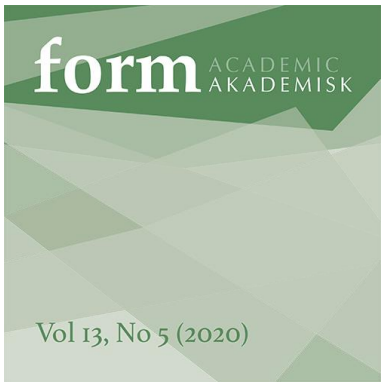

https://doi.org/10.7577/formakademisk.3755

Marie Davidová
MArch, Ph.D.
Welsh School of Architecture, Cardiff University
DavidovaM@cardiff.ac.uk

Multicentred Systemic Design Pedagogy Through Real-Life Empathy

Integral and Inclusive Practice-Based Education in the Research-by-Design Context

ABSTRACT
This article reflects on my integral design studio teaching and inclusiveness in its design processes. This is exemplified in two different systemic design case studies focusing on social and environmental justice via the lens of empathy. The design studio and/or design practice tend to be fused in this article because my design studios have always focused on practice-based, real-life built projects, while my commercial and not-for-profit practices have always implemented design education in real-life built projects through internships and/or other student participation. Therefore, my approach fully follows the pathway of 'learning by doing'(Dewey, 1997)*, focusing on systemic feedback looping of integral real-life experience and reflection through research and practice, targeting brighter post-Anthropocene futures.*

Keywords:
empathy; codesign; systemic design education; systemic design methodology; post-Anthropocene.

INTRODUCTION

The discussed work targets inclusivity in design and education through codesigning with a variety of expert and nonexpert stakeholders, integrating various age and social groups in cross-species focussed research by design. In the context of this work, the word *community* is not exclusive to humans. Rather, the social includes other species (Latour, 2005). Such an approach is critical for developing ecological literacy through design education, which, I agree with Boehnert, is a basis for responsible practice across design disciplines. This goal remains a significant challenge in design education. Ecological and sustainability literacy cannot be developed in a token 'green week' fashion; rather, they must emerge in a non-reductionist manner through full integration in educational design programmes (Boehnert, 2015).

According to Sanders and Stappers (2014, p. 33),

> Over the past 30 years, almost every aspect of doing design has changed. We still seem to be in the middle of a transition to greater entanglement and complexity, but with greater involvement of people and, hopefully, more value contributed by the design capabilities of many. We can anticipate these uncertainties with hope or fear. But if we can use design thinking, making, and enacting to visualize and explore the future together, then we will be able to harness our collective creativity to serve our collective dreams.

The work discussed here explores empathy praxeology as a systemic design codesigning methodology. It looks at feedback loops among a mix of individual and collective relating and making with a view to generating understanding and enacting that targets multicentred synergy. As opposed to 'top down' 'care', in this article, empathy is understood as an equity-synergising process. Bloom (2017) criticises empathy for not being 'objective' or 'ethical'. However, his discussion covers only peer-to-peer relationships, and it does not consider multicentred possibilities of such networked interactions. Nelson (2004) suggests three primary stages of design communication as the basis for the development of a model of design communication; these are as follows: conversation: trust and contracting; dialogue: common meaning, common understanding; and diathenic graphologue: uncommon meaning, uncommon understanding. The process of moving from one stage to the next is episodic and not simply linear. Conversation sets the stage for dialogue, and dialogue prepares the ground for diathenic graphologue. He continues that this can become an iterative sequence, repeating the full cycles as desired. However, for him, iteration is stopped and implementation initiated at the point that any new insight appears to be an adequate response to the client's original design question—'What is desirable?' (Nelson, 2004). In the work discussed here, these feedback looping processes never stop. They are codesigned and redesigned in real time in a 'real-life codesign laboratory' (Davidová et al., 2018). This approach is exemplified in two design studio cases—LoopPavilion and the Synergetic Landscapes unit. It is a critical aspect of these studios that the location, community and environment are real-time approachable, and that are not placed in remote destinations. This enables a real-life codesign laboratory with its codesigns and redesigns in real time.

Background

In my work, codesign has been performed mainly around urban or other landscape built permanent or long-term interventions or other relevant practice prototypes. The built prototypes cover lifecycles, material sustainability and ethics investigations, codesign processes with concern for environmental and social justice, observations and reflections on real-life prototypes, and often, their redesign or other adaptations. Through testing the prototypes in real-life in their real environment, one receives the most relevant evidence-based input within a feedback looping learning process. This is done through codesigning with the real-life environment. In my work, I call this a 'real-life codesign laboratory' that, as opposed to the traditional reductionist laboratory, addresses the complexity of real life (Davidová et al., 2018).

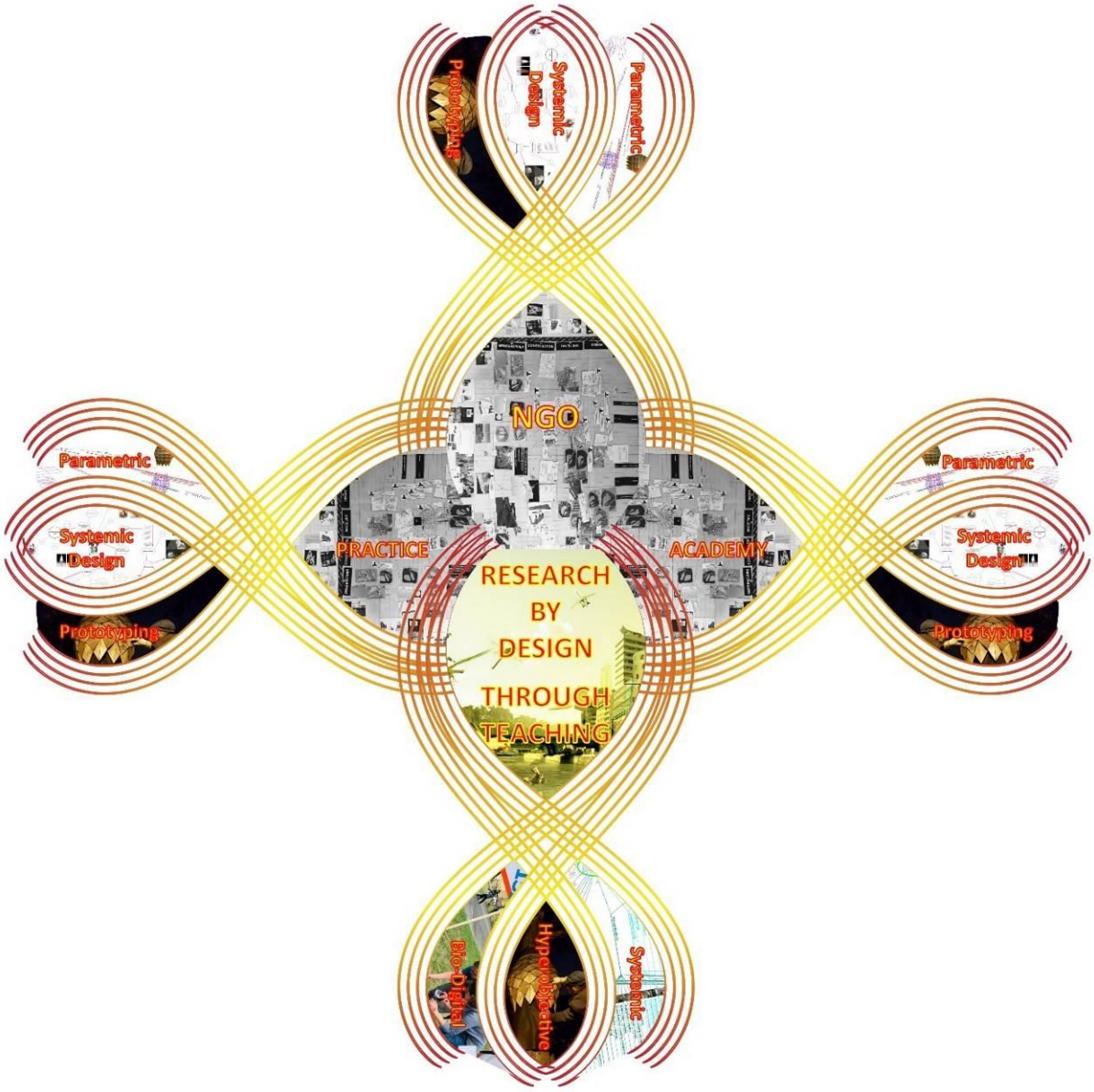

FIGURE 1: Fusing the project leadership of design team and processes across academy, nongovernmental organisation (NGO) and commercial practice into one 'research by design' (Davidová, 2019).

My teaching career began in 2005, as a master student and student assistant in information technology (IT), when I independently designed a Rhino3D software course at the Oslo School of Architecture and Design, Norway. This experience was critical for me because I learned that it is not so beneficial to share all possible knowledge at one time, but rather, to be responsive to students' needs. An experienced scholar develops skills step by step, dialogically uncovering knowledge over time through simple, responsive operations while dealing with complex systems. Soon after my graduation and first architect practice experiences, I joined architectural design studio teams as a full-time university lecturer, teaching at an undergraduate level at the Norwegian University of Science and Technology, Norway. My new lesson at that time, which applied specifically to design studio teaching, was that it is more important to ask and listen than to offer direct guidance. In other words, one offers guidance by listening, analysing and asking the questions. The same dialogical interaction may be applied to design. My first design studio teaching experience in a team provided me with a direction that I had also experienced at the Oslo School of Architecture and Design. This related to the scholarship practice of integrating one's teaching, practice and research as a 'research by design' developed through experi-

mental design studio teaching. However, in my work, this has been a rather literal synergy, without a boundary between either agency. Such an approach addresses Till's (2008) call for synergising academy and practice research through architectural processes, products and performance. This is performed through experimental teaching that develops empathy through real-life design research and practice. Sanders and Stappers (2014) point out that some students choose to focus their education on design and learn the skills and frameworks of hybrid designer/design researchers. They can choose whether to focus on a practical or academic route in contemporary education approaches (Sanders & Stappers, 2014). I would add that there is an approach to research by design that can be delivered through academy, in for- or not-for-profit practice or through all or any of those at once (see Figure 1). A similar approach has been developed by the New York–based studio Terreform One, which is also oriented towards social and environmental systems prototyping (Joachim & Aiolova, 2019). It is increasingly clear to me that, to realise projects with empathic agency, one cannot rely purely on one form of institution. Thus, I have been applying the synergy of teaching, practice and research grounded in research by design through teaching in multiple directions.

After starting our collaborative professional practice [Collaborative Collective] in 2011 in Prague, Czechia, with my colleague Krištof Hanzlík, who had just graduated from the Bartlett School of Architecture, and its sister nongovernmental organisation (NGO) in 2012—adding one more colleague, Martin Gaberle, educated at Czech Technical University in Prague—we have accepted many interns both from our country and international students coming under the Erasmus+ programme. These students have been under my direct leader- and mentorship. In the internships, students experience a variety of tangible experimental practice applications with a real effect on the built environment and related social systems, observing and dealing with their consequences. By taking an internship, they have also gained access to information and mentorship on how to start similar experimental (either for- or not-for-profit) practice in their future. Feedback from the interns confirmed that they had not previously had the opportunity explore such experience and gain such skills through their education. This is an issue I also aim to address through my university teaching.

Reflecting on Teaching and Practice

My design studio teaching has developed in a similar manner to my practice. Thanks to the experience described above, I gained many opportunities to engage in both design studio and workshops leadership, as well as playing a role of a scientific consultant within various experimental studios and workshops teams. The design studios that I designed and led, often in collaboration with other colleagues with various expertise, have always been developed as real-life projects with prototypes built and realised onsite (Davidová & Sevaldson, 2016a). This also implies that I have usually had to secure all funding for such studios. The studios have mainly been developed through an integration of transdisciplinary academy, NGOs and practice to make such 'research by design' projects happen (Davidová & Sevaldson, 2016b). Therefore, the students develop skills on how to make experimental projects happen in real life and in real practice. The purpose of arming students with tools is not to develop their physical muscles but their commercial ones—the kind of muscles that will enable them to risk success and profit from failure to prosper in adversity and make architecture an innovative rather than reactive profession (Harriss, 2014). A nice example is an experimental practice called 'Parametr Studio' (Šmejkal, 2019b), where a former student claims that such studio experience enabled him to start his professional practice in line with his personal interests and agendas, realising that 'everything is possible' (Šmejkal, 2019a).

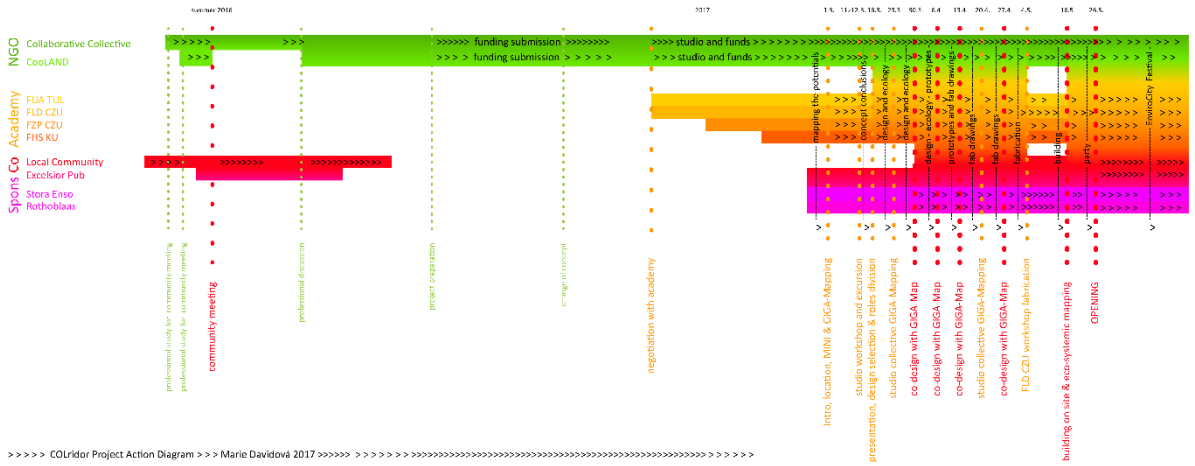

FIGURE 2: Action diagram showing individual and collective processes across multiple actors of the COLridor project (Davidová, 2017).

Studios that I have designed and led have typically been formed across various academic institutions by a transdisciplinary team, for example, of architectural, environmental design, wood engineering and ecology students. With such a team of students and types of projects, the involvement of teams of tutors with various expertise, and later, local communities, has been necessary. Crossing from senior to fully junior experts, as well as the public and other stakeholders, which have often lacked teaching and/or practical experience, managing such teams has required good skills in mentor- and leadership and an intuitive 'way of knowing' whether it is wise to take a risk. Such intuitive tacit expertise, which can be purely developed by 'reflective practice' and often asks for 'thinking in action', has been discussed by Schön (1983), specifically in relation to architectural education. Among the challenges in working collaboratively with a diverse group of stakeholders and participants (including professionals and nonprofessionals) is that risks do not have the same significance or impact for all—for some, the success of a project represents extremely high stakes, while for others, failure is acceptable. The expectations, roles, investments and degrees of involvement differ. Therefore, empathy across the team members plays a critical role in the project's success. Nelson (2004) characterises leadership as a process of achieving alignment through conversation and conspiracy that leads to shared vision. This has to be handled through well-developed design leadership where all participants have a common understanding and empathy related to what the project means to whom. They need to collaboratively cocreate and agree on an action diagram (see Figure 2) and their responsibilities in the project prior to its start, and they should not be excluded from its processes. However, as discussed in the case studies below, it is not always possible to avoid weak points, which are seen as a way of learning. For such situations, shared creativity in immediate improvisation, adaptation and redesign is a necessary skillset of every design team and its members.

Systemic Design in Design Education

Mulder points out that, today, we face extremely complex challenges. The same complexity must be considered in handling our design processes, which have to relate multiple parameters and stakeholders. Contemporary city making asks us to go beyond disciplines, leveraging spatial, technical and social disciplines through a transdisciplinary approach, anticipating the unpredictable and rapidly changing futures and dealing with societal challenges (Mulder, 2015). This can be generated through collective cocreating of artefacts (Mulder, 2018). To develop such real-life codesigned artefacts across the disciplines and related stakeholders requires tools to deal with complexity. Within systemic design discipline, it is suggested that such complexity, addressing real practice in design education, is well dealt with through 'gigamapping' (Blaasvær & Sevaldson, 2019; Davidová, 2014; Sevaldson, 2013; Wettre & Sevaldson, 2017). Gigamapping is a visual complexity diagramming codesign tool used in systems-oriented design across academy and practice (Sevaldson, 2018a). It focusses on both the relations

between items and parameters, as well as on the items and parameters proper. Gigamapping is a good tool to handle relating soft and hard data (Sevaldson, 2015), which may even be on the level of tacit or subconscious knowledge (Davidová, 2016). It accommodates dialogues, 'diathenic graphologue' (Nelson, 2004), and in this case, tangible objects conversations codesign processes. Such a methodological approach opens for receiving and responding to feedback in intuitive, though complex, ways.

Being playful, visual, tangible and unrigorous, gigamapping is a great tool for breaking various language, cultural, professional, social status or agenda and target barriers, as well as stimulating collective creativity and synergy among the participants through empathy, the teaching staff included (see Figure 14). I can confirm Sevaldson's (2018a) statement that a critical part of gigamapping involves empathy, ethics and the representation of experts talking on behalf of those who otherwise would not be heard; for instance, a dendrologist talks on behalf of the trees (Davidová & Zímová, 2018). This is because design may also contribute to normative and meta-ethical questions (Sweeting, 2018). Ethics and empathy should play critical roles in design education because they closely relate to both social and environmental justice. Unfortunately, their integration into design studios and other design education is often neglected (Jacobs & Utting, 2019).

My work attempts to integrate the above into teaching and practising research by design at the undergraduate, graduate and postgraduate teaching and research levels. My students' ages range from 17 to 70 years old. Empathy and ethical concerns are evident in students of all the mentioned levels across the age range. However, the skills of interpretation and implementation for in-depth, serious research by design practice are often lacking. They need to be trained through research by codesign with real-life application, followed by observations and/or even redesign. Gigamapping has been a successful tool for starting such processes.

CASE STUDIES

The two case studies below discuss how similar scholarship can be applied to undergraduate, graduate and postgraduate teaching design studio levels, which is less common in other places than it is in Scandinavia. One of the more striking Scandinavian examples has been a series of 'Scarcity and Creativity Studios', in which the explicit intention is enabling students to learn from integrated design, research and hands-on building activities (Hensel & Hermansen Cordua, 2015). However, while integrating social and environmental justice, such examples typically do not cover empathic reflective observations, interactions and redesigns after the interventions are realised. In my work, these evidence-based dialogical processes are critical learning outcomes for the students, as well as for me, where they are also the method for evaluating the effectiveness of my teaching. Therefore, the case studies also focus on this part.

Like all studios I have led, they have their sites directly in the units' locations to enable collective leadership. The cases differ in time and the opportunities given by different programmes and/or institutional structures in different cultures and regions. The first design studio case, 'Loop', is a studio that was transdisciplinary across two universities and was fully vertical across the undergraduate and graduate levels. It was held by a transdisciplinary team that I have been leading, educating students of architecture, environmental design and wood engineering of the Technical University of Liberec and the Czech University of Life Sciences in Prague, Czechia. The second case, 'Synergetic Landscapes', is a master of arts in architectural design (MAAD) unit of the postgraduate teaching programme at the Cardiff University, UK. The unit consists of architectural or architecture-related bachelor or graduate school graduates, typically with rich practical experience. The unit's teaching could not be team based because the institution is very individualistically oriented. However, I built a team of cross-disciplinary collaborators that voluntarily pop in and out to different studio events. Both projects were enabled through collaborations with NGOs, giving them the background for not-for-profit practice realisations. The two examples were both developed with the awareness that architecture is a collaborative practice that can have a critical influence on the lives of both people and other species. Therefore, my design studio teaching focusses on developing students' collaborative and inclusive skills in and through empathic codesign and reflective interactions.

Loop: The Environmental Summer Pavilion II Studio

The research by design process-based Environmental Summer Pavilion II studio, which resulted in a responsive wood pavilion called Loop, was fully designed and led by me in collaboration with Šimon Prokop (responsible for parametric design and digital fabrication) and Martin Kloda (responsible for structural design and making). This transdisciplinary studio was independent and directly accountable to the dean of the Faculty of Art and Architecture at the Technical University of Liberec. The project was fully integrated into and outsourced from my doctoral work in responsive solid wood research by design, in which the hygroscopicity of wood was used for bettering urban heat island micro-climates in the city centre of Prague (Davidová & Prokop, 2016).

The idea of real-life studios focussed on building pavilions is not new. There had been a long tradition of design studio build pavilions at the AA School of Architecture, London, UK (Self & Walker, 2010). However, those pavilions were mainly purely oriented towards making, not towards research by design proper. The research by design pavilions built by ICD at the University of Stuttgart, in contrast, have been focussed on exhibiting the research by design, not integrating any social or other systems or experiments (Davidová, 2017b). Therefore, I consider my approach innovative within the scope of design education.

The Collaborative and the Collective through Systems Oriented Design

The Environmental Summer Pavilion II studio was driven through a 'systems oriented design' (Sevaldson, 2013) methodology, addressing the complexity of real life. This makes such a pavilion design studio unique. The project required collaboration across experts with mixed teaching and practical experience across three universities (Czech Technical University in Prague, Technical University of Liberec and Czech University of Life Sciences in Prague), a governmental organisation (Institute of Planning and Development Prague), two NGOs (Collaborative Collective and Jaroslav Frágner Gallery), two private practices (Collaborative Collective and Archwerk) and many sponsors. We handled this through one collective gigamap that served as a discussion board. The team worked through the gigamapping interaction and relating secures such that, although every team member or invited expert had a clear responsibility, every team member was learning and gaining skills and understanding about the other types of expertise and their issues. This relates to training of empathy, which is not only about understanding but also enactment through collective design.

The areas of responsibility within the team were as follows: a) overall design, b) collective gigamap design and management, c) panelling, d) structural design and detailing, e) parametric design, f) site analysis and application and g) visualisations and blog. The learning outcome of the student at the end of the course was that each became an in-depth expert in the field(s) they selected; moreover, each student learned the collective understanding and synergy of the other expertise fields across the team and invited experts through integrating the knowledge into a holistic project. What is more, the students learned to relate their interest to others in one collaborative project. Therefore, they also gained synergetic skills for an inclusive design. The students were evaluated based on their group responsibility and ability to collaborate with others. This is because the cocreation of a common understanding of the context is essential to grasp the surrounding complexity and create a breakthrough design (Wettre & Sevaldson, 2017). The common understanding of the context is enacted, developed and tested in time. As opposed to the traditional approach in design studios, which leads the work from group to individual and from analysis to design, this studio implements the approach from individual to collective and from the design speculation to research. Later, this occurs in feedback loops. This means that the students are first asked to develop their minimap of their individual design speculation in relation to their research-by-design interests, with a view to mapping their own universe (see Figure 3). These universes are afterwards related across the team, which is driven through empathy. Then, with multiple perspectives in mind, they are individually developed again. These processes occurs in feedback loops, relating to designing, analysing and reflecting, thereby targeting multicentred holistic design. If done the other way around, it is very difficult to define the research questions and implement everyone's knowledge and interests. Without the feedback loops in such processes, designers struggle to develop their design from the analysis because they do not have the fully developed research questions at the

start when analysing and they cannot go back and update the research to address the local specific multiple-perspective design updates. The individual research questions in this work are modified throughout the process to contribute to the direction in which the team as a whole decides to move the joint project at each of the team meetings.

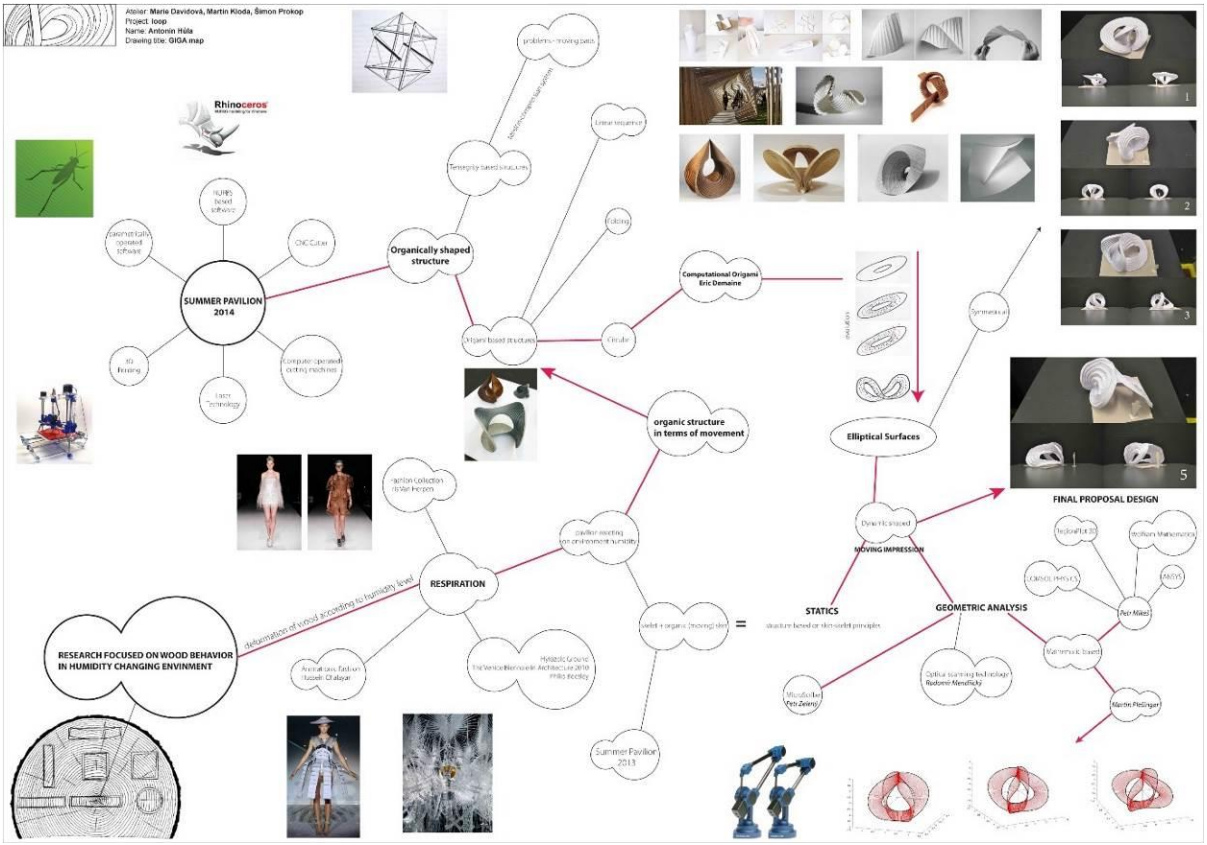

FIGURE 3: Minimap of the leading pavilion design proposal (Hůla, 2013; reproduced with permission of the author. All rights reserved).

The individual minimaps, as opposed to the gigamap used by the whole group, do not have to cover over 300 items (Sevaldson) and their complex relations; rather, they consider up to 50 items that relate to each other. However, the individual minimaps can serve as a basis of the collective gigamap. Therefore, they serve as a 'kick-off' for the design process (Davidová, 2014). In this studio, one leading proposal of the pavilion design was selected for further development. However, many items and parameters were taken from all the other minimaps, which meant relating their individual universes to the universes of the others in the collective gigamap. Individual items and parameters were all integrated in the collective gigamap made of individual printouts (see Figure 4 and 5). This was organised as a timeline following the lineages of responsibilities within the team. These were decided after the selection of the leading pavilion design proposal when starting the collective gigamap. The responsibilities for the research and design developments were cross-related and reflected at collective meetings within the gigamap's timeline. This was done to find synergetic solutions in relation to the given timeframe. Therefore, the process in this model was always oscillating between individual and collective, both phases that require adaptation and/or redesign. This is because there is an individual in-depth investigation into a certain problematique that appears with a certain design proposal. Then comes the phase when this individual investigation is cross-related with the other in-depth investigations. Therefore, the original investigation often needs to be adapted and/or redesigned. Next comes the phase when the requested adaptations and/or redesigns need to be individually investigated again, etc. The learning outcomes coming from this process are critical to today's designers. We must be able

to both investigate in depth and relate to—and codesign with—the other related experts and stakeholders in a search for synergy that moves the project forward. The above has to occur within the given timeframes of the project, although this can be open-ended.

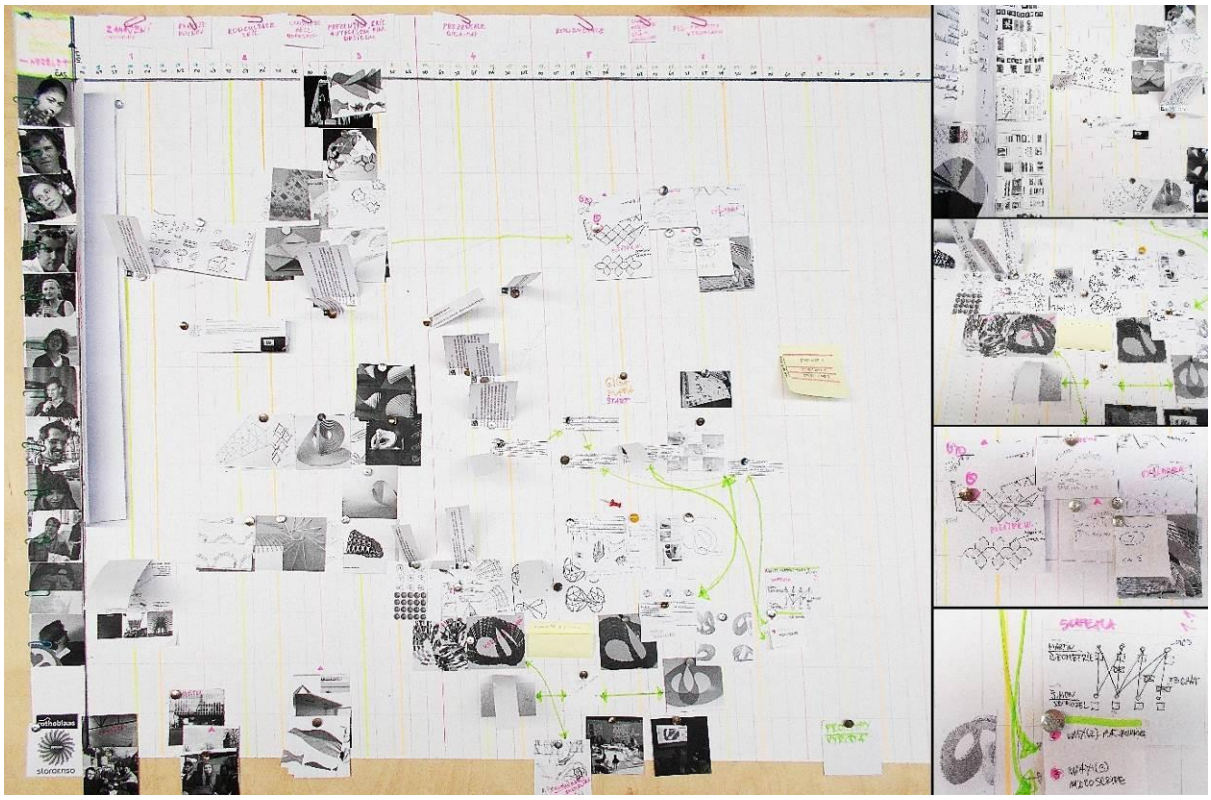

FIGURE 4: Work in progress processes within Loop's gigamapping (photo and responsibility: Pokorný, 2013–2014; Reproduced with permission of the author. All rights reserved).

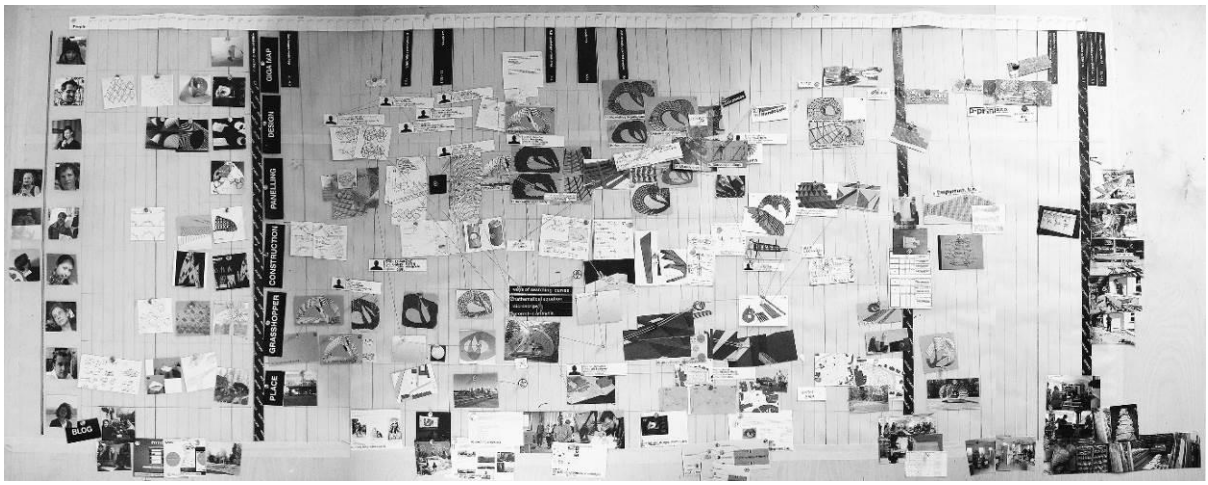

FIGURE 5: Loop process gigamap before the project's finalisation (photo and responsibility: Pokorný, 2014; reproduced with permission of the author. All rights reserved).

The Collaborative and the Collective Through Prototyping

In the prototyping part, the collaborative partnership with wood engineers was critical. We received excellent support from the related scientists and their equipment, for instance, the testing machines for joinery or material strength testing. Reflecting scholarship, the architectural and environmental

design students were better skilled in project management, drawing coordination and building planning, while the wood engineering students were much more skilled in hands-on digital and analogue prototyping in the wood and computer numerical control (CNC) fabrication workshop (Davidová & Sevaldson, 2016a). Through working together, employing empathy via understanding and enactment, they each learned the skills from each other while mastering their predisposition (see Figure 6). Therefore, the architectural and environmental design students built the intuitive knowledge of how things are really made at full scale. The wood engineering students developed better intuitive knowledge of the intriguing design and management complexity of the design disciplines. It was critical that all disciplines' students were present for all research experiments.

FIGURE 6: Erecting of the Loop pavilion at site 1 (photo: Davidová, 2014).

An important part of this project was collaboration with sponsors. Next to the financial support, we received a lot of material and work-related support. For instance, for the material, it was crucial to be in perfect coordination in the design phase. The student responsible for the structure and detailing was in direct collaboration with the joinery producer and consulted on the wood quality with the wood supplier. The students responsible for the grasshopper parametric model were in direct coordination with the wood supplier and the provider of the work on Hundegger Speed Cut CNC. The prototyping required significant coordination because the pavilion was assembled at the Faculty of Forestry and Wood Engineering in Prague, whereas the joinery was shipped from Italy, the wood was from the Czech mountains, some tools were borrowed from a sponsor from Liberec and the Hundegger work was produced in Moravia. The 5 x 5 x 5 m^3 pavilion was moved to the Institute of Planning and Development Prague in five parts, which was its first location. The transport of the material, CNC cut assemblies and pavilion was also arranged by different separate sponsors. This required precise coordination across both the team and the sponsors. The situation was especially tricky because the sponsorships were free;

therefore, it would not have been possible to reclaim any delays. However, thanks to the empathic atmosphere, where everyone wished for the project's success, if there was a delay on one side, support arose from another.

Collaborative projects can also cover harsher weaknesses in collaborations. We experienced serious troubles when one of the teaching team members became unresponsive and the project started to struggle with structural design development, which was his responsibility. Dealing with the complexity of the proposed design, of course, the pavilion cannot stand without serious structural design, and it was a lesson learned that such a problem could not be neglected and weak leading team members had to be replaced immediately. As we were unaware of how low was this work developed by the individual analysis by the colleague, we had to redesign the pavilion when it was already built, and the weaknesses had been shown. I consider this a highly positive lesson to our students. Such situations often occur in practice, and the educational systems can hardly relate to this if they do not address life projects.

Dealing with failures and colleague dropouts and replacement with more advanced and professional experts is a typical process in design practice. However, it is important to remain strong as a project leader and support the team, as team members tend to give up altogether when such situations occur. In this situation, I invited the structural engineer Dr Jan Zatloukal from the Faculty of Civil Engineering at the Czech Technical University in Prague, Czechia, who resolved all structural errors in the given timeframe, and the pavilion was rebuilt again. However, it was a big lesson learned for the students that the teaching staff can also fail. It is a natural part of daily architectural practice to deal with such issues, and students should learn such skills and test their dedication through collaborative projects.

The Collaborative and the Collective Through Cocreation

The pavilion was a central stage of the EnviroCity Festival (Davidová & Pánková, 2019), and it was specifically developed for this purpose. Its main organiser was [practice 1], of which I am a chair. The festival had two parts, with two sites, and the parts were run separately in collaboration with the Institute of Planning and Development Prague and the Landscape Festival organised by Jaroslav Frágner Gallery. This also required moving and building the 5 x 5 x 5 m^3 pavilion again at two locations, and it was necessary to secure students' availability over summer for doing that. The students also frequently volunteered at the festival, and they had to disassemble and upcycle the material of the pavilion in the autumn. Thanks to the strong involvement of the students, this was not a problem.

The EnviroCity Festival was a multigenre event curated by me and a culturologist, Michaela Pánková, where invited performers were asked to develop their performance/lecture/city game/other production in response to the research by design on sustainable cities and responsive wood (later ratified as the Systemic Approach to Architectural Performance design field), for which the pavilion was the prototype (see Figure 7). When there were no events, the pavilion was widely used by locals, either for eating lunch or for games. Its performance of bettering the climate also involved inviting other species, such as dogs or birds, which do not have many opportunities to sit and rest (see Figure 8). Such observations and their reflections became critical for both my future research by design through teaching development and the students, who could reflect on their real built work in seeing it performed. Among the other performance aspects, this showed that it is not only people who inhabit cities. Animal species have been increasingly adapting to life in cities in recent times as agricultural land has become poisoned (von der Lippe & Kowarik, 2008). A truly inclusive design has to include more types of citizens, which can be other than humans. There will always be synergies and conflicts among these citizens. However, this still occurs if one reduces the target group purely to humans. It is not possible to prioritise one group in a real-life environment because it needs to be shared by all. Therefore, design needs to be multicentred.

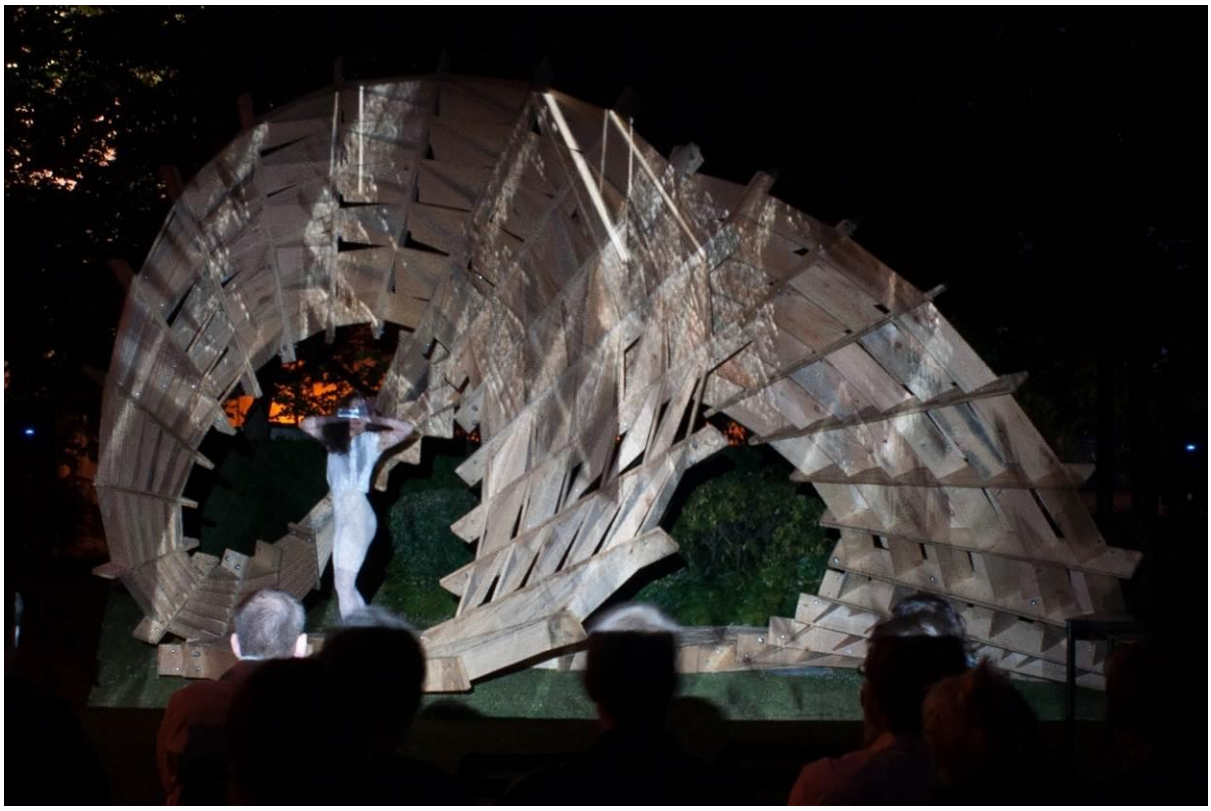

FIGURE 7: Loop pavilion EnviroCity opening; light performance: Lunchmeat; dance performance: Jana Vrána (photo: Dvořák, 2014; Reproduced with permission of the photographer. All rights reserved).

The human citizens were also included. In addition, the digital version of our gigamap was available on the site for public interaction (see Figure 9). Therefore, the performers and locals codesigned the research by their opportunistic uses, performances or comments (Davidová, 2017a). At this stage of the design process, like Mulder (2018), we not only moved from users to stakeholders but also stretched the cocreation even further by having the stakeholders aligned in a partnership, acting as co-designers. This led me into further exploration of the opportunities for codesign that appeared in further steps. The students were all present and introduced at the festival opening and the research by design presentation and discussion. They volunteered widely at the festival's events. Therefore, they experienced the richness of the variety of interactions and interpretations, and at the same time, they were interacting and reflecting and interpreting back.

The studio was in direct engagement with the pavilion's site location providers, both the Institute of Planning and Development Prague and the Landscape Festival. The position of the pavilion had to make sense both for the environment and the festival events, and it could not be in conflict with the site providers. This had to be precisely designed, although it experienced several crashes.

At the first location, the gardener was not happy with us occupying the lawn. This resulted in him watering the pavilion, which led to structural struggles with it, as one side had been watered, while the other was in direct, hot summer sunshine. This was a good lesson learned for all. Although the gardener had no decision-making rights, we should have included him in the discussion. This was a great example for both the students and the teaching staff of what can happen if the design is not inclusive. At the second location, the pavilion was not built at the precisely assigned position, and we were asked to move it immediately, which crushed some other plans. We asked all audience at the opening to lift the 800-kg pavilion and move it. This is a good example of when the interaction with the public is inclusive. Suddenly, everyone lends a hand and behaves supportively. I believe these experiences were beneficial both to us and the students. Such situations require thinking in action, as well as experiences of how togetherness is performed and how to interact with it.

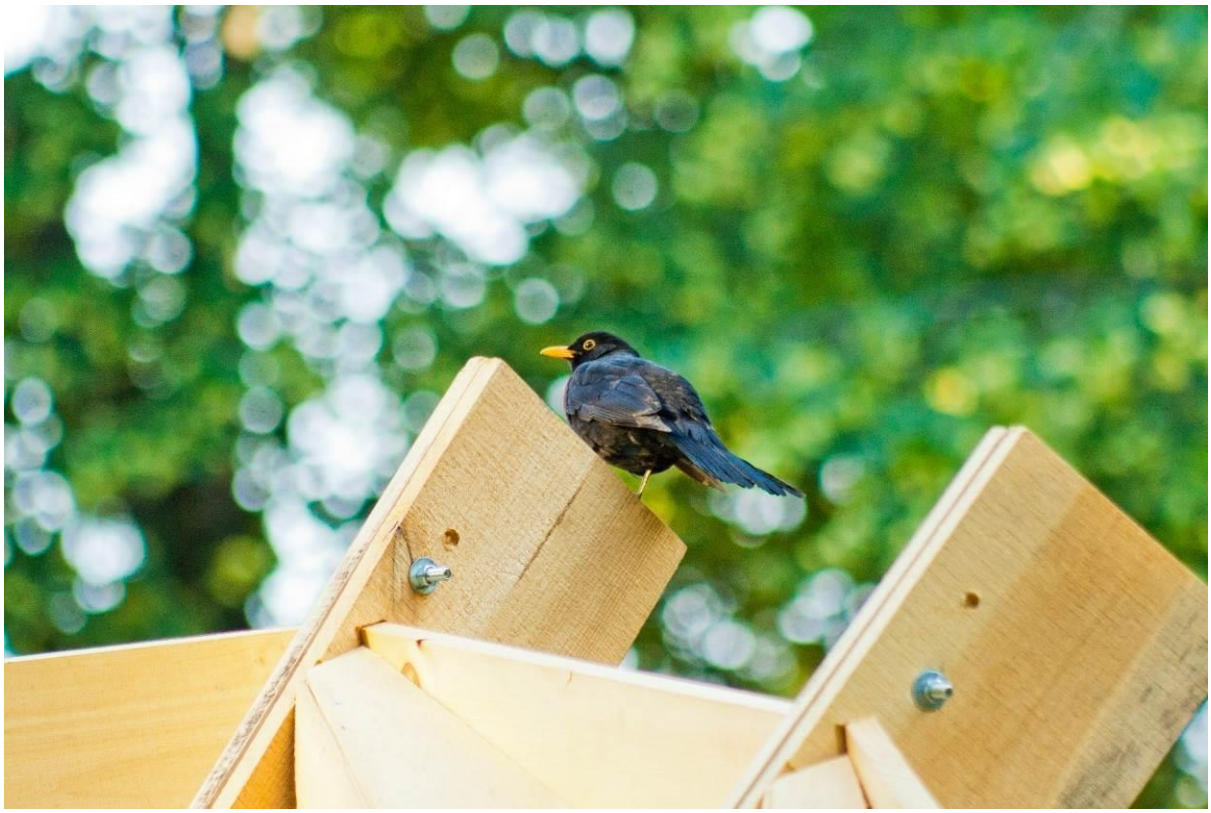

FIGURE 8: Black bird resting on the Loop pavilion (photo: Škuta, 2014; reproduced with permission of the photographer. All rights reserved).

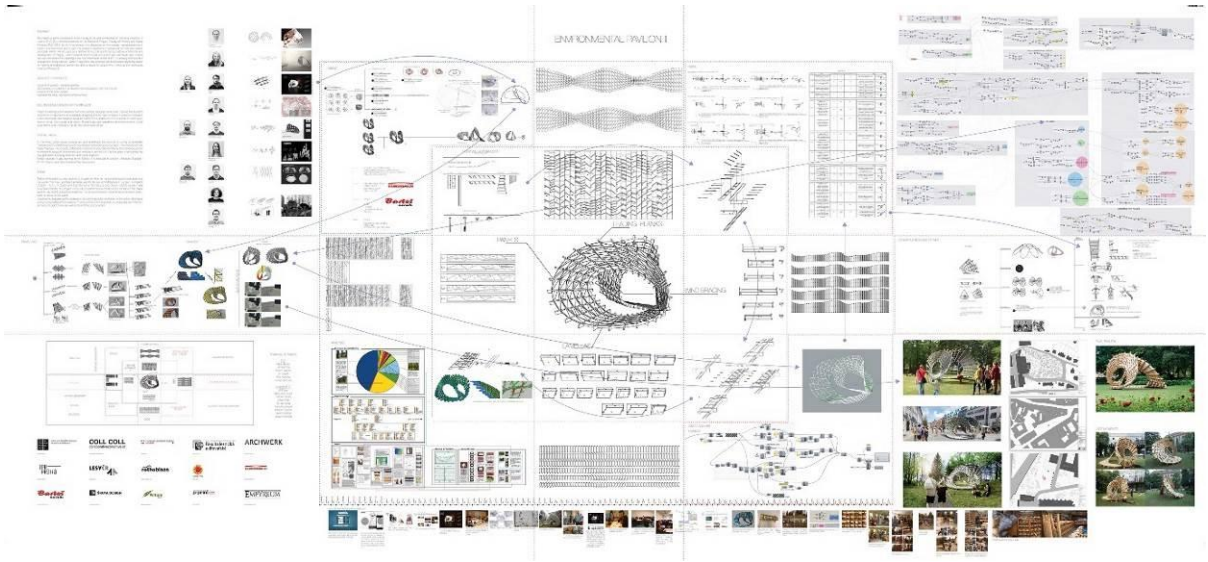

FIGURE 9: Loop Pavilion gigamap as a result of the Transdisciplinary Studio Course (administrators of the map: Hrušová & Pokorný, 2014; Reproduced with permission of the authors. All rights reserved).

Synergetic Landscapes Unit

The Synergetic Landscapes unit is a work in progress unit in the MAAD programme at the [Welsh School of Architecture, Cardiff University] that I designed. The work started in September 2019 and will be finalised in October 2020. Currently, the unit is finalising its design part and entering its thesis reflection part. It is a unit that is directly accountable to the MAAD programme director, and it has to fulfil his requirements for the programme. As opposed to the Loop case, the unit is not supported by any direct

sponsorship. This keeps it free in several circular economy and social and environmental justice-based proposals. The unit partners with the university's larger not-for-profit 'Community Gateway' project (Cardiff University, 2019), which has already been active in the area. This project is designed to empower a local deprived [Cardiff] community of Grangetown in Cardiff, Wales, UK, and it is community led. Our project is evolving directly around its central point, a newly built Grange Pavilion in Grange Gardens park, and it targets the support of biodiversity within the community. Therefore, the codesigning part plays a crucial role. This has been largely enabled through the Community Gateway's existing contacts and established social media pages.

The unit's work integrates both social and environmental systems within the community. It focusses on biodiversity support within the urban environment through prototypical urban interventions (see Figure 10). The targeted interventions are to support cross-species edible and habitable landscapes. The project should synergise circular economy with blockchain (a token system) and relate this to city's biocorridors and 'do it yourself' (DIY)interactions within the Cardiff's deprived community. This is done to raise the community-based values from the bottom up.

FIGURE 10: Hidden batbox prototype (Wang, 2020; reproduced with permission of the authors. All rights reserved).

The students of the unit have their first and the first first-person experience with community active participation in design, where they must relinquish the traditional perception of the role of an architect as an individual master who 'knows it all'. The work in the unit requires both an open mind to different and new design approaches and to the loss of the privileged self-confidence of the architect's professional arrogance that was common in the past. It also requires a loss of human arrogance in believing that architecture and the world's future creation in general should be purely targeted to people, meaning the human race. This approach to architecture is 'non-anthropocentric' (Hensel, 2013),

and the social system integrates other species (Latour, 2005). Therefore, my unit leader and personal mentor role is crucial here, and it is usually executed through humour and empathy, which keeps it lightweight and unrigorous.

The Collaborative and the Collective Through Systems Oriented Design

In contrast to the Loop case, the MAAD programme description requires individual architectural design output from each student, and the unit cannot be thought through by a team. Therefore, the students in this unit are individually designing more interrelated smaller prototypical design interventions integrated into one holistic unit project. The unit is organised as described below.

The unit is again taking the path from individual to collective work, and there is a feedback loop in such a process. The project develops through the initial individual minimap, where the students are asked to propose both their research interest within the unit team and their individual intervention proposal. The research interest becomes their individual responsibility within the team. They are asked to develop gigamaps for both their prototypical interventions and their individual selected responsibility. This all is synergised into one collective gigamap that is codesigned in the team and administered by one of the students as an individual responsibility (see Figure 11). The students will be evaluated based on this, as well as on the developed collaborative skills. The empathic systemic collaborative skills are evident in this project because each student's work has to relate to all the other students' work, and this has to be presented in all gigamaps.

The individual responsibilities within the team for the project have been decided as follows: 1) synergy and the overall collective gigamap, 2) biocorridors across the city, 3) community interaction and DIY, 4) blockchain, 5) circular economy, 6) grasshopper parametric designing and tutorials for DIY and 7) materials and prototyping. Each responsibility has to relate to the other responsibilities and the other interventions of each student. This should all appear clear in the wholistic collective gigamap relating and synergising together, as in responsibility number 1. This is again exercised and examined in weekly collective studio gigamapping workshops with invited stakeholders, as well as in codesign workshops with the local community (see Figure 13 and Figure 14). At these workshops, the individual gigamaps are cut apart, and different items are cross-related among the participants. Again, the responsibilities and interventions are advanced individually over the week. Such processes are again structured in feedback loops, which ensure that the collaborative project performs in all aspects and can set up a more complex and deep systemic intervention in an urban environment. The students are new to such systemic collaborative approaches and collaborative design, both with each other and other stakeholders. Therefore, learning collaborative skills for complex systemic design interventions while securing their individual influence will be their critical learning outcome.

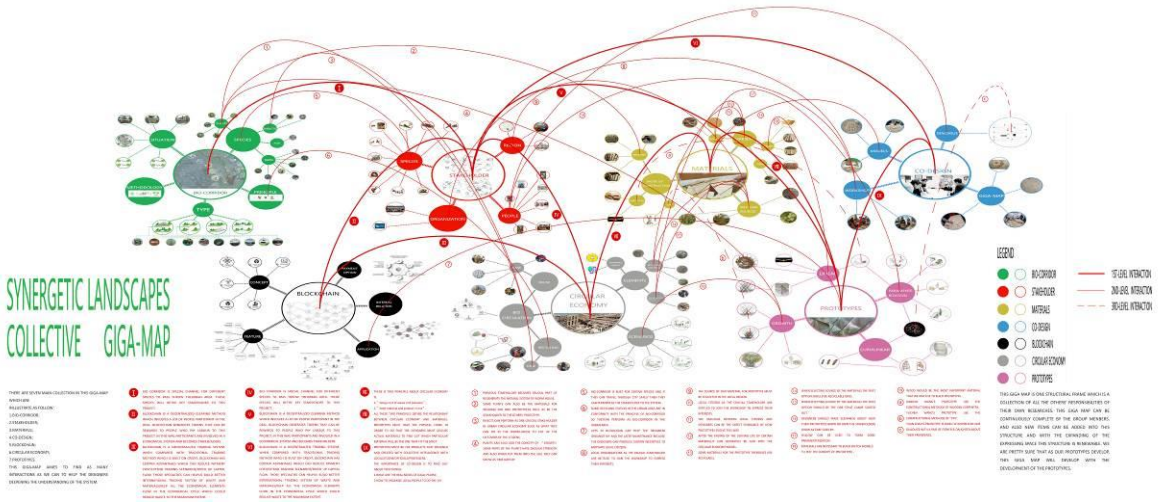

FIGURE 11: Synergising gigamap-related responsibilities within the team and interpreting each relation (Zhao, 2020; Reproduced with permission of the photographer. All rights reserved).

The Collaborative and the Collective Through Prototyping

The advantage of the one-year postgraduate programme is that the studio unit research by design directly results in students' research by design dissertations, and afterwards, journal articles or conference papers co-authored by me. Therefore, the learning outcomes are evident through such reflections. The dissertation can implement reflective observations and redesigns of the prototypical interventions and their material experimentations from the first semester. Thus, the 'real-life codesign laboratory' can be investigated in depth, enabling reflection on the real-life consequences of prototypical interventions.

FIGURE 12: Prototyping experimentations at Christmas reviews (photo: Iqbal, 2019; Reproduced with permission of the photographer. All rights reserved).

The observations also enable reflections on the use of the local materials and their techniques, applications and experimentations (see Figure 12). In this case, the students are allowed to use only natural materials they find on site or in the neighbourhood. They are encouraged to explore their local specific fabrication experimentations, such as willow and other species weaving, or straw and hay sewing (see Figure 13). This is what is often lacking in both education and practice. With the typical traditional design process, the design ends with the realisation, or in a typical architectural design studio, pin ups and review. Such typical design approaches struggle to reflect on the natural and transport resources or material and material technique performance on site, instead considering their price on the market. Such misconceptions often result in professional arrogance that does not reflect real life or real social and environmental systems. This is because such an approach struggles to reach the point of the confrontations: The designer steps away after the building is 'finalised'. This does not enable empathic reflection, codesign and redesign in response to the real-life environment. In contrast

to this professional failure, the Synergetic Landscapes unit seeks synergy through cocreation with its social, natural and cultural environment.

FIGURE 13: Gigamapping the prototypes and materials in reference to the circular economy and the socio-natural and cultural ecosystem (photo: Davidová, 2020).

The Collaborative and the Collective through Cocreation

Related experts and stakeholders are invited to the weekly workshops, codesign workshops enabled through the Community Gateway project (see Figure 14 and Figure 15) and reviews. Therefore, our frequent guests include the following individuals: Dr Dermott McMeel from Auckland University, New Zealand (online), a rethinking blockchain expert; Dr Rob Thomas, a landscape ecologist from the School of Biosciences; Kateřina Zímová from the Collaborative Collective NGO; Jazz Austin, a representative of the 'Giving Nature a Home' project from the Royal Society for the Protection of Birds; and Dr Mhairi McVicar, the lead of the Grange Pavilion Project and many others. Specifically, the interaction with the local community is new and alien to the students, who are typically used to discussing their proposals with their tutors, reviewers and sometimes, at the maximum, with each other. Given the opportunity to interact in real-life feedback loops through trial and error, they are not only developing their design, but most importantly, they are enhancing their empathic interaction, dialogical cocreation and codesigning skills. This should be a critical toolkit of future practitioners and/or researchers.

FIGURE 14: Codesign workshop with the community in the local library (photo: Davidová, 2019).

FIGURE 15: Codesign workshop with the community in a local pub (photo: Davidová, 2020).

Beyond the codesign workshop interactions, my work claims that the realisation of the intervention is the most important point when the codesign and cocreation truly starts happening. This is performed through different cocreative events, covering simple vandalism, improvements and alterations by various community members or inhabitation, for example, by algae on a wood surface or insects in the insects' hotels. The insects' hotels can then perform as fast food restaurants for bats and birds that move to the location. This means that the synergetic edible and habitable landscape is codesigned and cocreated by its environment in real life and real time. Within this unit, this will be reflected in the design thesis over summer 2020, and due to the Corona Virus crisis, it is purely performed through interactions with the community through their DIY in their front and back gardens. In this stage, the role of Community Gateway partnership with its established trust, links, contacts and social media pages is critical because it has the ability to engage the community.

The unit is asking the DIY participants to tag their prototypes with our DIY recipes (Davidová, 2020a) and upload their pictures to an interactive map that is targeting motivating the community to generate biocorridors (see Figure 16). Such interactions are supported by the designed generative community-based bottom up token system (see Figure 17). This layer interacts across the ecosystem and the social system, which requires feedback looping in a larger timespan. The topics are developed through asking such questions as the following: Can I be paid (with tokens) for reproducing the bug hotel through DIY? Can a bat buy it to own her fast food restaurant? Can a local cafe provide a cup of coffee to me for watering the community garden from which it takes tomatoes or a pollinators' garden? Can pollinators be paid for pollinating tomatoes? These questions are directly linked to the fact that, in the 21st century, rivers and others are reclaiming their legal personhood with social, cultural, economic and environmental interests. The example that has raised this discussion was the Whanganui River in New Zealand (Argyrou & Hummels, 2019). Clearly, it is the Maori people acting on behalf of the river who have raised this discussion. In the same way, an ecologist can act on behalf of the butterfly, buying a meadow for it within its flying distance. Therefore, as opposed to ecosystems services, this approach is non-anthropocentric, and I call it 'non-anthropocentric ecosystemic service design' (Davidová, 2020b). This can be observed, developed and co-re-designed before and throughout the dissertation phase of the students' work. Therefore, the students can oscillate between the role of observer and participant within the system. This is what I relate to as a third-order cybernetics (Davidová, 2019; Kenny, 2009) that is happening within the 'real-life codesign laboratory'.

Critical parts of this unit are frequent expert guided site visits in Grange Gardens, which will be followed by DIY prototype testing. For the students, discussing the local diverse social and environmental settings with experts who have an in-depth knowledge of both the human and non-human communities is supportive within this less conventional project, which requires an open mind and rich source of knowledge. Therefore, that the location is within walking distance of the school is highly beneficial to the unit.

FIGURE 16: DIY competition poster (Wang, 2020; reproduced with permission of the photographer. All rights reserved).

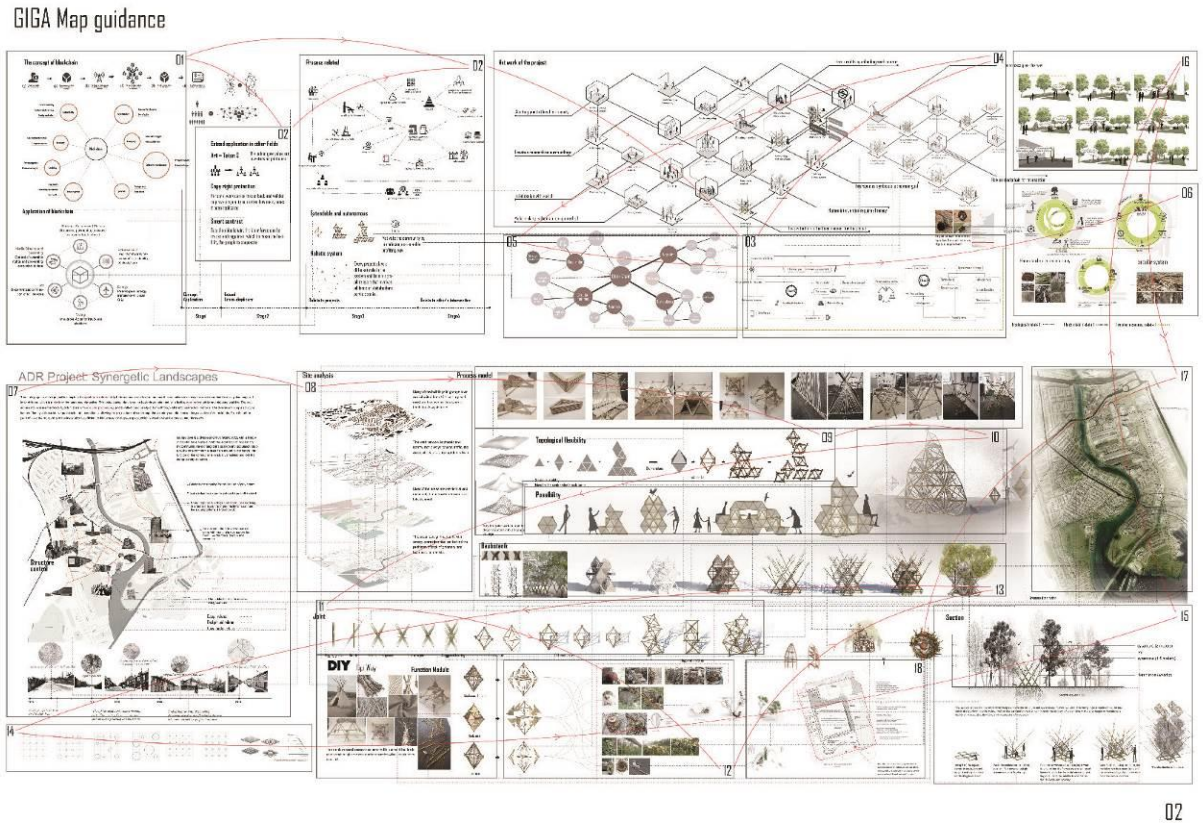

FIGURE 17: Relating the token system to the ecosystem and individual prototype (Wang, 2020; Reproduced with permission of the photographer. All rights reserved).

DISCUSSION AND CONCLUSIONS

The need to address systemic approaches to design problems and appropriate education is not new. It has been developing for at least 45 years since Nigel Cross's declaration about design methods for complex problems (Nousala et al., 2018). It seems clear that our educational institutions should not be generating another deprived employee for just another office within the society that is leading to Anthropocene Mass Extinction. Education should motivate the graduates to engage in empathic, responsive and responsible practice—whether through academic, for-profit or not-for-profit institutions. At the start of the millennium, Banathy (2001) pointed out that our current educational system was designed for the industrial machine age of the nineteenth century—an assembly line factory model. This model still seems to be requested by governmental bodies and society in general. Jacobs and Utting (2019) suggest that the studio (education) could support educational models that are an alternative to market-ready forms of self-valorisation. Rather than being a passive frame for neoliberal paradigms, such curricula could emphasise how architecture can support new social conditions, political actions, ethical frames, labour models and financial systems (Jacobs & Utting, 2019). Harris (2014) makes clear that the student's empowerment to deal with real-life problems best occurs through life projects. Norman and Stappers (2015) state that the emphasis on perfecting craftsmanship using a variety of materials no longer seems necessary, while enhancing problem-finding and observational skills and cultivating an ability to manage iterations of prototyping and testing do seem relevant. This raises the discussion on methodology. Although Bloom's (2017) critique of empathy makes sense, he is offering a purely singular perspective on how it is dealt with. Rather than marketing, empathy can be a methodology for nonlinear multicentred design, such as it is performed in systems oriented design (Sevaldson, 2018b). The proposed model of feedback loops between individual and collective strengthens the empathetic communication: One understands and communicates one's universe; one who understands that everyone has a universe that can be different or even contradictory and who re-

cognises insecurity in oneself empathically understands others. The search for synergy then starts generating the enactment through empathy. This enactment occurs within the real-life codesign laboratory and often leads to adaptation and/or redesign (see Figure 18).

FIGURE 18: Research-by-design feedback looping process for the Synergetic Landscapes unit (Davidová, 2019).

As opposed to the first case of Loop Pavilion, the Synergetic Landscapes case allows for more 'hyperobjectivity' (Morton, 2013), engaging with the larger complexity of socio-environmental systems. It is much better developed in terms of social and environmental justice and human and nonhuman participation, although it is not that spectacular in its appearance. The Synergetic Landscapes unit is also much better developed research-wise, enabling reflective observations and redesigns in the dissertation part. However, it is challenged by the demand for an individual output requirement. Nevertheless, working at the postgraduate teaching level makes a difference because the students often already have rich practical experience, although the disadvantage is that the team is less rich in disciplines. The brief is equally more demanding, more focussed on research by codesign rather than on making, as it was in the first case. This, together with the fact that each student has to generate one individual architectural prototype output, is more demanding on empathic collaborative skills from the students and coordination and leadership skills from me and the students' unit team. It often drags the students to the singular authorship approach comfort zone of their initial background. To my mind, such complexity can only be handled through systemic design methodologies and the integration of academy and practice, both for and not for profit.

Not relying on sponsorship allows us to deal with more responsible design. It is possible to fully employ a local specific ecosystemic circular economy. The students are directly required to build only from what they find in the local landscape and what is a natural material so that anyone who wishes to can live in it. This allows for empathy with the landscape and the ecosystem through deeper ethical, ecosystemic and circular understanding and enactment from the students, who are by now used to ordering everything online from China for no money. This typically means low-cost products through unpaid work and resources. In relation to this, I find similar oscillations between the academy, NGOs and practice highly beneficial, with one enriching the other. It is important that my practice is not a typical practice, so is not my NGO or teaching. However, this may be why it represents the design for transitions to brighter futures of the post-Anthropocene era and opens directions for starting similar responsible, responsive and empathic practices.

ACKNOWLEDGEMENTS

The article has benefitted from the fruitful discussion in an online event, 'Empathy and Care in Design Research', by the MAAD team, Federico Wulf, Marie Davidová, Marianna Marchesi, Giorgio Talocci and Mamuna Iqbal, from the Welsh School of Architecture programme

event, for the London Festival of Architecture, with the guest speakers and discussants Birger Sevaldson, Susu Nousala and Elena Pascolo (MAAD - Welsh School of Architecture, 2020). It also benefitted from the discussion at 'Pedagogic Lab' held by the same progamme and preliminary review by my mentors Mhairi McVicar and Alia Abdelmoty from Cardiff University.

The Loop Pavilion teaching team comprised the following individuals: Marie Davidová, Šimon Prokop and Martin Kloda. The Loop students were Alena Novotná, Anna Hrušová, Antonín Hůla, Barbora Slavíčková, Jakub Kopecký, Jiří Fáber, Jiří Pokorný, Petr Tůma, Tereza Jílková, Radim Sýkora, Eliška Antonyová, Tereza Lišková, Filip Janata, Tomáš Kytka, Marie Kortanová, Vojtěch Holeček, Martin Vaníček, Jakub Hlaváček and Petr Havelka. The EnviroCity Festival was managed by Michaela Pánková and Autor. The unit lead of the Synergetic Landscape unit was Autor and the students were Danjian Wang, Yutao Feng, Huicong Meng, Yuchen Wang, Yuan Zhao, Meihui Wang and Assan Abdrassilov.

The projects were widely published in both professional and popular journals and at conferences. The Loop project was managed by Collaborative Collective through my leadership and would never have happened without kind support from the Faculty of Forestry and Wood Sciences and the Czech University of Life Sciences in Prague, the Faculty of Art and Architecture at the Technical University of Liberec, Faculty of Architecture and Faculty of Civil Engineering at the Czech Technical University in Prague, Institute of Planning and Development Prague, Jaroslav Frágner Gallery, Stora Enso, Rothoblaas, Nářadí Bartoš, Eurodach, Lesy ČR/Czech National Forests, Natura Decor, Easy Moving and Collaborative Collective. The Synergetic Landscapes unit was led in partnership with the Community Gateway project.

REFERENCES

Argyrou, A. & Hummels, H. (2019). Legal personality and economic livelihood of the Whanganui River: a call for community entrepreneurship. *Water International*, *44*(6–7), 752–768. https://doi.org/10.1080/02508060.2019.1643525

Banathy, B. H. (2001). We enter the twenty-first century with schooling designed in the nineteenth. *Systems Research and Behavioral Science*, *18*(4), 287–290. https://doi.org/10.1002/sres.424

Blaasvær, L. & Sevaldson, B. (2019). Educational planning for systems-oriented design: Applying systemic relationships to meta-mapping of Giga maps. *Proceedings of the 21st International Conference on Engineering and Product Design Education: Towards a New Innovation Landscape, E and PDE 2019*, *September*, 1–6. https://doi.org/10.35199/epde2019.40

Bloom, P. (2017). Empathy and Its Discontents. *Trends in Cognitive Sciences*, *21*(1), 24–31. https://doi.org/10.1016/j.tics.2016.11.004

Boehnert, J. (2015). Ecological Literacy in Design Education - A Theoretical Introduction. *FormAkademisk - Research Journal of Design and Design Education*, *8*(1), 1–11. https://doi.org/10.7577/formakademisk.1405

Cardiff University. (2019). *Community Gateway - Cardiff University*. Community Gateway. https://www.cardiff.ac.uk/community-gateway

Davidová, M. (2017a). Systemic Approach to Architectural Performance: The Media Mix in the Creative Design Process. *FormAkademisk - Research Journal of Design and Design Education*, *10*(1), 1–25. https://doi.org/10.7577/formakademisk.1713

Davidová, M. (2017b). *Wood as a Primary Medium to Eco-Systemic Performance: A Case Study in Systemic Approach to Architectural Performance* [Czech Technical University in Prague]. https://doi.org/10.13140/RG.2.2.17123.45607

Davidová, M. (2020a). *Systemic Approach to Architectural Performance*. Wordpress. https://systemicapproachtoarchitecturalperformance.wordpress.com/

Davidová, M. (2020b). Synergy in the systemic approach to architectural performance: The integral multi- and cross-layered agencies in eco-systemic generative design processes of the post-anthropocene. *FormAkademisk - Research Journal of Design and Design Education*, *13*(2), 1–30. https://doi.org/10.7577/formakademisk.3387

Davidová, M. (2014). Generating the Design Process with GIGA-map: The Development of the Loop Pavilion. In B. Sevaldson & P. Jones (Eds.), *Relating Systems Thinking and Design 2014 Symposium Proceedings* (pp. 1–11). Oslo School of Architecture and Design. http://systemic-design.net/wp-content/uploads/2015/03/MD_RSD3_GeneratingtheDesignProcesswithGIGA-map.pdf

Davidová, M. (2019). Intelligent Informed Landscapes: The Eco-Systemic Prototypical Interventions' Generative and Iterative Co-Designing Co-Performances, Agencies and Processes. In M. H. Haeusler, M. A. Schnabel & T. Fukuda (Eds.), *Intelligent & Informed - Proceedings of the 24th CAADRIA Conference* (pp. 151–160). Victoria University of Wellington. http://articles.cumincad.org/cgi-bin/works/article/caadria2019_242

Davidová, M. (2016). Socio-Environmental Relations of Non-Discrete Spaces and Architectures: Systemic Approach to Performative Wood. In P. Jones (Ed.), *Relating Systems Thinking and Design 2016 Symposium Proceedings* (pp. 1–17). Systemic Design Research Network. https://systemic-design.net/rsd-symposia/rsd5-2016/rsd5-complexity/

Davidová, M., Pánek, K. & Pánková, M. (2018). Spiralling Slope as a Real Life Co-Design Laboratory. In J. Bean, S. Dickinson & A. Ida (Eds.), *AMPS Proceedings Series 12. Critical Practice in an Age of Complexity* (pp. 133–142). University of Arizona. http://architecturemps.com/wp-content/uploads/2018/11/AMPS-Proceedings-12-Critical-Practice-in-an-Age-of-Complexity.pdf

Davidová, M. & Pánková, M. (2019). *EnviroCity - Facebook*. https://www.facebook.com/envirocity/

Davidová, M. & Prokop, Š. (2016). Advances in Material Performance of Solid Wood: Loop, the Environmental Summer Pavilion II. In M. S. Uddin & M. Sahin (Eds.), *2016 DCA European Conference: Iclusiveness in Design* (pp. 501–507). Özyeğin University. https://www.researchgate.net/publication/307934969_Ray_3_The_Performative_Envelope

Davidová, M. & Sevaldson, B. (2016a). 1:1, A Transdisciplinary Prototyping Studio. In J. Slyk & L. Bazerra (Eds.), *ASK.the.Conference 2016* (pp. 302–308). Warszaw University of Technology, Faculty of Architecture. https://www.researchgate.net/publication/307935449_11_A_Transdisciplinary_Prototyping_Studio

Davidová, M. & Sevaldson, B. (2016b). NGO, Practice and University Driven Research By Design on Performative Wood. In M. S. Uddin & M. Sahin (Eds.), *2016 DCA European Conference: Inclusiveness in Design* (pp. 509–517). Özyeğin University. https://www.researchgate.net/publication/307934911_NGO_Practice_and_University_Driven_Research_By_Design_on_Performative_Wood

Davidová, M. & Zímová, K. (2018). COLridor: Co-Design and Co-Living Urban Adaptation. *FormAkademisk - Research Journal of Design and Design Education*, *11*(4), 1–30. https://doi.org/https://doi.org/10.7577/formakademisk.2647

Dewey, J. (1997). *Experience and education*. Simon & Schuster.

Harriss, H. (2014). The Playful Ping-Pong Pavilion: Learning from Risky Experimentation in Real Time. *Open Arts Journal*, *2*, 1–5. https://doaj.org

Hensel, M. (2013). *Performance-Oriented Architecture: Rethinking Architectural Design and the Built Environment* (1st ed.). John Willey & Sons Ltd.

Hensel, M. & Hermansen Cordua, C. (2015). Architecture by Latitude and Locality: The Scarcity and Creativity Studio. *Architectural Design*, *85*(2), 48–57. https://doi.org/10.1002/ad.1876

Jacobs, D. & Utting, B. (2019). Un-Working: New Tactics for Architectural Pedagogy. *Journal of Architectural Education*, *73*(2), 261–263. https://doi.org/10.1080/10464883.2019.1633208

Joachim, M. & Aiolova, M. (Eds.). (2019). *Design with Life: Biotech Architecture and Resilient Cities*. Actar.

Kenny, V. (2009). "There's Nothing Like the Real Thing": Revisiting the Need for a Third-Order Cybernetics. *Constructivist Foundations 4(2): 100-111, 2009*, *4*(2), 100–111. http://constructivist.info/4/2/100

Latour, B. (2005). *Reassembling the social: an introduction to actor-network-theory*. Oxford University Press.

MAAD - Welsh School of Architecture. (2020). *Empathy and Care in Design Research*. London Festival of Architecture. https://www.youtube.com/watch?v=R2TAzvxgito&list=PLT-oDxnJUt0zf82Ij0VdDPnUUl02r7eNw&index=6&t=4736s

Morton, T. (2013). Poisoned Ground: Art and Philosophy in the Time of Hyperobjects. *Symploke*, *21*(1–2), 37–50. https://doi.org/10.1353/sym.2013.0025

Mulder, I. (2015). Citizen centered design. *IN_BO. Ricerche e Progetti per Il Territorio, La Città e l'architettura, 6*(3), 107–111. https://in_bo.unibo.it/article/view/5925/5751

Mulder, I. (2018). Co-creative partnerships as catalysts for social change. *Strategic Design Research Journal*, *11*(3), 178–185. https://doi.org/10.4013/sdrj.2018.113.01

Nelson, H. (2004). Bela H. Banathy: the legacy of a design conversation. *Systems Research and Behavioral Science*, *21*(3), 261–268. https://doi.org/10.1002/sres.620

Norman, D. A. & Stappers, P. J. (2015). DesignX: Complex Sociotechnical Systems. *She Ji*, *1*(2), 83–106. https://doi.org/10.1016/j.sheji.2016.01.002

Nousala, S., Ing, D. & Jones, P. (2018). Systemic design agendas in education and design research: A report and reflections on the RSD5 Symposium workshop. *FormAkademisk*, *11*(4), 1–14. https://doi.org/10.7577/formakademisk.2608

Sanders, E. & Stappers, P. J. (2014). From designing to co-designing to collective dreaming: Three slices in time. *Interactions*, *21*(6), 24–33. https://doi.org/10.1145/2670616

Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books.

Self, M. & Walker, C. (Eds.). (2010). *Making Pavilions* (1st ed.). AA Publications.

Sevaldson, B. (2018a). Visualizing Complex Design: The Evolution of Gigamaps. In P. Jones & K. (Kyoichi) Kijima (Eds.), *Systemic Design* (pp. 243–269). Springer Japan. https://doi.org/10.1007/978-4-431-55639-8_8

Sevaldson, B. (2018b). Beyond User Centric Design. In S. Barbero (Ed.), *Relating Systems Thinking and Design 2018 Symposium Proceedings: Challenging complexity by Systemic Design towards Sustainability* (pp. 516–525). Systemic Design Association. https://systemic-design.net/wp-content/uploads/2019/03/6-Sevaldson-def.pdf

Sevaldson, B. (2015). Gigamaps: Their role as bridging artefacts and a new Sense Sharing Model. *Relating Systems Thinking and Design 4*, 1–11. https://app.box.com/s/tsj7ewtcy9dr63knf64tvo3yrepmzdov

Sevaldson, B. (2013). Systems Oriented Design: The emergence and development of a designerly approach to address complexity. In J. B. Reitan, P. Lloyd, E. Bohemia, L. M. Nielsen, I. Digranes & E. Lutnaes (Eds.), *DRS // CUMULUS 2013* (Issue May, pp. 14–17). HIOA. https://doi.org/ISBN 978-82-93298-00-7

Šmejkal, J. (2019a). *Jiří Šmejkal - 6 let co jsme za deštivého počasí v dílně s CNC...* Facebook. https://www.facebook.com/shmejky/posts/10219158779430383

Šmejkal, J. (2019b). *Parametr Studio*. https://www.parametrstudio.cz

Sweeting, B. (2018). Applying ethics to itself: recursive ethical questioning in architecture and second-order cybernetics. *Kybernetes*, *July*, 1–16. https://doi.org/10.1108/K-12-2017-0471

Till, J. (2008). Architectural Research: Three Myths and One Model. *Building Material*, *17*, 1–5. https://jeremytill.s3.amazonaws.com/uploads/post/attachment/34/2007_Three_Myths_and_One_Model.pdf

von der Lippe, M. & Kowarik, I. (2008). Do cities export biodiversity? Traffic as dispersal vector across urban-rural gradients. *Diversity and Distributions*, *14*(1), 18–25. https://doi.org/10.1111/j.1472-4642.2007.00401.x

Wettre, A. & Sevaldson, B. (2017). Teaching Team Work in Systems Oriented Design. In B. Sevaldson (Ed.), *Relating Systems Thinking and Design (RSD6) 2017 Symposium. Oslo, Norway, October 18-20, 2017* (pp. 1–13). Systemic Design Association. https://systemic-design.net/rsd6/systemic-design-pedagogy-and-education/#wettre