for designers, even if the approach was rightfully criticised as binary and too biased on western notions of design (Bardzell & Bardzell, 2013). Opposed to affirmative design as problem-solving reinforcing the status quo in the industry's service, Dunne & Raby (2013) characterise speculative design as problem-finding in the service of society, asking how the world could be.

'Proto-typing' is a means of trying out solutions beforehand. In contrast to other critical practices, it mainly uses prototyping to gain knowledge. Iterative processes go on until stakeholders agree on the result. Thus, prototypes are not only futuristic but deeply discursive objects. They bring a proposal to the table, as preliminary as it may be. Embracing such a heuristic instead of dismissing design once and for all because of its undisputedly capitalist and colonialist heritage could help overcome future crises.

In the one-term MA teaching unit setting, speculative design approaches helped the students greatly free themselves from the burden of delivering ready-to-implement proposi-

tions. In activating their exploratory and observational skills, they nonetheless gave valuable inputs to the company regarding their repair processes or managing their leftovers, amongst others. At the same time, the students achieved a practical understanding of the difficulties of transforming linear into circular production and consumption processes in real life.

Hands-on: Understanding materiality
in project-based teaching units

Circular economy formulates another promise for design which plays a central role in the upcoming transformation of society and production systems (Irwin, 2015). This role also implies 'repairing' instead of inventing 'the new' with its modernistic notion of starting from scratch on a white sheet of paper, but at the same time, subscribes to design to adopt a much more active and integrative role along production and consumption cycles.

The drawbacks of the Circular economy on the systemic level, i.e. the real danger of keeping an unsustainable system of overconsumption in action, were easily discerned by the MA students particularly critical of greenwashing. Therefore, focusing on the crucial role of design decisions to make a service, a product, or a system more 'circular' – in any of the different circles drawn by, i.e. Ellen Mac Arthur (Ellen MacArthur Foundation, 2013), Braungart McDonough (2002), or others – entails a better understanding of both systemic flaws like rebound effects that also affect design decisions about materials or production processes. Design educators, therefore, are called upon to reconceptualise the temporal dimension of designing from a linear to a circular understanding.

Parallel to designing proposals for the specific company, the students began to reflect on what does it need to be able to anticipate practices of usage and beyond in designing? How does this broaden definitions of stakeholders? Do we have to redefine co-designing, considering the environment on a planetary level at stake? Do we have to redesign 'design' as a whole? Such questions lead to a thorough redefinition of material's role plays in everyday life.

Designerly material knowledge forms part of the long-lasting entanglement of design and environment(Fallan, 2019). Knowing of and about materials is based on the findings of material sciences integrating a historical and cultural perspective on materiality. As a transdisciplinary practice, design needs a deeper understanding of materiality to expose hidden meanings and historically rooted use and misuse of materials. Combined with a speculative design approach, this leads to a broader understanding of materials-in-use meanings. Assuming design unlocks and redefines materiality through experimental, creative, and prototyping approaches, the question arises of how to validate material knowledge in the design process and pass it down to future generations. Thus, conceiving a material-based design methodology could lead to a revision of design education. The demand for sustainable design based on material knowledge and acknowledging where materials-as-resources come from is anything but new. Given the foreseeable depletion of resources, the report 'The Limits to Growth' (Meadows & Club of Rome, 1972, p. 177) called on designers to create easily repairable and durable products to minimise resource consumption despite higher (design) costs. To "improve the functioning of a society in a state of equilibrium", the report called for, among other things, efficient recycling techniques to reduce resource depletion, a better design

to extend product life and promote repairability so that capital depreciation rates are minimised. The methodologies needed to achieve this have since been differentiated with Green design (Burall, 1991), Circularity (Stahel, 1996); Ecodesign (Braungart & McDonough, 2002); (Charter & Tischner, 2017); Co-Creation (Meroni, 2007), (Manzini, 2015); Circular Economy (Ellen Macarthur Foundation 2013) and Transition Design (Irwin, 2015). Not all of them extend material knowledge in historical and cultural dimensions.

Materials are central role in circular design methods (Oberhuber & Rau, o. J.). Therefore, the teaching unit with the MA students began by exploring the outdoor sports company's textile leftovers and used and damaged products. The students realised how time-consuming it is to undo consumer goods like highly functional sports apparel, high-end rucksacks, or jackets and how many different textiles are combined in just one product. At this moment, they experienced hands-on how crucial the conceptual phase is for assessing the life cycles of artefacts and processes.

Theoretically, this perspective called for a redefinition of the design process. Instead of conceiving a project and searching for the most sustainable materials and production processes, students learned to focus first on materials and then on their design tasks. It required researching materials and their origins, perceived cultural values and entanglements in colonial discourses. Finding out how to keep materials in circulation led the students to a different understanding of materiality. If their design project should keep materials in circles, it only 'borrows' materials for a limited time before transforming into something else. Such a metaphor can reverse the design process upside down with lasting effects on design education.

One potential outcome for future project-based teaching units on the MA level is reevaluating of material libraries and project archives. Assuming the informed choice of sustainable materials and production processes is crucial for designing sustainably, using such archives becomes an integrated part of practice-based teaching units. Material samples and artefacts from design processes convey applied know-how. They are usually stored in material and sample collections or project archives. To use them fruitfully, students must reflect upon them critically, as they, too, have a complicated history of their own.

Model and pattern collections were an integral part of arts and crafts schools at the end of the 19th century, from which art and design education developed. They were considered an effective means of enforcing design standards. As the core of the emerging arts and crafts museums, they served to educate general taste. (Pazaurek, 1919) We must critically evaluate archives' canon and existing structures to build up a designerly material knowledge. Archival systems should extend to materials and the implicit knowledge gained in design processes. Material collections combine cognitive information with haptic experience conveying material, technical and cultural knowledge through samples and descriptions of processes. Materials and their use are culturally coded. As such, they form part of discourses that need to be re-read from the perspective of decolonisation and sustainability. Therefore, archives could lead us to a historically and culturally informed mode of dealing with materials as a prerequisite for creating a more circular design.

The theory of the Commons in design education at the BA level

Undergraduate design students learn to base their design process on thorough research to determine its speculative potential. In doing so, they acknowledge the embeddedness of any design proposal in a pre-existing world. Thus, they lead their practice-oriented projects on mostly given briefs. In the process, they rely on generic descriptions of design processes as a work frame. However, questioning the base of such practice needs other settings or moments in a predominantly project-based education. Usually, theory classes seem to allow reflecting on methodology, but in doing so, we push the unfortunate division between theory and practice even further. To overcome such divisions at least partially, an interdisciplinary teaching unit at BA levels allowed developing a broader definition of acting as designers using the commons theory.

Commoning sense: Acting as being part of something bigger

Instead of designing discrete objects, designers should drive systems-level change in conceiving relationships, interactions, and experiences for and within complex social systems (Irwin 2015). Therefore, we can best describe design as a co-design activity involving various actors (Manzini 2015). In the view of the all-encompassing ecological crises, the 'actors' involved are not only human beings but all living beings and non-living entities of the critical zone, entailing a multi-species vision. Speculating about a sustainable future includes all entities now and in the future. Understanding any short and long-term ramifications of sustaining through using limited resources could profit from a close reading of commoning as a social practice.

Commoning reflects a social practice within limited resources, maintaining long-term use of Common pool resources. Historically, the discourse about common goods had a revival at the time of the Great Acceleration, coinciding with the Peak Oil theory first presented by Marion King Hubbert at a meeting of a branch of the American Petroleum Institute in 1956 (Gosh & Prelas, 2009). Hubbert predicted that global crude-oil production would peak in about 2000, decline quickly, and eventually disappear in the 22nd century. Such outlooks were perceived as disturbing in an economy heavily relying on fossil fuels. In his widely debated article 'The Tragedy of the commons', Hardin (1968) combined political economy with neo-liberal "life-boat-ethics" (Oakes, 2016, p. 238). Furthermore, an irritating lack of historical accuracy determined Hardin's notion of the commons (Cox, 1985). On the other side of the political spectrum, the need to discuss systems and rules was pervasive when the environmental movement was emerging, and the need to limit the damage of industrialisation was broadly recognised (Radkau, 2011, p. 124ff)

If resources are limited, we need consensually established rules for their use. Rules to preserve the commons and the ways of breaching and sanctioning such misbehaviour are historically contingent. They have always been formulated as co-existence systems and religiously or morally based intentions. Elinor Ostrom famously scrutinised them in her comprehensive study of the underlying principles of Common pool resources (Ostrom, 1990). The survey that posthumous got her the Nobel Prize in Economy in 2009 aimed to show how essential actors are in determining the regulations of sustainable use to prevent the debatable notion of the "tragedy of the commons". Based on many case studies, Ostrom analysed long-enduring Common-Pool resources (CPR). Her study shows why

some sustained and others deplete over time and how self-organised systems help to solve two of the significant real dilemmas of the commons, namely "the problem of commitment and the problem of mutual monitoring." (Ostrom 1990, p. 59)

As a social practice, commons are historically contingent; they are negotiated, structured, and embedded in rituals, virtually present in the minds of their participants and life-changing for them. They can be read as the changing notions of the lived embeddedness of societies in their natural environment. Therefore, the history of the commons explains how the conception of the intricate connection between the environment and societies is established and how it changes over time. As such, commons are comparable to systems design (Ernst, 2021). Understanding how they were designed and what policies – that historically also led to the exclusion of the have-nots and the socially vulnerable — had to be put in place for their long-term functioning shows the deeply collective task of designing sustainable environments. Thus, a historical perspective helped the BA students understand how environmental issues and eco-conscious practices always form part of socially regulated and therefore designed systems. In hindsight, one of the most efficient ways to teach the difficulties of designing a sustainable environment was to let students experience and discuss the value of cooperation with the help of the prisoners' dilemma formulated in the form of a short detective story by the American mathematician Albert W. Tucker (Mérő, 1998).

While the BA students were activated in debating the theory of the Commons in reading a syllabus of foundational texts, exploring game theory and the prisoner's dilemma, amongst others; the whole teaching unit was acutely lacking a practical exploration of commoning as a social practice in design. Nonetheless, the students appreciated debating an approach heightening the understanding of designing as a collaborative practice that questions the still widely uncontested creative paradigm of the (mostly male) designer-as-author.

Conclusion

While critically reflecting on traditional design education based on a linear understanding of designing, we should not refrain from design's potential to bring past, present, and future together. Based on its heuristics, design entails the promise not only to create solutions to existing problems but to undo or redo the effects of decisions taken in the past. Similarly, the current debate hopes for technical approaches to deal with the multiple crises due to rampant CO2 emissions; geoengineering is the latest resource. They inscribe themselves in Herbert Simon's definition of design as devising "courses of action aimed at changing existing situations into preferred ones." (Simon, 1988) Still, we must be aware that design is profoundly and methodologically entangled in the problem leading us into an unsustainable state. Therefore, it cannot offer quick solutions. Nevertheless, we could start redefining design by considering the embeddedness of design in the critical zone. Then, it would no longer be defined as a linear practice of framing a single problem and iteratively coming up with the best possible solution, as singular as it may be.

Designing may help us to reimagine and conceptualise the way of living together in the 'critical zone'. Therefore, due to its heuristic qualities, we should not refrain from design's potential to bring the past, present, and future together. To be grounded entails knowledge of situatedness and how to preserve it in the future. In other words, designing helps us to project possible futures without losing ground.

In criticising traditional design education based on linear notions of designing, we should try to develop easy-to-grasp metaphors of a different understanding. So instead of using a simple geometric operation that rounds a linear structure of iteration in a circle as in Circular design methods (and aptly performed by Tim Brown in his video on Circular Design), we should better use a spiral as inspiration. This form clarifies that we will have to rework what is already there on different levels. Replacing a linear representation with a spiral may sound meagre as a result. However, behind this insight lies a thorough and collective examination of the often disguised, unaddressed assumptions that shape undergraduate design studies, whether in the curricula, semester projects, or mentoring. Breaking through these underlying figurations seems to be a first step towards perceiving design education and practice differently.

Although designing is by no means limited to conceiving tangible material objects, design students on both BA and MA levels must learn to come up with discursive objects that may stand the test of a debate, anticipating possible futures. Prototyping, therefore, is a central aspect of design, relying significantly on designerly material knowledge. Such knowledge allows designers to act embedded and more conscious of one of the essential aspects of sustainable design processes and practices: Materiality. Unless materials are to be conceived of as Common pool resources, design education risks perpetuating unsustainable design practices even if they teach Circular design methods. Materials are always sourced in the critical zone; they are always considered precious and limited. Therefore, designerly material knowledge correlates with the theory of the Commons. 'Material Commoning' may serve as a further model for transition design, bringing together social issues, embeddedness in the critical zone, and a futuring prospect.

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