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Towards responsible interaction design education

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Abstract: This paper addresses the need and opportunities to align courses in interaction design with ideas behind responsible research, design, and innovation by focusing on values, responsibility, and longer-term and more sustainable perspectives. Rather than discussing the design of new courses leveraging a specific perspective, e.g., sustainable interaction design, we suggest ongoing iterative transformations of an existing course aiming to include multiple relevant perspectives toward responsible education in interaction design. The course re-design utilizes research through design approach exploring how to position responsibility, values, and ontological perspectives when teaching interaction design, using educational components that we identified as a design material. The paper contributes by 1) leveraging the importance of responsible education and 2) a method to 'steer' interaction design courses toward more responsible education in interaction and related design fields concerned with digital artefacts and interactions with technology.

Keywords: responsible research and innovation, responsible education, course re-design, interaction design

1. Introduction

The transformation of design from a discipline with a predominant focus on consumers, products, and services to a broader and more complex discipline that engages with current social and planetary challenges is contemplated by researchers from diverse fields, e.g. (Bardzell, 2010; Escobar, 2018; Irwin, 2018; Kossoff, 2015; Manzini, 2015; Meyer & Norman, 2020; Tonkinwise, 2011) to name a few. While this transformation does not disrupt the efforts of designers to create a distinction in products and services through continued innovation (Schilling & Shankar, 2019), environmental, social, and political consequences of present-day lifestyles, including consumerism, are becoming glaringly apparent. However, a growing number of designers and design researchers consider social, economic, and plane-

tary boundaries (Raworth, 2017; Steffen et al., 2015) and transition to lifestyles offering better futures for humanity than current trajectories (Irwin, 2018). As a result, there is a sense of urgency to re-think design, and even more so, design education (Irwin et al., 2020) since it shapes future designers, be it within architecture, Human-Computer Interaction (HCI), industrial, service, or interaction design.

The global challenges of the 21st century also affect higher education institutions. The complex task of reconciling teaching, research, and public service commitments became more formidable amid already recognized higher education challenges due to globalization, mobility, and the impact of disruptors such as online education. Some universities resolve this tension by conceptualizing their principal activities as basic research, teaching, and cross-sectoral collaboration (with industry, government, and public sectors) to increase their relevance and impact (Etzkowitz & Zhou, 2017). One way for universities to implement such collaboration is to engage in cross-sectoral research projects. In turn, these offer research-based teaching opportunities.

The University of Oslo, where we taught interaction and transition design, was strategically committed to innovation and cross-sectoral collaboration. Thus, when preparing to teach an already established bachelor-level course in interaction design within the Department of Informatics more than a decade ago, we opted for collaboration with industrial partners or funded research projects, leading to research-based teaching and better alignment with the overall university strategy.

Through teaching experience, we became increasingly aware that value co-creation was an essential motivational factor for instructors, students, industrial or research partners, and other stakeholders to invest effort, time, and resources into a course. Although values were not explicitly a part of the course description or curricula, they played an essential role in conceptualizing each new version of the course. Better alignment of the course with institutional and societal needs, in conjunction with the opportunity for value co-creation through education, had more meaning than simply delivering on the specific learning goals (such as mastery of interaction design concepts, processes, methods, or prototyping).

This paper discusses how the principles of responsible education might be integrated into interaction design courses, leading to a better understanding of what responsible interaction design education might entail. Starting from a rather traditional interaction design course (where we taught research methods and focused on user-centered and participatory approaches to design), we describe gradual, iterative transformations of the course that integrated principles of responsible research and design until changes become large enough that they called for a design of an entirely new course. We thought of this process as an ongoing course re-design that re-assesses our understanding of responsible education and approach to the practice of design, highlighting value co-creation each time the course is offered, without making substantial changes to the course description or learning goals that might require administrative approvals.

The primary mode of gaining new insights was based on research through design, implying joint reflections on how to work with responsibility and values within the context of the course (while teaching, after a course ended, and before a new run) and course management. The latter was inspired by service-dominant logic and discussed in (Karahasanović & Culén, 2022). To complement our reflections on the course, more traditional means of collecting and analyzing relevant data were used, e.g., course evaluations, learning outcomes assessments, questionnaires and interviews with students and partner organizations, and participatory observations of project work.

The paper contributes to interaction design education by 1) leveraging the importance of responsible education and 2) providing a method to 'steer' interaction design education toward a more responsible one, also in related design fields concerned with digital artefacts and interactions with technology.

In the next section, the concept of responsible research and innovation is described and related to the principles of responsible education. The methodological approach is presented in Section 3. Section 4 describes the course re-design process and provides examples that illustrate the diversity of projects, approaches, and partnerships. The findings are discussed in Section 5, followed by concluding remarks in Section 6.

2. Background

Design education and pedagogies became increasingly relevant for teaching HCI and innovation (Culén et al., 2014; Culén & Følstad, 2015; Lindtner et al., 2014; Wilcox et al., 2019). For us, this implied a growing need to understand our responsibilities as educators concerning integration of ideas related to responsible research, innovation, and design when teaching. Thus, we consider two topics in this section: 1) responsible research and innovation and 2) responsible research and innovation in interaction design education.

2.1 Responsible research and innovation

According to Burget et al. (2017) and Owen et al. (2012, 2013), the term *Responsible Innovation (RI)* was first used within the European Commission's Science in Society program to develop the strategy for Horizon 2020 program. Intuitively, the concept of responsible innovation makes sense but has been difficult to define clearly, hindering its wide use in practice. Stilgoe, Owen, and Macnaghten (2013) suggested the following definition: *"Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present"* (p. 1570). The authors provided a philosophical anchoring and framing of the concept, which allowed for consideration of purpose and response to uncertainty concerning the social impact of innovation and consists of 1) *anticipation* (of consequences, intended and unintended, supported by methodologies including technology assessments, futuring, scenario development, and others – all aiming to predict impacts); 2) *reflection* (questioning intent, purpose, motivation, knowledge, risks, areas of ignorance); 3) *deliberation*

(collective and inclusive opening of visions, questions, purpose to debate broadly and engage widely rising the opportunities for potential contestation), and 4) *responsiveness* (a process of collective reflexivity to the direction, influence, and pace of innovation, as an open process of adaptive learning, with the dynamic capability to respond to challenges that arise). In combination, these dimensions are conceptualized as the basis for better decision-making in technology design processes.

Von Schomberg (2013) suggested understanding responsible innovation as a *"design strategy, which drives innovation and gives some 'steer' towards achieving societal desirable goals"* (p. 30). In conjunction with the doughnut economics suggested by Raworth (2012, 2017), where the doughnut represents a socially and environmentally safe space for the development and sustainment of humanity, the 'steer' would imply that responsible research, design, and innovation should unfold within the doughnut.

The term *responsible education* was first introduced within the context of management education through the United Nations initiative PRME[1] (Principles for Responsible Management Education), which was established as a platform to raise global awareness around sustainability through alignment with higher education in business management and aimed to provide students with the understandings and skills to deliver change in the future. The six principles addressed the purpose, values, methods, research, partnership, and dialogue. We found that these same principles apply to responsible education more generally, thus, also interaction design education as discussed later in the paper.

2.2 Responsible research and innovation in interaction design

Technological opportunities have long been the driving force of innovation (Lindtner et al., 2014), giving rise to new devices, modes of interacting, interfaces, platforms, experiences, and more. However, we should not design new interactive technologies and innovate without assessing the impacts on society, culture, and nature. Bates et al. (2019) argue that *"RI may benefit all innovators; it is an alternative lens that can be used to increase the positive impact of technological solutions and reduce the risk of unintended consequences challenging the success of the innovation in the future"* (p. 3).

Although responsible research and innovation are still not widely discussed in interaction design, related directions are. For example, sustainable interaction design has been flourishing for a while (Blevis, 2007; DiSalvo et al., 2010), along with value-based design (Barreto et al., 2013; Iversen et al., 2010; Koepfler et al., 2014), design for change (Chick & Micklethwaite, 2011), design for social and environmental justice (Bates, Thomas, Remy, Friday, et al., 2018; Bates, Thomas, Remy, Nathan, et al., 2018), transition design (Escobar, 2018; Irwin, 2018; Tonkinwise, 2015), to name just a few. These research and design directions have built a foundation for dialogue on responsible research, design, and innovation. Therefore, it is also opportune to draw on these when reflecting on responsible interaction design education.

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[1] PRME https://www.unprme.org/

3. Teaching context and research approach

This section describes the teaching context first, followed by the description of the research approach and the process of exploring the notion of values and responsibility in interaction design education.

3.1 Teaching context

We started teaching the course in interaction design in 2011. It was a required course in the study program Design, Use, and Interaction at the Department of Informatics, University of Oslo. The course engaged about eighty bachelor's and master's students until and including 2017.

In 2018, the course was discontinued, and a new elective course in transition (translated to Norwegian as transformativt) design was planned. The new course started running in 2020. It engaged fewer but well-motivated last-year bachelor's students (17 on average). The same re-design practice used for the interaction design course continued. However, the transition design course explicitly focuses on values, environmental and social responsibility, reflexivity, and critical thinking, changing our inquiry from values and responsibility to currently emerging challenges, e.g., engagement with ontological and future-oriented design.

Between 2011 and 2022, we collaborated with more than 34 different organizations engaging student teams in 131 projects. The participating organizations included the public and private ones, startups, or research organizations with large, funded research projects. To participate in the course, the organizations would submit project proposals. The proposals were evaluated based on their suitability for the course in terms of learning outcomes and value co-creation potential (for students, organizations, other stakeholders, and the instructional team), and, if needed, modifications were suggested. Partner organizations committed to a minimum of four sessions with participating students.

The partnerships required attention to ethical issues. For example, the intellectual property agreement was signed for each project, leaving the intellectual property with the students. The premises of the agreement could be modified if desired by all parties.

To better support the project work, we also engaged expert volunteers (Ph.D. students or colleagues) to serve as project mentors and help with design processes. Teaching assistants were also available for interaction design courses and offered additional teaching in smaller groups. In addition, technical assistance was available through the department's dedicated maker space.

Projects often called for methodologies, methods, techniques, or tools that were new for students and not a part of the curriculum. In such cases, complementary literature was suggested, e.g., sustainable service design, speculative and critical design, design thinking, and design fiction. When partner organizations required students to learn proprietary systems, novel methods, or applications, they had to train students to the extent needed to complete the project. Often, student teams engaged in peer and flipped classroom learning.

3.2 Research approach

Research through design (Gaver, 2012; Zimmerman & Forlizzi, 2014) might be understood and communicated as engagement with three main activities areas: design practice, design studies, and design exploration (Fallman, 2008), each with *"its own purpose and intended outcome and the rigor and relevance have to be defined and measured in relation to what the intention and outcome of the activity is"* (Fallman & Stolterman, 2010, p. 268). We describe these areas as they relate to our efforts to understand how to integrate responsible education principles when teaching interaction design through course (re-)design practice, exploration, and design studies. The latter included seeking existing knowledge relevant to the course re-design and the inquiry into the meaning of purpose, responsibility, and values co-creation in research-based teaching and real-life projects. D*esign studies* also implied finding appropriate theories and methods to support students' projects, e.g., mediation theory that is concerned with relations between technologies, people, and nature (Verbeek, 2015), social practice theory (Shove et al., 2012), and value-based design (Iversen et al., 2010). In 2017 we became familiar with the transition design framework (Irwin, 2015), which helped shape the new course. *Design exploration* represented a synthetic and proactive activity involving exploring strategies to intervene in the course and make improvements towards integrating values and other principles of responsible education. Considering diverse components of the course, we asked: "What if we change this component?", "How would changing this element influence critical thinking, learning, or design practice?", "Do we have enough resources to implement the change properly?", "Are there alternatives?" Each intervention that we tried as a result of this activity was intended to benefit students primarily. However, other actors were also considered, including ourselves, and the intent to inquire into the notion of responsible interaction design education. D*esign practice* implied the implementation of the re-designed course, where the teaching practice was a unit of design (Kuijer et al., 2013) and based on the new configuration of educational elements described in the next section.

4. Iterative re-design process and examples of projects

When we first started teaching, we were motivated by a desire to increase the value of the course for students and the university by integrating theoretical and methodological aspects of interaction design with practical, real-life industrial or research projects. At the time, we were interested in the impact of such real-life projects on students' motivation and engagement. After the first run of the course was over, we reflected on our experiences with the course. Additionally, we requested feedback from students and project partners concerning motivation and engagement. Even though the experience was overwhelmingly positive for all stakeholders, many challenges were also noted, some surprising. For example, while the students' motivation was very high concerning the collaborative design practice part of the course, the theoretical and methodological parts were neglected. The student feedback showed that several teams spent all their time doing design work and did not engage with the theoretical curriculum. We also found out that students thought about the project as

group work (a set of individuals working on an assignment) rather than teamwork (a collaborative effort to effectively and efficiently reach the desired project goal). The partners' feedback showed that students lacked professionalism in making and keeping appointments precise. They sometimes did not understand industrial partners' time constraints and did not present a team front but instead acted individually, resulting in communication challenges and an inefficient start to the project.

The above inquiries led to more questions than answers – as is common for research through design: How would we like the students to behave? Is this something that we should teach? What have they valued most regarding real-life practice-based learning? How to bridge the theory-practice gap better? How to deliver feedback on projects so that students learn from it rather than experience it as critique? How to introduce new practices where students get feedback publicly from diverse stakeholders? How to find out if partner organizations got real value from the student projects or, at least, the return on investment of time? Should we even be concerned with partner views, given that we need to provide a good learning environment for our students? Do we find value in organizing and managing a course of this kind since it demands more time than projects without partnerships? This process of questioning diverse aspects of teaching sensitized us to become more observant and reflective (Schön, 1983, 1987) in preparation for the subsequent course delivery.

Based on these initial reflections, we composed the first list of educational elements to pay attention to in re-design practice and explorations. These included ***time and temporality*** – where multiple dimensions were considered, from tuning the timing of lectures with design practices to future-oriented aspects of RI, anticipation and deliberation; ***teamwork*** – focusing on efficient and effective collaboration and partnership; ***purpose*** – having a purpose is known to be a critical factor that influences teamwork (Whelton, 2004); ***professional conduct*** – included respect for other people's time, clear communication, fulfilment of mutual agreements, clarity over rights; ***engagement*** – included interactions with instructional team and other actors, engagement with the project and its purpose, deliberations and dialogue (Krippendorff, 2005; True et al., 2013); ***mastery of research approaches and methods*** – supporting mastery through traditional lectures and a coursebook (Lazar et al., 2010), but also in relation to concrete projects and knowledge needs using proximal development (Vygotsky, 1978) and learning from either experts or peers what is directly of relevance for the project.

The second run of the course produced several surprisingly successful design outputs. For example, one team made an app for finding books in the library building that became a finished product used by both students and librarians for several years after the course. Another team proposed an augmented reality solution for installing telecommunication equipment in homes, leading to a research and development project at a large telecom company. Such examples made us aware that innovation was of high priority for participating organizations and that the selection of partner organizations impacts the creativity and innovation aspects of projects. Furthermore, we recognized the value of repeat partnerships. Thus, we added ***partner and project selection*** – a way to assess the opportunities of projects and

partnerships to elucidate value and help students learn effectively. In addition, we considered the implications of ***diversity*** – in terms of thinking styles, skills, and knowledge within a project team, which have been shown to positively influence the team's performance and creativity (Budijanto, 2013). The diversity of projects enabled exposure to opportunities to showcase different approaches to problems, methods, perspectives, impact assessments, dialogues across contexts, and more. Under diversity, we also considered different teaching formats and pedagogies that might benefit students. We also added the ***understanding of the situated context*** – partners presented the situated context within which the project work takes place, but we needed to help students to start thinking about design by providing pointers to previous design exemplars, or related research work; ***the potential impact of a project*** – the students were explicitly asked to articulate how they thought about possible positive and negative implications of their projects, and include their reasoning into the final presentation of their project; ***novelty*** – also the final project presentation dimension, asked students to consider what is novel about their approach, application area, or design outcome.

During the third run of the course, as often with project-based learning, some internal team issues surfaced, which led us to consider ***inclusion, trust, and safety*** – focusing on inclusion for all, development of mutual trust, and safety when voicing opinions. Reflecting on this element, we could support team-building exercising and open and timely discussions of issues within the team. Since projects were tied to specific stakeholders, it was difficult to change the project when either the partnership or the team did not work well; ***leadership and project responsibility*** – students were encouraged to decide on a strategy to work together and take responsibility for their project. For example, they could choose distributed leadership (different people in charge of different project stages), select someone as a team leader, or follow an alternative form of decision-making and responsibility-taking; ***students in charge*** – of processes and decisions such as timelines, milestones, activities, approaches, and other actors to include in their project work.

The next run of the course surfaced the topics around ***values***, which we then added to the list and considered methods to elucidate values and discuss multiple kinds of values. As pointed out by Iversen et al. (2010) and Koepfler et al. (2014), value often remains invisible to others, and just how the values are elucidated and co-created in educational settings has become central for understanding RI). A related question: 'Value for who?' led to the list entry ***identifying all stakeholders*** – projects often involved many stakeholders such as partners, students, instructional staff, customers, ethics board, and others. It was important for each project to identify as many stakeholders as possible and consider if and how the project provides value for them. Finally, ***communication skills*** – being able to articulate and communicate about the project (its purpose, design outcomes, value co-creation, novelty, impact) needed support.

This process was repeated, with educational elements added or taken away when practices related to an educational element worked well and changes were not needed.

In 2018, the changes to the course became so substantial that it needed a new name, description, learning goals, and outcomes, leading to the new course in transition design, as described earlier. Today, after three years of teaching experience with the transition course and work with educational elements, new elements have emerged: ***ontological design*** – a challenge to think of design as being ontological in that all designed objects, tools, or services bring about particular ways of being, knowing, and doing, i.e., increase the awareness and sensitivity concerning the mutual shaping between designs and their users; ***ecological thinking*** – a recognition that humans are not separate from nature; ***systems thinking*** – integrating a more holistic perspective on the design of new technologies, and ***future-oriented design*** – taking a look at what is desirable in a long term when considering the design of new technologies.

Next, we provide four project examples from interaction and transition design courses.

4.1 Partnering with children's museum and environmental agents

Since the first opportunity to participate in the course, the *c*hildren's *m*useum became a repeat partner. The collaboration started with students creating fun and playful interactive experiences for children. Over time, design projects engaged with more serious, complex issues, exploring current and relevant social and environmental challenges such as environmental noise pollution, sustainable behaviors, loss of biodiversity, or climate change. The best projects were also featured at the museum's family events, CityKids. Figure 1 shows two such projects: Noise, the project from 2017, exploring urban soundscapes and focusing on noise pollution (1a), and the interactive installation Eco-Agents from 2016 (1b).

Figure 1   1a) CityKids installation Urban Noise featuring a collaborative exploration of noise pollution 1b) Students setting up Eco-Agents installation to explore children's sustainable behaviors.

Eco-Agents project featured an extended collaboration that included a children's environmental agency. Students also co-authored a publication (Culén et al., 2016) discussing the installation. Both project teams aimed to impact broader audiences, bringing attention to environmental challenges, and engaging children and their families in discussions on environmental sustainability at the level appropriate for children's age. As a result, the children's museum integrated such students' designs and prototyping as a part of its events and general strategy to renew museum's offerings.

4.2 Partnering with a research consortium

The example shown in Figure 2a) from 2017 addressed mental health issues among youth. The project team designed a chatbot for Facebook Messenger to reach a wide range of youth who could easily access help in that way. The implications of using Facebook were considered in depth because of Facebook's privacy policies and negative perceptions concerning the commodification of personal information. However, the opportunity to get immediate help on a platform that young people use extensively took precedence.

The Chatbot was designed in collaboration with the research project, a consortium consisting of two universities, a research hospital, and an independent research organization. The project was challenging both ethically and in terms of Chatbot design, which students had never done before. Nevertheless, the consortium valued their input to the research project. Students saw their ability to learn and understand innovation and the responsibility as designers to be of significant value.

4.3 Partnering with a startup

The project in Figure 2b), also from 2017, aimed to connect children and imprisoned mothers. It was done in collaboration with a quickly growing startup company, delivering products mitigating isolation among members of different social groups on the international market.

The project's aim was seen as the design for social good, which motivated the student team. Although the collaborating prison was highly interested in real-life testing of the working research product, this was not done due to security reasons. However, the learning through the project was valuable for all involved actors. The startup benefited from explorations, while students experienced barriers to work around and the importance of regulatory work. The regulatory work usually does not cover new technologies, which might impact those producing such technologies and their intended users. Such issues were new for students. The regulatory work usually does not cover new technologies, which might impact those producing the technologies and targeted user groups. Such issues were new for students.
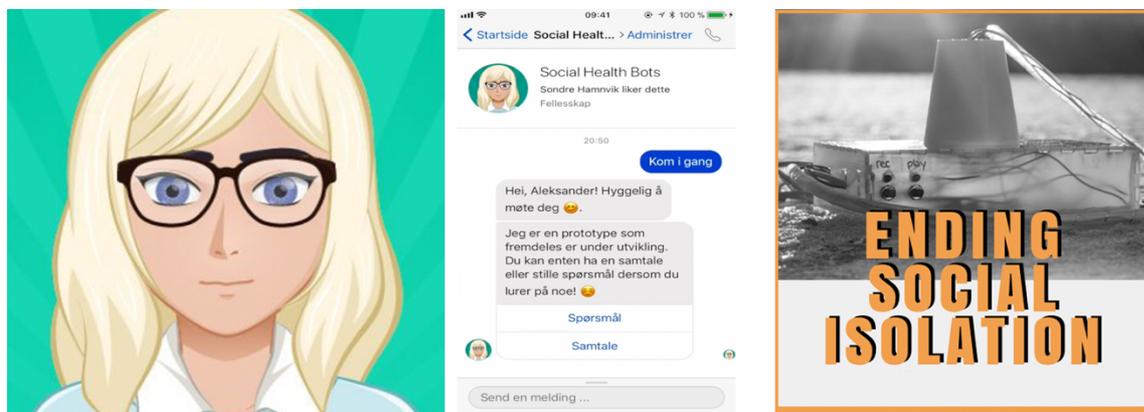

Figure 2 a) Chatbot Avatar and the opening conversation, respectively, b) Ending Social Isolation project designed a device that connects children and their mothers serving prison time.

4.4 Partnering with a maker space

The project Élan from the 2021 run of the course in transition design, focused on how to make maker spaces more sustainable. Students have done multiple explorations in collaboration with a maker space, ending with a service that connects the maker space with diverse local opportunities for projects based on recycled materials and sources of inspiration, Figure 3. They have been guided in their work by the transition design framework (Irwin, 2018), and envisioned a network of actors in a local community that might support maker spaces to run sustainably.
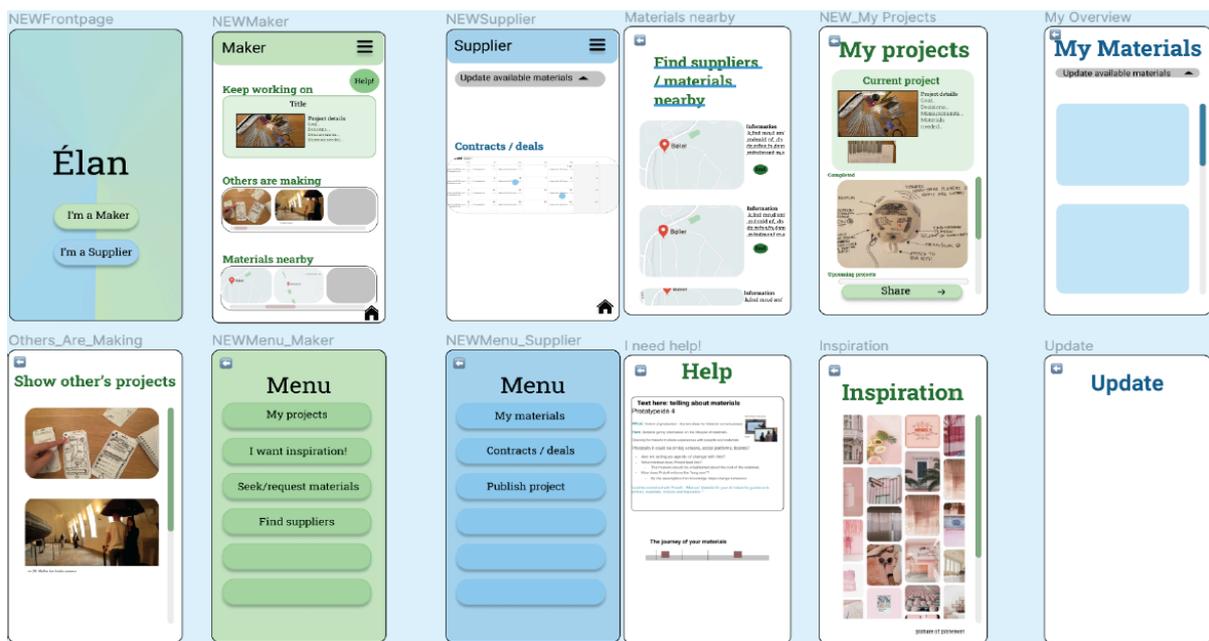

Figure 3   In Élan project, using transition design framework and local cosmopolitanism (Manzini, 2015), students aimed to connect the maker space with suppliers and sites of inspiration.

The above projects illustrate the range of design approaches utilized: service design, chatbot design, tangible design, sustainable design, and transition design. As discussed earlier, the projects focused on values and concepts related to sustainable and responsible innovation.

5. Discussion: Responsible Interaction Design Education

We organize our discussion into two subsections. The first one addresses the importance of responsible education, and the second one offers a way to work with existing courses in interaction, transition, and similar areas of design toward the integration of responsible education principles.

5.1 The growing importance of responsible education

Given the growing complexity of current global challenges that we briefly discussed in the introduction, shrinking resources, political and social instability, it is becoming obvious that a different kind of education is needed, including design in general and design of digital things

in particular, to prepare students to respond to these and forthcoming challenges. In addition, a mindset reset is necessary. It is time to move from reductionism and solutionism toward more systemic views and focus on finding the right problems to solve and ways of doing it, preferably through collaborative efforts also in educational settings.

When we started teaching, much of the work on values and social and environmental responsibility was not yet well-articulated or broadly discussed within interaction design. Thus, ongoingly and actively, we sought studies that might help introduce better tools, methods, frameworks, and theories for students. Equally significantly, focusing on such activities helped us understand the principles of responsible education in areas relevant to our research and teaching practices. We were first inspired by the work of Iversen et al. (2010) on cultivating value in design, then Stilgoe et al. (2013) and von Schomberg (2013) on responsible research and innovation. The last years of teaching were inspired by the transition design work (Escobar, 2018; Irwin, 2015; Irwin at al., 2020) that helped broaden our perspective to include non-dualist, sustainable, long-term, future-oriented, and decolonizing thinking. Today, we align with Escobar's (2018) opinion that there is "the need to imbue design education with the tools for ontological reflection in ways that make designers conscious of their own situatedness in the ecologies for which they design" (p. 132) and aspire to communicate such standpoints to our students.

The ontological way of thinking is in strong contrast to the relation students had to projects when we first started teaching interaction design – then, students thought that the sooner they landed on an idea, the better. This attitude narrowed the space for reflections, deliberations, and responsiveness in design processes (Stilgoe et al., 2013). Such behavior was observed through our participatory observations of selected projects and was perceived as the dominant attitude toward project work. Currently, we aim to inform our students of alternative ways to think about design and designing, discussing the ontological turn, holism, and everyday lives as the basis for their design practice. A growing interest in responsible interaction and transition design education, e.g., (Bates et al., 2018), is helping our efforts to increase awareness and interest in this direction among students. At the same time, examining the design literature, there seems to be much room to discuss responsible design and design education (Lettis et al., 2018; Meyer & Norman, 2020), indicating that work like ours might be timely.

5.2 Transitioning courses to include principles of responsible education

From the start of our ongoing course re-design process, we aimed to provide motivation, primarily through the focus on the project's purpose, teamwork, engagement, diversity, materials, processes, and environments that enable compelling learning experiences and deepen the understanding of the responsibility for the future (Stilgoe et al., 2013).

We described our work as research through design (Fallman, 2008; Fallman & Stolterman, 2010, Gaver, 2012), where the research inquiry focused on understanding values and responsibility in education from a perspective of partnership with organizations and learning

based on real-life projects. The research activity areas consisted of design practice, exploration, and studies centered on ongoing, iterative re-design of interaction and, later, transition design course. A part of this work might have been described as a proto-practice design (Shove et al., 2012), but the RtD framing helped us focus on the inquiry (how to integrate principles of responsible innovation) better.

The course re-design practice consisted of conceptualizing and carrying concrete interventions into teaching practices to make improvements while allowing for the integration of values and focus on responsibility. We decided on interventions after considering data collected from partners and students and actively exploring alternatives. The data usually pointed to challenges that students or partners experienced. For example, communication skills presented an ongoing challenge that needed to be addressed. As part of re-design explorations, we sought alternative ways to improve students' communication skills. Better skills, in turn, improve value co-creation through dialogue and deliberations concerning the project (Krippendorff, 2005). Selecting an alternative to mitigate communication challenges was then translated into a concrete learning activity, e.g., teaching students to pitch an idea better. We also implemented a competition for the best project presentation in front of an audience and a jury. Exploring more radically different ways to foster communication and engagement, we tried organizing seminars for participating partners and students after the course was over and students no longer felt pressure to perform well.

Similarly, each educational element discussed in Section 4 offered opportunities to explore support for learning on the one hand and integrating responsible education principles on the other hand. Like seminars for participating partners and students, other interventions were tried after the course was over to extend the learning opportunities, such as installation work or publishing articles.

Through their project work, students learned to problematize socio-cultural contexts and technological solutions that enable certain behaviors, like the Chatbot's design example and Facebook messenger as an enabler. They also learned that technological solutions aiming to solve problems might have limitations and negative impacts. They discovered ecologies where only individual artefacts were seen previously. They learned to recognize and consider wicked problems. They experienced applying the knowledge gained through the course to real-life problems. Some students experienced that their knowledge and skills amounted to an actual change. Some of them reported, through interviews and questionnaires, that the opportunity to initiate actual, real-life changes was the most rewarding aspect of the course. In the transition design course, the students were required to explicitly reflect on their mindset and posture as designers. They reported that this experience was perceived as quite valuable. It made a difference in their work and understanding of transition design better.

Although students were the primary actors benefiting from research and real-life project-based teaching, analysis of data collected from participating organizations shows that part-

nerships were perceived as beneficial, sometimes in unexpected ways. Prior to the collaboration with the interaction design course, the primary motivation for participating organizations was to explore, with students' help, novel ideas or the ideas that they had but could not explore due to time or resource constraints. After experiencing the collaboration, the organizations brought up the importance of students' creativity and the value of their processes and activities, not only design outcomes. Many organizations became repeat participants, highlighting that experimental and conceptual explorations done through projects generated significant value to the organization. Design outcomes were found to be interesting, either as usable products or as experiences. Furthermore, opportunities for growing the network were significant and led to new research and design collaborations. These findings indicate that the space for partnerships exists and can be further developed.

We have attempted to integrate the values associated with both social responsibilities and sustainability into our academic activities. However, these efforts were mainly realized by selecting partners and projects that might represent those values well. Still, it was a step in the right direction for the interaction design course. In the transition design course, values and designers' posture and mindset are explicitly taught as part of the framework (Irwin, 2018), requiring introspection and reflection, thus, tapping into internal motivation better. Furthermore, closer collaborations focusing on local environments and the ideas related to local cosmopolitanism (Manzini, 2015) utilized in, for example, Élan, could also trigger stronger motivation and deeper engagement with the project.

Furthermore, we recognized that the interaction design course could improve the methods to explore and envision alternatives. The students were encouraged to use design fiction, speculative and critical design, and future scenarios. Transition design, however, offers a broader range of methods addressing visioning for the future. Thus, responsible interaction design might benefit from integrating some of these to consider alternatives and outcomes with positive social and environmental impact.

Finally, we point out that responsible education in design, including interaction design, cannot have only focus on learning. While learning remains the primary goal, education should be collaborative, reflexive, future-oriented, ontological, and an active force to take us to a safer and more just space for humanity (Raworth, 2012).

6. Concluding remarks

Responsible education in design-related disciplines includes understanding values and design approaches that focus on social and environmental challenges across diverse design contexts, such as design for governance, transitions, or re-futuring. Moreover, learning – and finding – appropriate methods to tackle problems, construct frameworks, facilitate the work in cross-sectorial partnerships, and produce learning environments conducive to dialogical engagement are essential to prepare students for the increasing complexity of real-life challenges.

Research through design offers a viable option for design researchers and educators to study, understand, and iteratively incorporate principles of responsible education in courses like interaction design. As illustrated in this paper, elucidating educational elements opens up alternatives. A closer examination of these alternatives involves much reflection and thought related to becoming a responsible educator, understanding responsible education, and appreciating value co-creation. The findings presented in this paper point toward both opportunities and challenges with implementing responsible interaction and transition design education.

7. References

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