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## Relating Systems Thinking and Design (RSD12) Symposium | October 6–20, 2023

### **BioDiveIn: Leveraging the ecosystem through social and environmental systems**

**Marie Davidová, Maria Claudia Valverde Rojas, and Hanane Behnam**

BioDiveIn is one of several interventions developed by collaborative efforts. These are testing the transition towards Post-Anthropocene and ecological aesthetics. The intervention offers multiple species habitats, edible landscapes and water pools for bats, swifts, small-sized birds, squirrels, insects and plants. The intervention (touch point) is also equipped with two QR codes—one leading to DIY recipes to multiply the installation and one to spot-a-bee application for joining the citizen science on pollinators. The intervention was codesigned through gigamapping and full-scale prototyping through an experimental systems oriented design studio course with students, invited experts and other stakeholders. It resulted in DIY events and a launch with a gardening party to accommodate the plants in the prototype.

**KEYWORDS:** prototypical urban intervention; touch point; ecological aesthetics; gigamapping; prototyping; systems oriented design; systemic approach to architectural performance

**RSD TOPIC(S):** Cases & Practice, Methods & Methodology, Socioecological Design

## **Presentation introduction**

We need to look around and see what else is alive. What plants grow in our neighbourhood? Are they native or imported? The birds: do they migrate by seasons or stay put? Where do these flying creatures eat and mate? What other animals live around us? How about honey bees? Bees seem to like urban living. And us: How do we organise our communities, cities, and regions? What are our histories, our laws, our institutions? What do we believe in? (Steiner, 2019).

What is the pattern that connects the crab to the lobster and the primrose to the orchid, and all of them to me, and me to you? (Bateson, 2000)

Part of Bateson's work can be summarised as trying to move our attention to the relationships, information, and semiotics that make up ecologies, whereas conventional science tends to focus on material and energy as with physical systems (B. Sweeting, personal correspondence, 2023). This presentation shows how the two can be synthesised together. The presentation will discuss ecosystemic services of prototypical urban intervention (Doherty, 2005) developed through design studio teaching in the winter semester of 2022-2023, that is, to adapt buildings towards the transition to post-Anthropocene. It follows a previous intervention, POL-AI (Davidová, Fischer, et al., 2022), which was installed on the same wall. Eight out of the ten Earth Systems Boundaries have been exceeded on a global level (Rockström et al., 2023). Recently, many species have adapted to life in the cities; for other species, cities lie on their critical migration paths (Spotswood et al., 2021). However, our cities did not develop with a more-than-human perspective (Davidová & Zímová, 2018). We are recently facing Anthropocene Extinction. That is a current ongoing event in which a large number of living species are threatened with extinction or are going extinct because of environmentally destructive human activities (Wagler, 2023). Therefore, we need to adapt our cities to coliving with other species.

The patterns of biodiversity changes in cities are now fairly well established, although diversity changes in temperate cities are much better studied than in cities in other climate zones. Generally, plant species richness often increases in cities due to the importation of exotic species, whereas animal species richness declines. Abundances of some groups, especially birds and arthropods, often increase in urban areas despite declines in species richness (Faeth et al., 2011). This is because some species adapt more easily, and others don't find suitable habitats or food. Therefore, our intervention focuses on these.

## **Methodology**

BioDiveln was cocreated within the studio course COLife: More-than-Human Perspective to CoDesign. Several types of codesign processes where related stakeholders and discipline representatives were involved. This covered sociologists, an ecologist, an ecologist NGO representative, and neighbouring high school and hotel representatives. We combined digital and analogue technics of gigamapping and prototyping and finalised them with the real-life installation and DIY workshop at a local high school. The challenge with designing for new fields is the lack of information, knowledge, experience, and skills that are specific to the area. To address this, we have developed a very fast learning process conducted in a designerly way through gigamapping. These learning processes help designers achieve an overview and single out areas where support from insiders and experts would be needed (Sevaldson, 2022). The gigamapping, in our case, is always accompanied by prototypes to develop rich and tacit knowledge (Davidová, 2017).

First, the students created their minimaps about their own personal perspectives on the project in Miro, stating what responsibility they would like to take. Then, they started putting their minimaps on one board and started to search for relations amongst each other and interpret them. One person was responsible for the overall graphic design and organisation of the gigamap (Figure 1). However, the whole team collaborated on this codesign process. For the codesign with stakeholders, the gigamap was printed out. It was presented to them by the students with every single topic and the organisation so that they could quickly orient themselves and find their position. They would then draw into the printed gigamap. I.e. in practice, templates are used for the clients to orient

themselves (Paulsen & Rom, 2014). The gigamap was accompanied by models and prototypes (Figure 2). This engaged the attention and better understanding. Working with tangible objects supports the interaction.

The Miro gigamap gets then updated with the findings. Sevaldson critiques the overdesigning and ordering in the gigamapping (Sevaldson, 2013). However, we discovered that this ordering was necessary for participation when the stakeholders were only able to pop in and out for a limited time. They struggled to respond to the maps in a messy stage and presented disappointment. Therefore, the messy and ordered state appeared in feedback loops, which is typical for many design processes in research by design (Figure 3). Therefore, it is important to create a methodology for current situations that is improvisational rather than dogmatic, as also suggested by Sevaldson (Sevaldson, 2013).

Simultaneously, DIY recipes were cocreated for the public to reproduce the installation. When the installation was installed, QR codes leading to the recipes on the author's blog (Davidová, 2023) were placed on the installation, which served as a touch point (Clatworthy, 2011). Therefore, the installation becomes generative. Also, a QR code leading to a citizen science application spot-a-bee (Cardiff University & University of Glasgow, 2021) was placed on the prototype. This application helps us to collect data for training image recognition to recognise whether the pollinators are pollinating. Several public engagement events were arranged to increase the audience, such as two Girls' Days prior to the studio (Figure 4), a Workshop with Dillmann Gymnasium (Figure 5) or a community gardening event at the prototype's opening (Figure 6). At the Spring 2023 gardening event, the community participated in cocreating the prototypes by planting plants in them. Recently, we have been working on developing an urban game in the adjacent biodiverse cemetery.

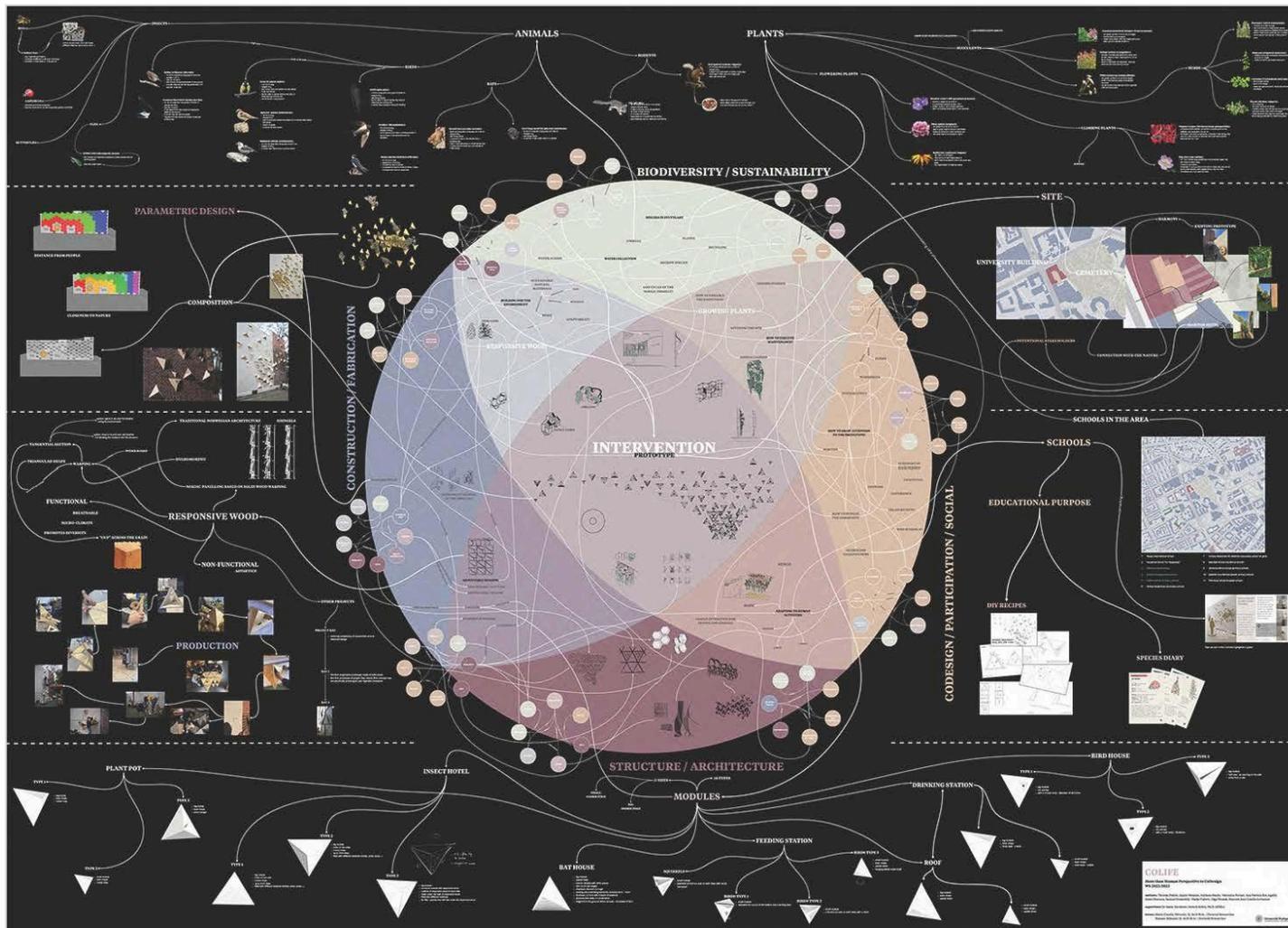


Figure 1: BioDiveIn Gigamap (COLife Studio 2023)



Figure 2: CoDesign with Gigamap and Prototypes (Photo: Behnam 2022)



Figure 3: CoDesign Workshop with Printed Gigamap (Photo: Valverde 2022)



Figure 4: Girls Day Teaching the Girls to Use Spot-a-Bee Application (Photo: Davidová 2022)



Figure 5: Testing the DIY recipes through a workshop with Dillmann Gymnasium. (Photo: Behnam 2023)



Figure 6: Community Gardening Event at BioDiveIn Opening (Photo: Behnam 2023)

Other design tools were developed along with gigamapping to test the feasibility and suitability of different design concepts for urban intervention. The students combined parametric and digital models, which are computer-based simulations that can be manipulated and adjusted (Woodbury, 2010), with craftsmanship skills and used physical models and prototypes, which are tangible representations of their ideas that can be tested and refined (*Tools | IDEO.Org*, n.d.). Such skills are critical for intuition and tacit knowledge (Davidová, 2017, 2020a) and practice reflection in action (Schön, 1983). We also applied the 'learning by doing' approach, which is a pedagogical strategy that emphasises hands-on experience and reflection (Kolb, 1984), to train each other to build the products and test the DIY potentiality, which is the possibility of reproducing the intervention by using simple and accessible materials and techniques.

Then, the studio outcome's modules got reparametrised by combining the use of computational design with specific parameters of DIY recipes (i.e., size, numbers, etc.) in order to develop a generative design system (SEQUIN, 2005) of their alternatives (Figure 7). The parametric design enables the DIY recipe to be generative and optimised according to the different preferences of different species. This reparametric "DIY" is also dedicated to users with digital fabrication tools (CNC machinery) and basic knowledge of Rhinoceros and Grasshopper (Davidová, 2023), which enable users to express themselves through the design thinking approach. This actually means that these DIYs include tools, information, inspiration, and preliminary designs from the designer's point of view (Hoftijzer, 2017).

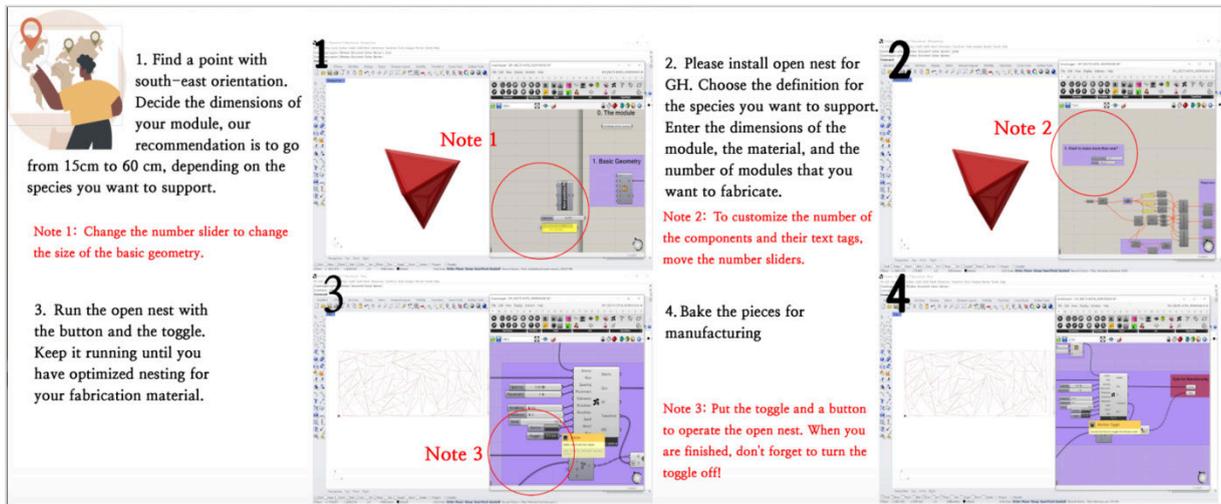


Figure 7: Reparametrising the DIY recipes. (Recipe: Valverde 2023 in Davidová, 2023)

Recently, we have been working on developing an urban game in the adjacent biodiverse cemetery. In 1974, Richard D. Duke (1974) proposed "Gaming as the Future's Language," which can sensitise and stimulate a hypothetical world to the people, giving them an immersive experience with the power to change the dynamics of the complex system. According to this, we employ gamification as a significant tool to drive user engagement in reproducing the DIYs. In this semester, through a gamification strategy, the students aim to design the interaction by using elements and mechanics of game design in a non-game environment to bring on certain behaviours in individuals that enhance their motivation and engagement in reproducing the DIY recipes (Sailer et al., 2017).

## Conclusion

It is politically difficult to agree on courses of action, such as reducing living standards, and there are ethical difficulties in doing so because of the intersection with social and global injustices (Sweeting, 2022). Therefore, we need to search for ways that are socially attractive. This we approached in a creative way through service design and technology. There are various approaches to service design and technology (Suoheimo et al., 2023). Our approach is experimental in nature. The gigamapping codesign with invited stakeholders worked well with the printed gigamap and tangible objects because

it is at hand on the table and tangible. This is also due to the clear presentation of the students, who navigated the stakeholders through every topic and explained with tangible prototypes. It is important to print out the gigamap for both the team as well as for the incoming people. If we worked with the Miro map over all the processes, the stakeholders would get lost and lack orientation in the digital tool. This was proven during the COVID-19 pandemic when we tried to do similar workshops in Miro with the Synergetic Landscapes Unit at the Welsh School of Architecture (Davidová, Sharma, et al., 2022). It is also important to point out that SOD integrates more tools than just gigamapping. Social interaction is being developed during the project also within the 'real-life codesign laboratory' (Davidová & Zímová, 2020). For now, it is observed that we have visitors for the DIY recipes on our blog (Davidová, 2020b) through QR codes. We will get in touch again with our colleagues from Cardiff University about the new data collected from Germany with the spot-a-bee application after the summer. However, we are aware that the environmentality of such technologies presents different challenges to politics, engagement, and ethical choices (Perera, 2023). However, through the placement of real-life codesign, we answer a lot of ethical questions through participation (Sweeting, 2018). The prototypical interventions could serve as a valuable resource for gaining a deeper understanding of the behavioural patterns of various species. This also means that the prototypes develop over time. By analysing factors such as occupancy rates, nesting preferences, and the types of species supported, we can extract design parameters that can be used to optimise the design of future biodiversity supporters. During the observation period from May to July 2023, several wild species were observed in the designed layout provided by BioDiveIn (Figure 6). This suggests that the interventions were successful in supporting biodiversity and attracting a diverse range of species. However, also many species died on our installation in its higher parts. By continuing to monitor and analyse the behaviour of diverse species, we can further refine our design strategies to promote biodiversity in the urban environment. Our gigamap and recipes can be found in our dataset '*COLife\_01 - Gigamap and DIY Files*' (Davidová et al., 2024).



Figure 8. Diverse species observed in BioDiveIn intervention from May to July 2023, including wild bee nests, a white-coated bumblebee, and wild meadow plants. Photo: Valverde, 2023.

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