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**Relating Systems Thinking and Design
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POL- AI

Leveraging Urban EcoSystem

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The work-in-progress project relates ecosystems with socio-technological systems (STS) in urban environments. It focuses on the development of more-than-human cities of the post-Anthropocene. Through a prototypical urban intervention POL-AI built from responsive wood, we aim to support more-than-human edible and habitable landscapes on existing buildings, thus supporting urban connectivity for wild nature elements such as insects. The prototype covers elements that are often used in so-called insect hotels, pollinator gardens and artificial intelligence (AI) monitoring systems for pollination, garden ecosystems and responsive wood performance of habitats. Further on, this prototype will include QR codes, leading to its own Do-it-Yourself (DIY) recipe and a citizen-science mobile application, Spot-a-Bee, that informs the AI image recognition database when the pollinators are pollinating. Therefore, the project becomes generative. The prototype has been developed through gigamapping, which is a systems oriented design tool for synergising the multi-centred perspective of related stakeholders. It is being robotically fabricated. However, making its iterations in makers' labs or even on a mitre saw should be easy. We have recently faced high extinction rates in wild species and

their habitats. The "Planetary Boundaries" model clearly points to biodiversity loss as one of the most alarming global issues. Yet, for some species, urban environments can offer better habitats than poisoned agricultural land; however, the connectivity between urban habitats is often low. Therefore, urban adaptations for more-than-human architecture are necessary to counteract biodiversity loss.

KEYWORDS: more-than-human, systemic design, urban interventions, action design, codesign, full-scale prototyping, urban biodiversity support

RSD TOPIC(S): Architecture & Planning, Socioecological Design, Sociotechnical Systems

Presentation summary

Biodiversity is crucial to our human survival on a global scale, and our economic models cannot survive without it (Dasgupta, 2021). However, biodiversity loss has already reached the points behind the border of planetary boundaries (Steffen et al., 2015). Recently, we have been facing the 6th Mass Extinction, also called Anthropocene Extinction, an ongoing current event in which many living species are threatened with extinction or go extinct because of environmentally destructive human activities (Brondizio et al., 2019; Wagler, 2017). Within such ecosystem change, cities can become critical leverage points. In some cases, urban environments can become more suitable for species than their rural counterparts, as they may adapt to specific urban surroundings (Spotswood et al., 2021; Villaseñor et al., 2020).

However, this project integrates non-human social systems with human social systems, as we cannot reach environmental justice without social justice and vice versa (Davidová & Zímová, 2018; Haase, 2017; McIntyre-Mills, 2014). In the past, our cities were mostly built from the anthropocentric perspective, not considering living and foraging habitats for non-human species. Therefore, we aim to support the search for adaptations of the human-built environment toward a city that functions for multiple – species, including both human and non-human beings. One strategy is the creation of smart cities and

their digital technologies (Catalano et al., 2021). In line with this, our project POL-AI aims to prototype such multi-species systems that could be scalable in the future. It integrates environmental, social and technological systems through full-scale prototyping and its DIY recipes, citizen science, environmental sensors and artificial intelligence.

Methods

The project integrates systems oriented design tools, such as gigamapping (Sevaldson, 2018), full-scale prototyping (Hensel & Menges, 2006) and the integration into the real-life codesign laboratory (Davidová, 2020b; Davidová & Zímová, 2021) through prototypical urban intervention (Doherty, 2005). Before the gigamapping took place, students received basic input on urban ecosystems and ecological design ideas to create an initial knowledge base for plant- and pollinator-specific planning in the urban context and aspects of urban agroecology (Fischer et al., 2016, 2020; Fischer & Kowarik, 2020). The gigamapping, in this case, is gathering personal perspectives and relating them over the board in the search for synergy across the participants. After this, part was initiated with a group of students of two Master Programmes (M.Sc. Planning and Participations, M.Sc. Architecture and Urban Planning at the University of Stuttgart), and the stakeholder codesigning event came along. Related stakeholders were asked to find their zoom-in points on the gigamap the students created and develop their agenda on separate minimaps. The stakeholders developed their systems along with their agendas, involving the institutions they represent. After this workshop, each subtopic from the gigamap was developed into a separate gigamap. The investigations covered: 1) urban biodiversity, 2) humans, and 3) design and material. The workshop finished with the full-scale models and shopping for the prototyping. Recently, the prototyping has been performed, and the first part installation took place at the end of June 2022.



Figure 1. POL-AI Prototype. Photo: Koemel 2022.

The concept of POL-AI

POL-AI is a prototypical urban intervention gathering multiple perspectives. The installation is hyperobjective (Morton, 2013). It is zooming in and out from a little screw to the large social and environmental systems. The physical intervention itself covers responsive wood insect hotels based on the concept of TreeHugger (Davidová, 2019; Davidová & Prokop, 2018; Davidová & Zímová, 2018), pollination garden, sensors system for climate monitoring and image recognition for acknowledging the pollinators pollinating the plants. In addition, a link to the DIY recipe will be engraved into the prototype (Figure 1).

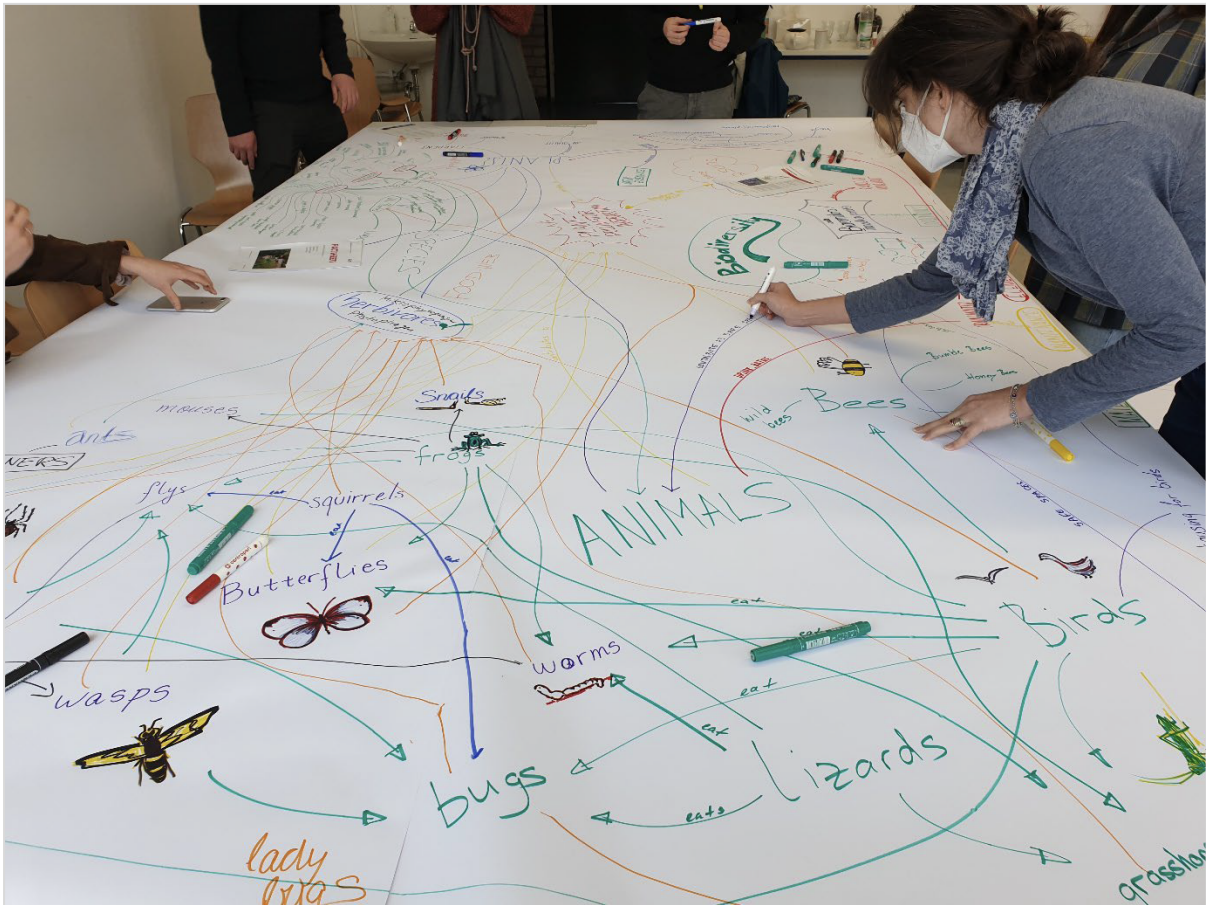


Figure 2. Transdisciplinary gigamapping. Photo: Davidová 2022.

The stakeholders

This transdisciplinary project involves architects, ecologists, biologists, and wood and computer scientists. Also, a teaching block of the programs of Master Planning and Participation and Integrated Urbanism and Sustainable Design was involved in the project. The project also attracted the neighbouring Maritim Hotel, which offered access to the site and the project's integration into their programme for maintenance. Also, they suggested a sponsorship for the next year's expansion of the project. All these visions were gigamapped (Figure 2).

The tangible prototype

The tangible prototype consists of responsive wood insect hotels, a responsive screen Ray (Davidová, 2014, 2016, 2017), and a pollinators' garden that is integrated into the prototype. It also integrates image recognition for observing the pollinators pollinating the plants. The responsive wood insect hotel is based on wood material science; when the wood is cut in the tangential section from different parts of the tree trunk, it responds differently to the relative humidity and temperature conditions.

Therefore, a diversity of climatic chambers is created across the prototype. Local honey-blooming species have been selected with the support of Mike Thiv from the State Museum of Natural History Stuttgart and KomBioTa as a part of the participation.

The sensorial and AI system

The pollination of the vertical garden will be observed by the image recognition system, registering the value of pollination from insects, especially bees. Simultaneously, the climate and the earth's moisture content will be monitored using temperature and humidity sensors. This system will not only act for an ethical value but will also monitor the ecological data about the pollinators' presence and activity under certain conditions. It will involve understanding the relationship between pollinators, plants and the environment. Environmental ethics proves that non-humans possess an intrinsic value to the ecosystem by virtue of their existence. Bees, for example, are important to themselves because of their existence. In addition, their existence helps to increase biodiversity and crop yield, which happens to be of benefit to humans, regardless of if their decisions to exist have a moral basis (Rolston, 2003). Also, different climatic chambers of the insect hotel based on the responsive wood will be monitored and registered for different species' habitat preferences.

The DIY recipes and social systems

On the responsive wood panels, there will be engraved QR codes leading to both the DIY recipes on how to generate a similar system at home on the SAAP blog (Davidová, 2020a) as well as to the citizen science application Spot-a-Bee (Cardiff University & University of Glasgow, 2021). This way, the prototype becomes generative by integrating social systems. Thus, this generativeness is supporting urban connectivity, as more people might be encouraged to place such prototypes on their walls or balconies.

WIP future visions

The future vision of this project is to establish an economic model where pollinators, as well as others, are paid for their performance within the ecosystem. This is rooted in the fact that our economy is dependent on the overall ecosystem and the services the ecosystems provide. However, our economic models do not reflect this. Therefore, we are facing Anthropocene Extinction (Wagler, 2017). This project aims to suggest a transition towards the Post-Anthropocene where humans are not on the top of the hierarchical model, and the interaction across the species and other beings is circular.

Therefore, the image recognition system could assign a value, therefore a digital currency, to the pollinator for pollinating your tomato (Davidová et al., 2022).

Therefore, this project aims for more-than-human social and environmental justice.

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