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SYSTEMS THINKING AND INTERDISCIPLINARITY IN DISCIPLINARY DESIGN EDUCATION

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ABSTRACT
The field of education is highlighted as an essential area for sustainable development. With the aim of developing a positive attitude to addressing global changes, the lifelong learning of the individual is emphasized. UNESCO promotes eight key sustainable competencies to be included in education to ensure that future agents contribute to the necessary green transition and the work towards achieving the 17 UN Sustainable Development Goals. The first one of these key sustainable competencies is 'systems thinking competency.' Many of the systems which surround us and make up our current paradigm on the one hand contribute to keeping the status quo, despite numerous initiatives towards a green transition, and on the other hand the systems entail a complexity that is challenging for students to comprehend and thus change, alter or disrupt. Generally, there is a lack of systemic understanding among students at VIA Design & Business, which, from an environmental perspective; affects their ability to contribute to the radical change needed.
The paper explores how students can obtain a deeper understanding and knowledge of the system and sub-systems constituting the industry they train for and how this can contribute to foster a green transition.

Keywords: Systems thinking, interdisciplinarity, new paradigm, system mapping, fashion design

1 CONCERNS AND MOTIVATION
There is an increased attention on the necessity of creating a substantial green transition. Changes and alterations can no longer be viewed as sufficient to solve the environmental crisis, we need an actual paradigm shift. *"Instead of changing the world to suit us we need to change the us to suit the world"* [1: vii]. The educational system has repeatedly been emphasized as one of the fields to drive the necessary change [2]. However, critics are simultaneously emphasizing how the educational system in general fail to disrupt the current traditional Western paradigm [3,4] and that this preservation in itself is the obstacle to a substantial green transition and a radical paradigm shift.
Design educations are thus faced with the challenges of implementing new - relevant and constructive - teaching goals aiming to build student competences to foster the necessary green transition and the emergence of a new paradigm. Consequently, Design & Business students at VIA Design & Business have continuously been introduced to a variety of different strategic approaches, models, and tools aiming for responsible design and business developments; for example, the triple layered Business Model Canvas [5], various approaches to Circular Economy [6], and critical design [1].
Despite the increased focus on responsible development, our daily empirical realities and experiences as lecturers reveal that students' projects tend to be somehow superficial in the development of sustainable solutions and that originally well-meaning suggestions and innovations fail to address sufficient perspectives and to take obstacles, potentials, and the wider systemic consequences into account. It seems curricula fail to provide the students with substantial knowledge of systems and system intersections.
For design students, the environmental challenges create a field of tension between dreams and reality [7]. A field of tension between dreams of making and needs of responsibility and action in relation to the environment.
On the one hand, we have students who are preoccupied with becoming skilled designers and create dreams. On the other hand, they are concerned about the environmental impact of their creations and

the fashion system in general and wish to act consciously and responsibly to contribute to a more sustainable industry.
Research demonstrates that students at Higher Education (HE) in general show a significant - and worrying - lack of systemic understanding and competencies when working in sustainable, social or complex real-world challenges [8,9]. According to UNESCO [2], future curricula must address and enhance students' connectivity with nature and biosphere as an educational space using knowledge commons, social and emotional learning and community involvement practices. Over the past 10-20 years, a new field of research and practice within the area of Education for Sustainable Development (ESD) has emerged in HE, revising the concept of education and illustrating how ESD can become the core of a transformation of the societies in the Anthropocene [2]. Teaching and learning in the 'Anthropocene' involves generating new educational practices and perceptions when entering an epoch where all human activities affect all life critical zones on Earth [10]. With the 17 UN Sustainable Development Goals (SDG), a platform of construing the world's challenges has provided a normative argument for the political educational path forward. In this regard, the 'Anthropocene' requires developing a new profound systemic revision and understanding of the view of the planet Earth and a recognition of the interconnectedness between human activities and nature in educational practices [9]. Among the recommended future student competences, UNESCO highlights systemic understanding as a crucial key competence.
The feedback from students states that they lack knowledge about sustainability. On the other hand, an increased implementation of sustainability workshops collides with their - and the institutions' - aims and wishes to become and create skilled designers with a deep knowledge of products, properties, materials, manufacturing, and on top 2D and 3D communication. The aim of the institutions is to prepare students to create desirable products that make a change for future design. Consequently, our aim is to educate designers that know about the systems and are able to navigate in them and reach out to other disciplines to combine 'design of products' with 'systems thinking.'
The authors of this paper acknowledge, value and represent both perspectives. The design discipline including the practical skills is in a juxtaposition with systems thinking and circular economy. This paper is thus based on an interdisciplinary approach that intends to foster transdisciplinary approaches that will look into ways to broaden the systemic perspectives.

2 SYSTEMS THINKING OR SYSTEMIC THINKING

The UNESCO 2021 Roadmap report shows how the problems facing humanity are highly interconnected and complex. The educational paradigms are currently changing towards a 'systemisism' scope as new principles of educational thinking and policies emerge [3]. In 2011, Wiek et al. [11] made a comparative study on the future requirements to competence development and defined five key competences for developing an educational framework for sustainable future. One of the five competences in line with the UESCO key competencies is a 'systems thinking competence.' As such, a new systems thinking approach to understanding educations as a crucial part of the needed change marks a shift in the urgency to radically rethink how the ecological, living or whole systems view of the world becomes a part of the future educations. It also challenges the question of what the students should learn – what competences are needed for handling the present and future challenges.
When defining 'systems thinking,' endless pathways open up. Checkland [12] described the scientific change from reductionist to systems thinking as a movement rather than a discipline.

> *"The systems movement comprises any and every effort to work out the implications of using the concept of an irreducible whole, 'a system,' in any area of endeavour. [. . .] Because systems ideas provide a way of thinking about any kind of problem, systems thinking is not itself a discipline."* [11:99]

The systems approach argues that all phenomena can be seen as a network of relations among parts - a system. All systems, social, technical, biological or electrical consist of common properties, patterns and behaviours which can be analysed and used to develop insights into the order and reactions of the complex phenomena. By following the ideas of mapping the roots of the system, there is even more need to try to identify new areas. Says Abson *"even more powerful but still undiscovered areas of intervention even those less obvious and radical"* [13].
In this paper, systems thinking will be used as a lens to investigate how sustainability issues are interconnected in the fashion system and its surrounding systems - as a sub-system and as a "system of interest." A "system" is bounded and defined by the researcher's prejudices, interests and constructs -

but does not as such exist as a real physical “thing.” It is a construction, made by the researcher, providing an epistemological approach in which the researcher chooses to delineate a system. To establish an understanding of the fashion system, we need to acknowledge and adapt interdisciplinary approaches to the inquiry but also define its boundaries. But, without a set of boundaries for a given complex problem scenario, it is unlikely to develop an understanding of its nature to other stakeholders and thereby establish solutions for the area of concern and stakeholders.
A system view of the fashion industry and the fashion educations can help us understand and influence the challenges of the industry and its many consequences across the community. This can be done by establishing a framework to identify the many interconnected elements, which allow us to better understand the multiple implications of the present practices and decisions. Systems thinking could be applied to areas of science, knowledge and organizational settings connected to the fashion industry and fashion educations systems and as such we can construct an epistemological lens and understanding which can provide new insights and help us identify patterns of connections and failure.

3 WORKING WITH SYSTEMS THINKING

The point of departure is our concern that the green transition and a paradigm shift is moving too slow. Future graduates will be the bearers of change, the necessary change agents, and our curricula need to support and foster the graduates' ability to act as such. Our approach is thus partly motivated by the articulated need for a paradigm shift, partly by the approach that SDG 17 has to be viewed as an obligation and not an option, and partly by our empirical experiences of students’ lack of systemic knowledge. Our approach is grounded in the conviction that students need to understand the systems to be able to intervene and thus contribute to change them.
VIA Design & Business students are predominantly employed in the fashion and lifestyle industries. These industries are characterized by a complexity of systems, complex systems, and system intersections. There are obvious intersections between e.g., the political, economic, ecological, and technological systems. Simultaneously the social, cultural, and emotional systems with their layers of intangible mechanisms, preferences, and predispositions intersect with the above mentioned as these systems drive the why, what, and how of consumption. Understanding these diverse systems individually is a prerequisite for understanding their intersections and the influences they bestow on each other. However, to obtain understanding of the individual systems requires diverse type of knowledge and approaches. Understanding business models, which are part of the economic system, requires a set of tools differentiating from the set of tools required to understand the cultural and social mechanisms, and yet the latter intersect with the former. The introduction of the system of fashion intends to create awareness about the system and the intersections but does not expect students to become experts in the details of all sub-systems. On the contrary, we wish to educate students with a deep specialized knowledge within their specialty, but with the system knowledge that enable them to envision consequences, obstacles, and potentials of actions in one sub-system and how that intersects and interacts with other sub-systems. This knowledge and awareness are prerequisites for the realization that you need to involve other professions in future developments.
The introduction of a more systemic approach to understanding the surrounding world is still in its infancy at VIA Design & Business. The first students have been introduced to the concept of 'system mapping' through lectures. The initial visualization as shown in (Figure 1) was developed in connection with a course in education for sustainable development competence for lecturers at VIA University College, Denmark, the; ‘Circular Economy and Sustainable Development in the Education’ course (CESDE) 2020 [14]. The visualization (Figure 1) has been continuously evaluated and developed based on feedback from peers as well as students. The visualization is thus preliminary, in no way exhaustive, and should be viewed as work in process as well as progress.
The point of departure was mapping the elements constituting the obvious system of fashion from business model to production and consumption. Next step was to approach each of the elements to expand the mapping in any possible direction, e.g., which business models do we know within the fashion system (fast fashion, made-to-order, etc.), which system (the capitalistic) conditions these business models are based. Which actions support the models, e.g., consumption and then which mechanisms drive consumption etc. Each of the main elements multiplied into new sub systems and entities. Working iteratively, we then approached business models again. The business model of fast fashion is – among other things – conditioned by the previous outsourcing decades ago that gave access to cheap labour. Laws and regulations allow or prevent the emergence of new business models, while

the consumption behaviour of users determine whether a new business model succeeds or fails. The intention is that lecturers subsequently use the visualization to place their lecture subjects in the model and thus emphasize the depth of knowledge connected to each sub-system.

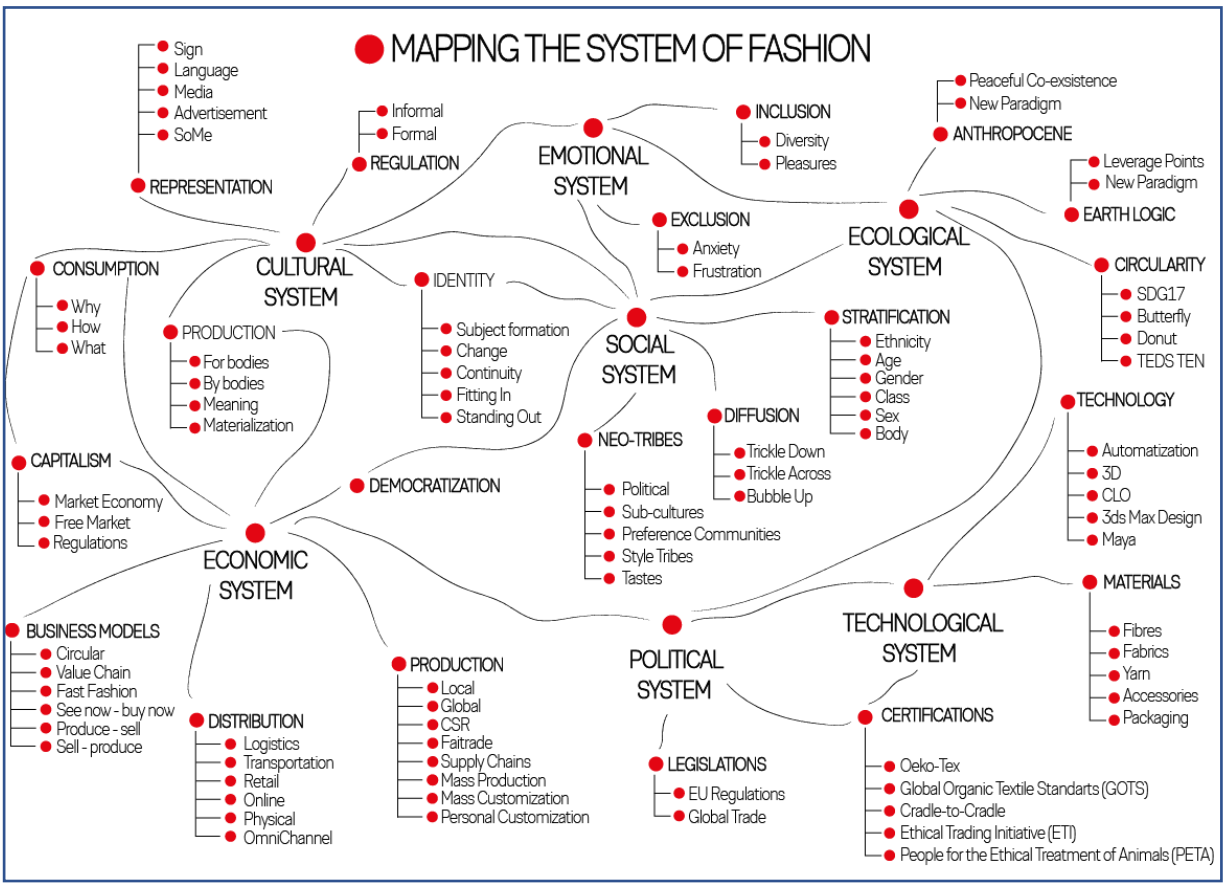

Figure 1. Mapping the fashion system, preliminary work

The actual design is inspired by Paez's approach to mapping as a tool. In this case, the concept of mapping has focused on visualizing the system and the numerous intersections representing the current paradigm of fashion rather than suggesting an alternative and at the same time to *"[…] establish a dialogue between what exists and what is yet to come…"* [15:21].

The visual tool, lectures relating to the various sub systems, and workshops focusing on identifying the elements constituting the system and sub systems each contribute to students' understanding of the complexity of the fashion system and the multiple intersections emerging within it. Students at 1st semester level have been introduced to the visualization through lectures in autumn 2020 and 2021. In the incubator environment, other students have participated in workshops during autumn 2021 where they themselves have had to identify elements within selected system headlines, but none of these students have yet come so far in their education that the effect has been read or is measurable in their individual projects.

By Professor Dilys Williams and Education for Sustainability Leader Nina Stevenson at the Centre for Sustainable Fashion, at London College of Fashion, University of the Arts (LCF); a *"…framework and set of pedagogic principles have been developed to support evolutionary and transformatory approaches to fashion education, communicated through its research, teaching and learning and knowledge exchange projects. This includes the development of a framing of fashion education as a system, which has been applied to this plan"* [16:8]. The LCF approach is interesting in this connection as it is a full-scale attempt to implement both values, didactic and pedagogical principles and collaborations with the surrounding communities.

4 DISCUSSIONS

The western educational practices have produced a destructive Separation Paradigm with futile learning processes – including sustainability education – merely reproducing a reductionist and linear western

tradition [3]. Students are taught to live their lives through separation mechanisms. This can lead to dehumanisation, slavery, oppression or even destruction of our non-human relatives or earth systems. Separatism is everywhere in the construction of our knowledge institutions and practices [3]. In this way, we tend to forget how things were separated to study them, rather than use the separated example as an indicator of something from reality. Separatism is imbedded deeply inside our modernist assumptions: *"reductionism separating the parts; scepticism with opposed ideas to ascertain truth; dualism implicit in dichotomies, oppositions, and binaries; rationalism marginalising other ways of knowing; the scientific method as outside of ethical concerns; and anthropocentrism separating humans as well as human and non-human species"* [3:30]. Lange et al. [3] demonstrate how paradigms of separation have created separation of everything in our lives.

> *"When stepping outside of the paradigm of Separation, and into a perception and embodiment of Relationality, it is common to understand Relationality as interpersonal relations; but this remains within the boundaries of anthropocentric humanism. We expand the notion of relationing further, into a cosmo-ontological approach, understanding the cosmos as inherently connected and all beings and non-beings as always relationing, thus decentring humans"* [3:217].

Changing curricula and subject descriptions are fraught with challenges as the former is politically determined and covers national learning objectives. However, it is possible to navigate within the framework and still incorporate more systems thinking. A relational as well as systems thinking approach can be pursued by critically evaluating current teaching elements and placing them in a system mapping similar to our example of fashion mapping.

One thing is to understand systems and models, another thing is to break them down into action and combine them with disciplinary core competences of - in this case - fashion design. In this paper, we have described the dichotomy between disciplinary skills and the necessity of an interdisciplinary collaboration that broadens the perspective and create impact.

The urgency and complexity of contributing to foster the necessary paradigm shift tends to overwhelm and disillusion students. The intention with the introduction of the system approach is to assist the students in dealing with this complexity and to realize how and where their focus get impact. At the same time, the system approach intends to open the students' eyes to the shortcomings of their own knowledge, to respect and embrace it, and reach out for the lacking knowledge in transdisciplinary collaborations.

5 CONCLUSIONS

We highly agree with Abson [13] who advocates for a new research agenda *"inspired by systems thinking that focuses on transformational 'sustainability interventions', centred on three realms of leverage: reconnecting people to nature, restructuring institutions and rethinking how knowledge is created and used in pursuit of sustainability"*. This is also in line with fellow VIA researchers' work [14] where they argue that we tend to hit the wrong layers with our present disciplinary and silo-based sustainability research. We agree about the need to look into the potential for transformational change changing the way we educate radically. In this paper, we argue that it could be supported by systems thinking and by adapting transdisciplinary research approaches that provide new methods for integrating values, norms and knowledge of humans in both scientific and societal processes. Despite the lack of empirical evidence of the actual benefits of implementing systems thinking as part of the curricula at VIA Design & Business, we still contend that the approach can contribute with knowledge and understanding that enable students to suggest more substantial changes to the industry. But it also requires that the institution management has the courage to break away from the current paradigm and educate graduates, the future employees, with alternative competencies and knowledge than the clienteles, the industry, expect. Following Sterling [4], we see an urgent need for contributing to a paradigmatic shift of HE in fashion design responding to necessary socio-economic and ecological conditions and trajectories.

The next step is to collect empirical data to strengthen our work with systemic thinking. Therefore, in August 2022 we have decided to apply systems thinking as a frame for understanding in a common module with 300+ design and business students on BA-level.

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