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(Re)thinking Resilience

Is Service Design the Right Way for Designing with Nature?

A case study on how to design nature-based solutions for resilience.

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ABSTRACT: Nature-based solutions (NbS) have emerged in the past years in Europe as critical instruments to achieve climate-resilient cities. Due to their complexity, systemic functioning, contextual embeddedness, and multifunctionality, designing NbS eludes the practice of conventional urban design, architecture, and landscape architecture. This study follows discussions of a participatory design process in Hungary, meeting the standards of NbS scholarship to argue for a new design theory suitable for NbS. Using a grounded theory approach, it is presented that concepts and principles of service design was ubiquitous in the sampled design process, even though the service design framework was never explicitly used. The experiences are leveraged to argue that adopting service design would create a shared language for participatory design, prime designers to apply a systems perspective, and integrate operational requirements from early design phases – all of which are pertinent to overcome the design challenges stemming from NbS complexity. The contribution of this study is providing case evidence for a service design approach to NbS design.
KEYWORDS: Nature-based solutions, Service design, Co-design, Ecosystem services, Design theory

1. INTRODUCTION

Nature-based solutions (NbS) are critical components in hybrid engineered-ecological systems of adaptation for climate-resilient cities. NbS leverage biophysical, biochemical, and ecological processes to perform as in an urban green-and-blue infrastructure. Furthermore, they perform more than one function, in fact, the same NbS can serve different roles simultaneously, for example offering nutrients, regulating urban water cycles, filtering air from pollutants [1]. Furthermore, as they become large, city-shaping features, often public, semi-public spaces, their distribution, and design have a justice aspect, and it is critical to subject them to participatory planning and governance [2].

Of the several barriers hindering NbS uptake, informational barriers are critical. A general lack of information and high degree of uncertainty on NbS performance and design persists [3]. Despite multiple cycles of research projects, NbS knowledge appears unable to penetrate from academic discourse. In practice, NbS are designed by architects, landscape, or urban designers, overseen by public institutions prone to fragmentation of responsibilities. This does not only limit the value and novelty to be captured from NbS [4], but also hinders long-term maintenance, crucial for NbS performance [5]. In short, while NbS researchers highlight the complexity of their object, stemming from multifunctionality, systemic nature, and the need for participation, NbS production is stuck on conventional planning practices led by siloed departments [6].

The objective of this study is to identify a conceptual framework for integrated design process that accounts for NbS complexity and has the potential to bridge the gap between academia and practice. Thus, our research question is how should an NbS design problem be conceptualized to afford effective discourse in a participatory design process?

The research question can be translated to the selection of an appropriate design theory to be fit for integrated and participatory NbS design. This is an ambitious goal, and a definitive answer is beyond the possibilities of this study. What is presented here is an argument to the pertinence of one design theory: service design. Service design is a theory where the design object is one or multiple service(s), and the design discourse is centred around experiences and interactions between the service provider, the service itself, and the user [7]. Our hypothesis is that service design offers the conceptual framework for answering the research question.

2. MATERIALS AND METHODS

2.1 Methodology: grounded theory

To ascertain whether service design provides an adequate conceptual framework for NbS design, we rely on a grounded theory approach, that is, the

systematic coding of qualitative data to arrive at concepts, categories, and eventually, a theory [8]. However, the result of the process in this case is not the development of a new theory, but evidence whether service design is a viable theory for NbS design. The research question is answered by matching the concepts emerging from the grounded theory analysis with concepts of service design.

The data of the study comes from the joint participatory design of two NbS projects, a public park and a nearby schoolyard in the town of Szombathely, Hungary – meaning the findings are not generalizable. The project consisted of a four-part workshop series organized by an international research consortium, with local expert and layperson stakeholders, focusing on: (1) strategic placement of the NbS, and identification of objectives, (2) conceptual programming and design of the NbS, (3) critical evaluation of NbS concept alternatives, and (4) specification of monitoring indicators. What makes this project a suitable case study is that each workshop was preceded by internal discussions of the project team – a single municipal department and commissioned experts – with the exact same scope. The workshop series models a holistic approach, managed by NbS researchers, whereas the internal discussions model a conventional green space development project. The coding itself relies on memos, contents created by workshop participants, and written observations.

2.2 Conceptual framework: service design

The main tenet of service design is a shift from putting material artefacts and goods as the object design to services, originating from a wider service shift in the areas of marketing, economics, engineering, and management [7]. Service is the core concept, which is defined by a set of common characteristics (Figure 1). Most importantly, Shostack's tangibility continuum is used to distinguish goods from services. Anything of value can be described as an interconnected bundle of components, and the dominance, with services being more intangible than tangible [9]. Second, services, though intangible, are encountered through tangible, material experiences, also called evidence [10], service encounters [11], or touchpoints [12], either essential or peripheral to the service. Third, a service does not exist autonomously and continuously, rather it is co-produced by service users and providers in lived, embodied performances in staged environments [13]. This means each service is unique – to an extent – to the actors and context in which it plays out. Finally, due to all the above, activities of a service are split into a domain of interface, where exchange takes place, and a domain of infrastructure, which facilitates it [7]. The service shift in essence is expanding the focus of design from the infrastructural with the interface.

The service characteristics paint a different design practice, which has not yet seeped into all design fields [7]. It calls for a multidisciplinary practice integrating applied behavioural sciences (e.g., marketing), technological expertise (e.g., ICT), and a design field (e.g., graphic design) that allows simultaneous design of material elements and intangible interactions [14]. During service design, the starting point is the service outcome, which helps identifying evidences or touchpoints, where material arrangements can be made [10]. A service outcome can be anything of value for the user, can be tangible or intangible, lasting or temporary. Service outcomes are co-produced with users, as long as the service prerequisites, the necessary resources are in place [15]. What is in control of the designers, is to (1) describe the core and supporting services as the service concept that addresses real user needs, (2) imagine a realistic model of unique user processes as a set of actions that generate service outcomes, and (3) specify the service system, i.e., the resources necessary for the service process to materialize. These three areas form the three main tasks of service design (Figure 1).

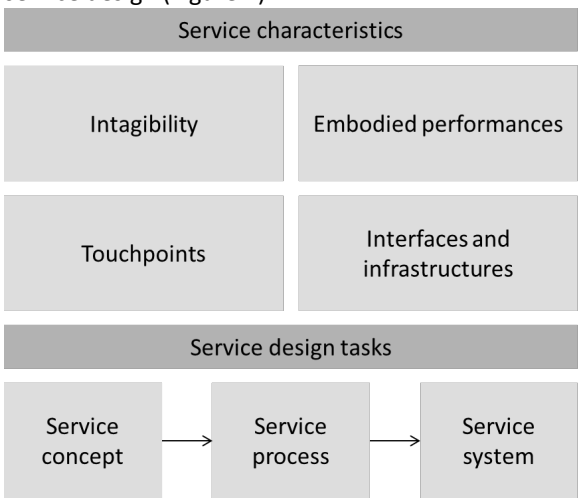

Figure 1: Service design conceptual framework

Each of the three design tasks require a different language. When formulating service concepts, discussions focus on values, form and function, experiences, the service outcomes [16]. Behavioural sciences are used to argue for or against a service concept, evaluating them in terms of perceptions, pleasure, flow of time, memories [17-18]. User processes on the other hand are input-output models, with a flow of user-based and operational activities [19]. They are usually drawn up as scripts, and the main success factor is the fidelity of the design script to the user scripts [20]. Finally, the service system includes the service prerequisites to facilitate the service, including staff, physical and

technical environments, organisational and control activities; and the users themselves, described by their knowledge, capabilities, scripts, and states of mind [15]. The service defines the roles users, staff, and the provider organization assume, and a good service system optimizes their relationships for efficiency, satisfaction, perceived control, and autonomy [13]. The ultimate guiding principle of design is the performance of the service system during the service process. What should happen in broad terms during an encounter with a service is broken into how it should happen in more detail, which provides performance standards for design. Better descriptions of sub-processes are the ones that are more easily relatable to design dimensions, and better fitting to evaluate solution alternatives [19].

3. RESULTS AND DISCUSSION

The results show that the discourse during the workshops bears the hallmarks of the service design framework. In this section, we present the clearest examples of each concept introduced in section 2.2 and opine how this might influence NbS design.

2.3 Identified service design concepts.

Most notably, the workshop discussions reproduced Shostack's **(in)tangibility** continuum and evidence concepts. Stakeholders tend to describe NbS as a sequence of tangible and intangible offerings, where the intangible ones are evidenced by a tangible clue. Places to sit, somewhere to go with a dog, things children can do outside, and protection from traffic noise came up among intangible components, but tangible items, like chess boards, playgrounds, and flower beds were also mentioned. When pressed for what they imagine, intangible components like places to sit were tied to different shreds of evidence, like stone benches or wooden platforms. Landscape designers have a crucial role in decoding intangible experiences to a variety of tangible elements in an open dialogue. For example, during the workshops, the intangible need to interact with nature more than just looking at it was first translated to a rerouted river with aquatic playground elements, then to a barefoot thematic and educational pathway in the schoolyard (Figure 2).

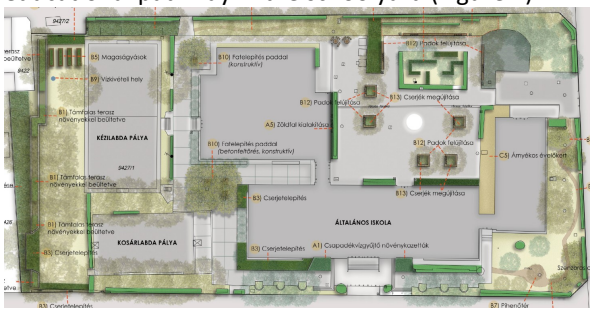

Figure 2: Concept design for the schoolyard. Educational pathway is in the bottom right, the vegetable garden is in the top left corner.

Exposure to users from the start also nudged the designers to think less in terms of design visions are more in terms of **user processes**. For most design choices, like a Miyawaki microforest (Figure 3), and Tetris-style modular benches, the designers had to prove their utility while talking about how it would be used. Specifically with the modular benches, the issue of vandalism came up, conflicting some user scripts of damaging the furniture with the idealized designer scripts of creatively rearranging them. The participatory design sessions led to a gradual shift from rationalizing design choices by adherence to a design narrative, towards by telling stories of what people will be able to do. For example, the designers were instructed earlier to include rainwater harvesting, because it fits the NbS narrative. However, this feature was later evaluated by its ability to reduce maintenance costs by providing irrigation water. It also meant that the designer's attention naturally shifted from the infrastructural to towards the interface domain of their designs.

Figure 3: Concept design for the small park. Miyawaki micro forest is in the top, the river on the right side.

Another notable shift was a better representation of the maintenance perspective. Both the school director and the municipal green space management representatives signalled their inability to operate costly and complicated solutions. For all core components of the interventions, there was an ongoing brainstorming on how to link the exploitation of the new green spaces to distributing maintenance duties. For example, the school received vegetable

gardens, the most popular solution, specifically because they would be tended to by a children's cooking club (Figure 2), whereas a resident with carpentry experience expressed interest in teaching others how to protect timber structures in the small park. This line of discussion fits the design of the **service system**, assigning roles and resources not simply for the upkeep of physical elements (like the timber structures), but specifically to sustain a service (vegetables for the cooking class). The workshop addressed the importance of service system elements, including user competencies, staff competencies, organizational activities, and technical environments. In the schoolyard, elements like the skills of the students, teachers' available time, cooking class schedules, and raised vegetable beds were prioritized. The system also includes educational activities, for which the garden was designed for. No physical element was confirmed before considering maintenance. Aside from landscaping, the design also included the coordination between the school board and director for the organisation of training and planting workshops, the engagement of students, especially teenagers, through diverse activities such as art calls and outdoor events, and the crucial involvement of parents in weekly tasks like watering and planting. One observation included the necessity to broaden the range of activities beyond mere planting workshops. The prospect of implementing such diversified activities on a medium-term basis was considered, with the potential of functioning as an exemplary project for other educational institutions.

An interesting element of the local service system discussed was the role of local fauna, particularly beavers, that ascend rivers and damage trees in public parks. This topic emerged during a workshop with local water authority representatives. In service design, understanding the context isn't just about producing immediate solutions, but fostering relationships between various actors that could influence the transition from the current to future states. This principle implies that actors, even non-human ones like beavers, are integral to the system model. As Kimbell (2010b) asserts, design for services focuses on the relationships between elements and actors within systems, rather than the objects themselves [21]. Consequently, the boundaries of design become blurred, necessitating considerations beyond the intervention site. These include beaver habitat protection efforts, culling policies, and broader ecological relationships. Thus, non-human users also become part of our service system model.

3.2 The value of service design

While service design was not a guiding principle for the design process, the presence of related concepts offered a glimpse into the benefits of explicitly applying the service design framework. In our opinion, the three most important benefits are: (1) having a common language between laypeople and various experts involved in participatory design; (2) introducing a system thinking mindset to the design process, (3) consciousness of operational requirements in early design phases.

The workshops diverted discussions very soon from technical problems to understanding who was involved in the functioning of the NbS, who the users are and what are their needs. This is exactly the starting point of Shostack's service blueprinting, and subsequently every service design [10]. Understanding the users and their perspectives helped guide the formulation of problems and evaluation of design solutions, focusing on interface elements and user experiences. Additionally, the use of service design aids in the development of new services and understanding of user needs. It highlights the significance of adding new functionalities and actors in the NBS context during a service's operational lifetime to assess quality and identify necessary redesigns.

On the one hand, NbS are infrastructural components, managing rainwater, modulating the microclimate, mitigating environmental pollution and hazards. On the other hand, they are interfaces, providing irrigation water, sheltering from summer heat, and dampening traffic noise. Discussions in terms of user processes not only provide useful information for designers to make better choices but also raise the awareness and approval of NbS – a concept unheard of in the study city before the workshops.

Service systems are of particular value for NbS design, given how they also function as systems embedded into larger systems themselves. Conventional landscape architectural practice does not routinely capture the different larger systems suggested by the different NbS roles. For example, it is not common in Hungary for a landscape architect to conduct microclimate simulations to see how specific green and blue arrangements influence outdoor comfort through shading, wind patterns, and evapotranspiration. Similarly, the project team did not consider beavers as potential hazards for trees.

Much like a service, an NbS is an embodied performance of human and non-human actors, not a set of tangible objects with clear boundaries. Adopting service design primes the designers to start asking questions about the systems at play and involve the necessary disciplines as soon as possible.

Finally, talking about user processes and expected benefits, and experiences opened the possibility to discuss NbS operation, use, and maintenance even before the first design concepts emerged. If

embedded into urban infrastructure, the importance of urban greens increases, and the different infrastructural roles prescribe different quality requirements landscape architects may not yet routinely consider. For example, a sedimented bioswale is not only an eyesore, it also impedes runoff reduction. Each of these NbS roles can be reformulated in the language of services, and having operational expertise from public utilities represent the customers would guarantee that a service design approach to NbS systematically responds to diverse operational requirements.

4. CONCLUSION

The research question inquires on an appropriate design theory to conceptualize NbS in a participatory design process. Appropriateness in this sense means that it affords effective communication among designers and stakeholders. According to our case study contrasting conventional and NbS literature-compliant design processes, service design is one possible answer. This is demonstrated in the presence of service design concepts in the holistic, research-led, and participatory design process, as opposed to its absence in the conventional, siloed, linear approach.

The novelty of this study is in suggesting that a grounded theory of NbS design may coincide with service design. The suitability of service design for NbS has not yet been proven – to the knowledge of the authors. The significance of linking an existing, well-known design theory lies in the opportunity that mature concepts, methodologies can be relied on to deliver NbS, meeting the standards of the NbS literature. This allows designers not so close to the research of NbS to engage in NbS, as opposed to conventional landscape projects. More case studies in different contexts, and different NbS types would reinforce this claim, while a dedicated methodology of service design of NbS is warranted to deductively test the suitability of the theory – since grounded theory is an inductive method.

Critical reflection on the way NbS is designed in its best practices is essential to identify design theories that open the process to more practitioners. It would be interesting to see if other design theories could be interpreted from ongoing research projects, and how different NbS they would produce. The link between design and improvement in services is frequently tied to its cross-disciplinary character. When we consider NbS, service design boosts the exchange of information among stakeholders, organizations, and local communities. Implementing service design from the outset is a fluid process. It fosters ongoing innovation among varied groups in ever-changing scenarios. Adopting service design, or other proven design theories could lead to a systematization of designing NbS, accelerating their widespread integration into urban systems, and contributing to improved urban resilience.

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