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## Education as a transforming practice

### *designing together for complex, sustainable living*

Caroline Hummels and Pierre Lévy

Our current education systems do not adequately support students to learn how to deal with complex challenges and to create together alternative practices aimed at sustainable futures. We have developed a design approach and repository for transforming practices (TP) in order to engage with the world in co-response-able ways. During the past 20 years, we have explored and transformed educational practices to enable situated, self-directed and lifelong learning. In this paper we explain our journey of transforming our education systems and how the 5 principles of TP have been guiding this process, i.e., complexity, situatedness, aesthetics, co-response-ability and co-development. We illustrate with examples from our own educational practices how TP can help transforming current education systems into corresponding lifelong learning practices that support designers and participants in designing for alternative complex, sustainable futures.

Keywords: designing for transforming practices; self-directed lifelong learning, complexity; situatedness, co-response-ability

## Introduction

The first author recently saw a movie *The Man Who Knew Infinity* (2015) about the genius Indian mathematician Srinivasa Ramanujan (1887-1920). Despite it being a beautiful movie, it is painful to see that such a genius was thwarted by the existing education systems and the dominant views of doing proper education and research during almost his entire life. It was thanks to specific persons like professor Hardy, who enabled him to come to work/study?? England, that Ramanujan finally got recognition for his exceptional work in the field of mathematics, although he is still quite unknown in the Western world given his brilliant talent.

We are now over a century later. Have we managed to change rigid education systems that crush students who do not fit in? Do our current education systems support individual students to learn, grow and get the best out of themselves? Ken Robinson states that this is clearly not the case. Our education systems are still modelled on principles of industrialism, as if school were factory lines with ringing bells, separate facilities and subjects, and batches of students divided by age (Robinson and Aronica, 2016). Not only is it likely, that geniuses like Ramanujan will be crushed in our current education systems, but many students will not fit in, as rapper and spoken word artist Prince Ea (2016) also indicates in his clip *I sued the school system*.

Apart from the tension that individuals experience when their values clash with those of the education system, one might also wonder whether the current system suits our (future) necessities. Are our education systems adequate to prepare students for unknown futures, up to at least 40 years from now, when they will still be working? Do current education systems support us learning to deal with complex challenges and create roads to sustainable futures? Here too, we feel tension and see major value and paradigmatic conflicts. Most education systems seem to fit better with the classical-scientific view based on reductionism, determinism, objectivity and predictability developed by, for example, Newton, than with “new” scientific views based on relativity, self-organization, complexity, and non-reversibility developed by, for example, Einstein, Bohr and Prigogine (Doll, 1986). This seems strange, especially since many researchers and institutes stress the necessity of building upon the latter scientific view, i.e., embracing principles like complexity and self-organisation, to deal with our major societal challenges. This relates to both developing resilient complex systems to handle shocks and disruptions like global warming or Covid-19 (e.g., Barabasi et al., 2013; Vermeer, 2014; Mühlenbein & Rutsch, 2020), as well developing complex education systems that learn students and institutes to become competent with complex thinking and doing (Doll, 1986; Fleener, 2005; Rayner et al., 2010; Jacobson et al., 2019).



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We postulate that a transformation of concrete educational practices is needed to anticipate future paradigms -by which we mean shared beliefs, values, models and exemplars (Kuhn, 1970) - that fit new scientific directions and are able to address complex societal challenges. Over the past 20 years, we have been exploring and developing together with colleagues and students such alternative practices for education, that focus on, e.g., self-organisation and complexity. We have been focusing on higher and professional education but regard our work and principles valuable and applicable for all levels and forms of learning. We have captured our approach and principles under the heading Transforming Practice (TP), based on 5 principles: complexity, situatedness, aesthetics, co-response-ability and co-development, which we will elucidate in the second part of this paper.

Our work, which is part of the Systemic Change group at ID, TU/e, is highly related to the theme of this conference 'Playing with tensions - embracing new complexity, collaboration and contexts in systemic design'. We are exploring new ways to transform practices fitting alternative paradigms using similar principles as targeted by this conference. Additionally, tension forms a main part of TP, through the concept of dialogic – i.e., seeking duality in unity, where things are both complementary and antagonistic, which Morin (2008) coins as one of the three dimensions to deal with complexity. Moreover, our search for alternative paradigms evokes tension with existing paradigms that are based on different shared beliefs, as explained more in detail in our other publications (Hummels, 2021). For example, our continuous development of competency-centred learning ecosystems facilitating situated, self-directed and life-long learning is at odds with traditional learning approaches. We experienced that our radically different philosophical and pedagogical take is difficult to sustain in a landscape of schools with predominantly classical educational approaches, focusing more on end terms than on the process of learning, developing, and growing of learners in relation to the peers and surrounding.

In this paper, we'll first explain our journey of transforming in the educational landscape and the conditions that made it work. In the second part of the paper, we'll explain the five resulting principles of our Transforming Practices "approach" (Hummels, 2021), illustrated with examples from our recent educational activities. This way we aim to support the discussion on learning with systemic designers and educational transformation.

## Transforming our ways of learning – 2001-2011

Since the first author's student days, she has been fascinated by education. This feeling was fuelled by experiencing two radically different education systems, despite both being focused on product design: 1) the department 3D Design at the Arnhem School of Arts (where she studied between 1985-1987) focused on making, experimenting, discussing and finding one's own strengths, and 2) the Faculty of Industrial Design Engineering at the Delft University of Technology (where she studied between 1987-1993) focused on gaining extensive knowledge and skills through various courses and subsequently applying this in design projects. Both forms of education have their advantages and disadvantages, and the combination of the two turned out to be particularly valuable and influential for her future career. Especially because she was able to apply and refine the self-directed learning approach that she had mastered at the School of the Arts, at the TU Delft and beyond. It made her a strong advocate of self-directed and lifelong learning.

Next to her various experiments with self-directed and lifelong learning, when the first author was assistant professor at the Faculty of Industrial Design Engineering at the TU Delft (Hummels et al., 2003), her first major active contribution to this form of education took place between 2008-2011, when the first author became Director of Education at the department of Industrial Design (ID) at the Eindhoven University of Technology (TU/e). The department had a unique competency-centred learning approach as of its start in 2000. Her aspiration was to develop it further by creating a full-fledged, hologrammatic education system, where the values, principles and character of the whole system was present in every detail and vice versa. At the end of her term in 2011, ID had competency-centred, self-directed and life-long learning in the blood of its organisation. It encouraged and supported staff to take a learning-centred instead of a teacher-centred approach, and facilitated students learning to learn (what, how and why). This was concretised by having students writing their personal development plan (PDP) every semester and creating their own unique tailor-made curriculum based on their PDP. Students selected their courses and projects based on their individual learning needs and in accordance with the ID competency framework. During and at the end of each learning activity, students reflected on their activities and received written feedback on processes and results from relevant staff members. There were no exams and no grades, apart from the final bachelor or master exam (also without grades). Throughout their study, students developed and maintained a portfolio to show and substantiate their growth as a designer. In combination with an exhibition and an interview with the assessor and coach, they received at the end of each



that are embracing complexity, situatedness, aesthetics, co-response-ability and co-development (Hummels, 2021). We focus on the scale of practices, by which we mean temporary, relatively steady ways of living and working with others (Wittgenstein, 1993) in which human activities are intertwined with material arrangements - in particular people, artefacts, organisms and nature -, and which are informed by roughly defined aspirations, certain “rules” and specific ethics and values (Schatzki, 2010). We focus on practices since that offers designers a way to address both (preferred) values and the bigger scope of living and society, as well as the concreteness of the creation and appropriation of particular designed artifacts. We aim at transforming existing and developing new alternative practices by designing iteratively with stakeholders and beneficiaries new material arrangements and related activities to discuss, reflect on and transform the underlying aspirations, “rules”, ethics and values of a practice. And we are doing this in practices related to, e.g., energy transition, healthcare, new forms of financing, organisational change, the Netherlands in 2050, and of course education. We focus both on education for students at higher education, e.g., through our BOOST! project (the TU/e Education Innovation programme), as well as at professionals, e.g., European policy makers (ITHACA Policy Learning project). Moreover, we have projects like the Comenius Senior Fellowship of the first author, that focus on the learning eco-systems as a whole and the connections between various education systems. Comenius and BOOST! especially explored how to prepare design students for unknown futures and support them and us to learn to deal with complex challenges and design propositions that aim at enhancing sustainable living.

In the remaining part of this paper, we will show through examples of our work, how we concretised these alternative educational practices to support designing for transformation and addressing societal challenges. We will explain the five underlying principles of TP and simultaneously illustrate education projects and results elucidating these principles. After explaining and illustrating each principle, we will indicate the tensions we have experienced. Let us start with the first principle: complexity.

## Complexity

### Principles

To engage in self-organising, open complex systems, we use Morin’s three main dimensions (Morin, 2008):

- **dialogic:** seeks duality in unity, where things are both complementary and antagonistic. This means that TP does not strive for compromises and uniformity, but focuses on plurality and differences between learners, roles, methods etc.
- **organizational recursion:** a phenomenon is both producer and product, both cause and effect, in a continuous self-organising and self-producing cycle. This means that universities constitute students and students constitute universities, as well as that education systems are a product of society and simultaneously a means to constitute and steer society. TP also stresses that teachers support students to learn and by doing so, they also learn themselves through these activities.
- **hologrammatic principle:** the information of the whole is in every part, and every part is in the whole. This means that TP is going beyond reductionism (focusing on parts) as well as holism (focusing on the whole). For education this implies that even the smallest detail of an activity or instrument embodies the gist of the overall educational system, and vice versa. The student is the educational system, and the education system is also the student.

### Example from education

Let us elucidate complexity with the project *Probing Emerging Futures*. In this joint project between Philips Experience Design, Frank Kolkman Studio, Design Academy Eindhoven and Eindhoven University of Technology (2018 – 2019), we explored through design various potential future paradigms in the realm of healthcare: a post-biological society glorifying intelligence, a super-human society with the ideal of immortality, a steady-state no-growth society for all, or an eco-centric society where people live in harmony with nature. By designing and discussing prototypes for these different futures, we were able to research values and socio-cultural processes in society.



Fig. 2.: Probing Emerging Futures project exhibited at the Dutch Design Week in 2018 (left; photos by Juuke Schoorl) and in 2019 (right; photo by Philips Experience Design)

During this education project, a dialogic was pursued between different institutes, between researchers from different disciplines, between different students (within and between different institutes) and different paradigms. Moreover, the resulting prototypes for the 4 potential futures were presented at the Dutch Design Week (DDW) in 2018 and in 2019, thus stimulating dialogic debates with the broader audience. And a dialogic debate amongst professionals (from academia, industry and governance) was facilitated during the DRIVE festival at the DDW'18. Education in this project was approached from the perspective of a large learning community, with a variety of people, roles and disciplines, making use of a diverse set of activities, as well as multiple media, methods and tools to collaborate, co-create, communicate and to share insights.

## Tension

Organising education at the cross-section of multiple institutes in collaboration with society is at points challenging. It causes tension, since curricula generally do not match, time schedules differ, motivations and aspired outcome can differ, software platform often don't allow joint access, and organising joint working spaces require effort and flexibility of the participants.

## Situatedness

### Principles

At the beginning of the 20th century, new philosophical practices overturned the Cartesian Western worldview and refuted the subject-object and mind-body dichotomies. Phenomenology departed from "*être au monde*" or "*being in the world*" (Merleau-Ponty, 1962), meaning that we perceive the world from our own point of view, our 1st person perspective (Trotto et al., 2011). We are situated beings, with our brain, body and environment fully intertwined, and dynamically enacting world without mental representation of our goals (Gallagher, 2017). We cope skilfully in the world from day to day, in an embodied and unreflective way, solicited by the situation at hand (Dreyfus, 1996).

For TP this means that we start from having attention for embodied intersubjective practices (Gallagher, 2017) and participatory sensemaking (De Jaegher and Di Paolo, 2007), stressing the importance of situated working and learning together with a variety of people, as the Probing Emerging Futures project also showed. It also means we are incorporating a 1st person perspective (Trotto et al., 2011) since people cannot avoid their own point of view, thereby refuting objectivism, while stimulating dialogic interaction to maintain a plurality of perspectives. We embrace self-directed, lifelong learning in a community setting. Finally, we are working from the concept of affordances, which are skill-dependent, relevant possibilities for action situated in the context of a form of life, i.e., a specific practice (Smith et al., 2021). That is to say, we are developing specific materials arrangements and activities to support situated learning.

### Example from education

In our situated learning environment, we facilitate individual and community learning in relevant, meaningful environments for the participating students, researchers and external stakeholders, as well as for a broader public of citizens and interested parties. We do this for example, by jointly constructing all design projects with the participants, incorporating their individual aspirations and boundaries. Moreover, the context of learning is continuously tailored to the activities and ambitions. For example, we rented and furnished the Designhuis as a learning hub situated in the city centre of Eindhoven for several years. With its many spaces and our props, the

Designhuis afforded intensified collaboration between students, citizens and external partners through gatherings, workshops and exhibitions. Additionally, we organise various learning activities that stimulate exchange of different perspectives. For example, our Friday assemblies are open arenas for exploring and discussing topics brought forward and organised by one or more students or staff members. The last year, Covid forced us to drastically review our situated learning environment to accommodate the different individual needs, including wellbeing and counterbalancing social isolation. Hence, we explored various new media, tools and activities, e.g., Miro boards, hybrid spaces and bots that provokes coincidental online encounters.



Fig. 3. Designhuis acted as a 'blank canvas' to create different spaces fitting various activities for a broad audience in the city centre (left and middle). Friday assemblies are open arenas for voluntary learning (right)

## Tension

Organising situated learning can create tension with administrative, financial and support systems of schools and universities. Learning in the city, in unusual places, or in joint pop-up spaces does not fit in with most organisations (organisation and financial models assume usage of existing educational spaces and equipment), nor does learning outside office hours (e.g., hard to get access to buildings) or learning with external stakeholders (e.g., no access to learning platforms). Nowadays hybrid teaching, shows again the necessity of flexible, appropriate situated infrastructures, which do often not align with the standard education settings.

## Aesthetics

### Principles

Coming from a situated perspective, we consider aesthetics not to be an inherent property of the design itself, but sense of beauty that arises when appropriating the design. It can be gratifying for our senses, for our intellectual capacities, for a sense of social belonging and many other things. Aesthetics can refer to small concrete details, to large complex systems, to abstract concepts, etcetera. We believe that creating beautiful education in all its facets and manifestations is an important part of transforming educational practices, including e.g. its organisation.

To elicit aesthetics, we use the concept '*landscapes of affordances*' posed by recent movements in ecological and enactive philosophy, i.e., an ecological niche in the bigger scope of socio-cultural practices, in which possibilities for action are offered to people through our designs, which stand out as relevant for people in that specific situation (Bruineberg and Rietveld, 2014). Within TP, we strive for an aesthetics of material arrangements that can stimulate appropriation in several ways: to enable people to make sense of complex situations (Gaver et al., 2003), to spark people's imagination, and to subtly opening them up to the yet unimaginable (Overbeeke, 2007), thus nurturing the development of alternative practices and paradigms.

### Example from education

We continuously develop and experiment with a blended learning environment, where the procedures, platforms, projects, learning materials, methods, tools spaces, exhibitions etc. are developed to support designing for transforming practices. Our learning environment aims at evoking a sense of beauty, while enabling all learners (students, researchers and external stakeholders) to make sense of and play with complex matters. For example, we designed and offer physical banners and personal websites for leaving traces as well as organising activities to

stimulate joint reflection. We developed a large variety of embodied tools that can easily be transported to facilitate also situated workshop with external partners. Moreover, we researched together with the students the concept of an exhibition from a transforming practices perspective, resulting in hosted events with personal guides, offering a variety of routes and giving different entries to explore the designs, the theoretical concepts, the approaches and topics.



Fig. 4. Traces of the design process are positioned in the space as well as online (left 1-2). Collective mappings are made physically and online to reflect on the overall complexity of a topic (left 3-4). A variety of suitcases with embodied tools were developed to support situated workshops, e.g., for external stakeholders (right 5-6).

## Tension

Giving attention to aesthetics causes tension, e.g., when being at odds with the amount of work and deadlines, although our self-directed exhibitions showed that all parties involved considered them very rewarding. But most tension is experienced due to the lack of organisational aesthetics, for example, administrative procedures and software, learning management systems like Canvas, and learning equipment, are designed primarily for functionality and efficiency, and not for interacting with each other in beautiful ways. We are strong advocates of investigating how an entire education system with all its procedures can be experienced as beautiful.

## Co-response-ability

### Principles

As indicated above, situatedness implies an inextricable relation between beings and their environment. (Jonas (1985) calls on people to take responsibility for our environment, to take care of other beings and not to endanger human existence on/and earth. Jonas indicates that we should especially look at the potential problems caused by our technological progress, which might have far-reaching or even irreversible consequences when we may not even foresee. Haraway (2016) also urges us to be aware of this tight interweaving between multispecies and their environment, by encouraging sympoiesis - making together- and stressing our ability to respond to each other, which Haraway captured in the term response-ability. As responsive beings, also responsibility for each other and the environment falls to us (Ingold, 2016). We use the term co-response-ability to emphasize that people have both personally and as a community an ethical responsibility. TP embrace Jonas's, Haraway's and Ingold's stance to take responsibility and pursue a sustainable world.

We argue that design can create material arrangements and activities supporting co-response-ability and constituting alternative practices fitting paradigms that respect our environment. Moreover, co-response-ability demands a particular attitude and repertoire of actions. Sennett (2008, 2012) describes various of those elements, including commitment, trusting others and oneself, working with uncertainties and resistance, learning through failure, experimenting, being curious and empathic. Part of our TP is making the various participants familiar and comfortable with this attitude and way of working, which can be quite uncomfortable at first for most of them.

### Example from education

We explore with external stakeholders possible, probable, plausible and possible futures (Hancock, T. and Bezold, C., 1994) in relation to areas such as energy (with Enpuls, ZET and Province of North Brabant), healthcare (with Philips Experience Design), cities (with Eindhoven and Umeå), the Netherlands (with WUR and Rijkswaterstaat). By imagining futures, be it 1, 10, 30 or even 100 years ahead, and connecting them to the here and now through storytelling and prototyping, students, citizens, researchers and external stakeholders reflect on current practices

in relation to preferred values and paradigms. We develop dedicated methods and workshops to support TP-oriented speculation. Moreover, we support students and lifelong learners to develop new attitudes and skills, like trusting others, working with ambiguity and reflecting on their own responsibility towards the world.



Fig. 5. We develop speculative stories and toolkits (left; photo Tom Djajadiningrat, DesignDrone) and prototypes such as these seaweed shoes (middle; design and photo Jing-cai Liu) to facilitate imagining the Netherlands in 2050, in collaboration with Rijkswaterstaat (Smith et al., 2021). We train new skills, e.g. drawing mutual portraits using each other's hands acts as an icebreaker to trust others (right).

## Tension

We experience the most tension between all participants in taking co-response-ability, towards differences in ambitions and goals, the timeframe for change and impact, freedom for thinking out of the box, support for learning, and finally budget and time for experimenting. Transforming practices, systemic change and realising alternative paradigms is a matter of the long haul. It requires partnerships and communities that trust each other and find unity in duality to make a difference together our societal challenges. It requires nurturing of joint efforts and people willing to take to lead in facilitating joint initiatives and learning.

## co-development

### Principles

The last TP principle relates to the slow process of transforming concrete practices and bringing new emerging paradigms to fruition, including alternative educational practices to fruition. We discern four types of activities: learning, co-creating, appropriating and researching.

Moving toward alternative paradigms is per definition an unknown and challenging quest for everyone, which requires lifelong learning in dynamic situated learning settings. TP invites people to engage in an experience without judgment, and respond to surprises through reflection, thus learning from their actions (Dewey, 1916, Schön, 1983) with the possibility to transform their practices. We stimulate corresponding between a variety of learners (Ingold, 2016).

TP co-creates new material arrangements with a variety of stakeholders (Sanders & Stappers, 2008), navigating complexity and exploring and building alternative futures. Through visualizing and prototyping, TP makes ideas, dreams and potential futures from 1 to 100 years ahead, imaginable, experienceable and discussable in relation to current practices and past learnings experiences. In this way, we are collectively open ourselves to transforming practices.

Since the new designs are unknown to future users, we focus also on the appropriation of these designs, i.e., the way people make sense of them in relation to their understanding of the world, while using them in their daily practices (Kudina, 2019; which can be different than the intentions and ambitions of the designers. This requires experienceable prototypes to enable people to appropriate the designs which might help them to transform.

Finally, TP is using the act of researching through design in a multi-stakeholder setting, with attention to richness, nuances and situatedness, to generate knowledge (Zimmerman et al., 2007), to support the emergence of alternative practices and paradigms. We support transdisciplinary knowledge development on transformation

in its broadest sense, including philosophy, anthropology, design, technology, economy, governance, business, education, and many more disciplines.

## Example from education

The above-mentioned examples for the other 4 principles are all examples of co-development, some focusing slightly more on learning through reflection (see aesthetics), some more on co-creating (see aesthetics and co-response-ability), some more on appropriation (see situatedness and co-response-ability) and some more on researching through design (see complexity and co-response-ability). In general, all four activities are intertwined and incorporated in our processes towards transforming practices.

## Tension

The previous mentioned tensions for the other four principles, generally also surface during co-development. We do spot an additional tension that relates to the discipline of design itself. Developing TP as a transdisciplinary approach with a strong emphasis on design, can cause tension between the different disciplines; the ways of working, language, practices, values etc. do not always align. Moreover, being a discipline that is heavily interwoven with other disciplines, it is at times difficult to pinpoint and communicate the value of design and the proposed attitude and skills.

## Wrap up

In this paper we aimed at sharing our quest of transforming educational practices based on alternative paradigms. We elucidated our educational journey and illustrated five underlying principles - complexity, situatedness, aesthetics, co-response-ability and co-development – that drive our endeavours to transform our educational practices. As can be expected in the setting of complexity and situatedness, our work to address societal challenges and move towards alternative paradigm is never finished. Nevertheless, we hope that our experiences and insights support the endeavours of broader community of system thinking and design, in realising alternative complex, sustainable futures.

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