The tree as method: co-creating with urban ecosystems*

Ida Nilstad Pettersen
Department of Design, Faculty of
Architecture and Design, Norwegian
University of Science and Technology
(NTNU), Norway
ida.nilstad.pettersen@ntnu.no

Hanne Cecilie Geirbo
Department of Informatics, Faculty of
Mathematics and Natural Sciences,
University of Oslo, Norway
hannege@ifi.uio.no

Hanne Johnsrud
LINK arkitektur, Norway
hanne.johnsrud@linklandskap.no

ABSTRACT

Participatory design is based on the idea that those affected by a decision should get the opportunity to influence it. Addressing the imperative of climate change and the complexity of sustainable urban development requires collaboration and co-creation across disciplines, sectors and systems. Nonhuman participation and the innovation potential in designing with nature and integrating a concern for social, technical and natural systems do however remain underexplored. In this explorative short paper, we ask what it would take to take the needs of nature seriously, and to co-create with urban ecosystems. Taking street trees as examples, we discuss and reflect on what trees as participants might imply and open up for. We do that according to five fundamental aspects of participatory design. Pointing out directions for future research, we propose taking "the tree as method" as entry point for multi-actor explorations of the challenges and opportunities of street transformation across social, technical and ecological systems.[1]

KEYWORDS

participation, sustainability, urban ecosystems, trees

1 INTRODUCTION

Planetary boundaries set the premises for human development, but are already exceeded by human activity [1]. Where weak models of sustainability emphasise the triple bottom line and put ecology on the same footing as society and economy, evidence of human

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influence on the environment suggests that the stable functioning of the Earth's systems rather should be seen as a precondition for the global society to thrive [2-3]. Griggs et al. [2, p. 306] suggest that the sustainability definition of the Brundtland Commission [4] should be reformulated, to "development that meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends". Achieving sustainable development thus requires understandings and approaches that acknowledge natural limits and enable innovation with natural resources.

Cities are seen as holding a key role in achieving sustainable development. In 2014, 54 % of the world's population lived in cities, and by 2050, the share is expected to reach 66 % [5]. Europe belongs to the most urbanised regions (73 %), together with North America (82 %), and Latin America and the Caribbean (80 %). While exposed to changes in demography and climate change, cities may enable less environmentally impacting ways of life and enhance quality of life. Fostering sustainable urbanisation and making cities inclusive, safe and resilient places to live and work [6], requires changes in how societal functions are provided.

Cities depend on urban ecosystems to provide sustained conditions for life and human well-being [7]. European policy is currently bringing the innovation potential of natural systems into focus through strategies for nature-based solutions and re-naturing cities [8]. Nature-based solutions are inspired by, supported by or copied from nature, and designed to address multiple challenges while providing economic, social and environmental benefits. The European Commission [8] argues that they can contribute to sustainable urbanisation, restoration of damaged ecosystem, development of climate change adaptation and mitigation measures, and improved risk management and resilience.

In practice, and although approaches for valuing urban ecosystem services are proposed [e.g. 7], integration of nature in the urban setting is a challenge. Trees have been planted in public space for centuries and street trees may enhance resilience and quality of life through benefits such as biodiversity, local cooling, reduced air pollution, carbon dioxide uptake, flood control and improved human health and well-being [9-10], but do also add shade, reduced visibility, maintenance needs, and release airborne pollen. Urban space is valuable and subject to many and often conflicting concerns and interests [e.g. 11-12]. Streets are spaces for work, mobility and leisure, with technical infrastructures above and below ground, and not easily transformed.

Addressing complex challenges and governing urban sustainability transitions requires collaboration across disciplines

and sectors. Urban living labs and experiments where public and private sectors, science and civil society co-create are proposed [13]. Design is suggested as potentially having a key role to play in transitions and explorations of sustainable futures [e.g. 14-15].

In design, collaborative creative work is associated with fields such as participatory design and co-design. Here, we concentrate on participatory design, acknowledging the variation in term use and that fields overlap, albeit with different origins. The roots of participatory design stretch back to the Collective Resource Approach and the Scandinavian workplace democracy movement [16-17]. In the early days the emphasis was on improving working conditions and workplace democracy through trade union empowerment and worker participation in design activities. Over time, the scope has broadened, and participatory design has been brought into many different domains, including healthcare and urban development, and motivations may also be commercial. The term co-creation is frequently also used to denote generative work in which different actors collaborate. Sanders and Stappers [18, p. 6] define co-creation as "any act of collective creativity, i.e. creativity that is shared by two or more people".

In spite of the design emphasis on visualisation, materialisation and making, and the attention to sociomateriality in participatory design research [e.g. 19-20], approaches to participatory design tend to concentrate on human participants. Where other design fields such as design for sustainability take a more systemic and lifecycle-oriented perspective on design and change, there too, nature is subordinate to humans and technology. Emerging initiatives such as transition design are beginning to alter the equation, by addressing the protection and restoration of both social and natural ecosystems [e.g. 14].

In this reflection paper, we ask: what potential is there in bringing urban ecosystems to the fore, in using them as entry points to explore the potentials for synergy between natural, technical and social systems and dynamics? We challenge existing participatory design research and practice, following up on emerging initiatives [e.g. 21] to take nonhuman participation seriously. Taking street trees as examples, we reflect on how trees could participate in co-creation. We discuss what it would take for them to influence decisions affecting them, what the implications might be and what opportunities might open up.

Reviewing PDC research papers published in the period 2002-2012, Halskov and Hansen [22] identify five fundamental aspects of participatory design: politics, people, context, methods and product. Politics refers to the view that people affected by a decision should get the chance to influence it. When participating in design, their role is to act as experts on their own lives. Context is further a question about the situation of use, which is the starting point for the design process. Methods are the means by which users gain influence in design processes, whereas the goal of participation is to come up with alternatives and improve quality of life. Structured around an adapted version of these, we discuss and reflect on the current and potential role of nonhumans, and in this case, street trees, in participatory design and co-creation. Based on that, we propose questions and possible directions for future research.

2   TREES IN PARTICIPATORY DESIGN

2.1   Participants

In participatory design, people not trained in design are involved and contribute with their situated expertise [18,22]. Vines et al. [23] suggest that three main goals have motivated participation in design: sharing control and agency with technology users, sharing expertise, and inspiring individual, organisational and technological change. Halskov and Hansen [22] uncover great variation in how participation is defined and performed. It is either implicit, about user perspectives, or about mutual learning. Over time, participatory design has moved from involving users to involving people more broadly [22]. Much contemporary research concentrates on complex and dynamic situations of use, and may intentionally blur the distinctions between designers and "users".

In this paper, we ask how street trees may participate. With exceptions such as work with orang-utans [24] and explorations of the participation of birds [25], nonhuman participation has received limited attention beyond favoured topics such as design equipment, materials and design representations [21,26]. Theoretical perspectives such as Actor-Network Theory (ANT) have been mobilised to capture the sociomateriality of participatory design work and its role in shaping and staging participation, "making things public" or democratising matters of concern [e.g. 21,26-28]. Abandoning dichotomies between design and implementation or use, participatory design may for example be seen as about infrastructuring or staging of sociomaterial assemblies that evolve over time, and agency as emergent [19,26].

When discussing the participation of trees in design processes and urban environments we propose to think of agency in terms of the trees' ability to produce effects. We understand agency as distributed across ranges of heterogeneous actors [29]. Further, a tree is not a tree. Different species have unique characteristics, which play out differently in different contexts and over time, and make them more or less relevant as participants in specific projects. This is of consequence for the potential synergies and conflicts that may arise in relations with other participants and street elements, and opportunities for exploring them in a participatory design process. For example, poplars grow quickly, but have invasive fast-growing root systems developing near the soil surface [30]. Taking the path of least resistance, they may develop around pipes where the soil is less compact, lift up curbs, and make pavement crack [30-31]. The slow-growing oak becomes larger in diameter before creating conflict [30]. Oaks can reach great age, and serve as habitats for many other organisms [32]. The London plane thrives in cities and can shrug off its bark in what serves as a pollutant-cleansing process [10], but must be heavily pruned to not trap particle pollution at street level [33].

Urban site conditions, biodiversity and ecosystem service concerns and human requirements may influence the relevance of different species, and their opportunities for thriving [34]. Species can provide different services, and are part of urban ecosystems relating to other species – bacteria, birds and insects – and biochemical processes. Combinations of species and place, trees and broader systems, influence the potential for tree-related

benefits, and can cause unexpected problems [9-10]. Trees cannot voice their opinion, but their roots can penetrate water pipes, and root heave lift up pavement. Trees may contribute to increasing property value [35], and to processes of gentrification [36].

As participants contributing with their situated experience, trees might have preferences for sun conditions, street widths, surfaces, rooting space and water access. They bring with them daily and annual rhythms, and these will influence ideas about the speed of change and time horizons. With lifespans of hundreds of years in some cases, trees can connect to urban history, past and future generations, and may be seen as carriers of cultural heritage and historical ideas about place, urban life, design and planning. Consider the trees planted along Dutch canals or French avenues, or along a heated pedestrian street in Scandinavia, what they signify, have "seen" and lived, in terms of changes in urban life, biodiversity, soil and air quality and climate.

Deciding on whom to invite and inviting to contribute to street transformation projects from the perspective of the tree, the collection of participants might look different to business as usual. It might include ranges of other species, soil and water, sun and air, but also ecologists, arborists and landscape architects, those responsible for technical infrastructures and the built environment, street maintainers and green structure cultivators, as well as local residents, businesses and passers-by. Placing the street tree centre stage might engage new actors and make others unwilling to participate. It may lead to innovation triggered by the formation of novel alliances, and it may cause conflict that can both obstruct collaboration and generate productive friction, for instance by challenging current ways of distributing and executing power.

2.2 Context

Participatory design has entered new domains and contexts have broadened from specific workplaces to the general public [37]. Possible participants form less clearly defined groups [22].

Streets are composed of heterogeneous elements above and below ground. There are physical elements such as pavements, bike lanes and car-parking spaces, asphalt and curb stones, outdoor restaurants, signs and security cameras, garbage bins, pipes and cables, and street-users such as cats, children, pigeons and bumblebees, buses, trams, delivery trucks and snow ploughs. They influence the opportunities for planting trees, and for them to thrive. So do regulatory and institutional contexts for street transformation, and the practices and interests of property owners, cities, electricity utilities and transport companies.

A street is a physically defined context, but always undergoing change. Sassen [38] describes cities as complex, but incomplete systems, which can outlive much more powerful and formalised systems such as corporations and governments. This is also the case for urban streets. While shops close and open, buildings are constructed, renovated and torn down and residents move in and out, the street itself may remain for centuries and even millennia, with visible traces of the historical development; Wi-Fi networks and sensors on top of historical infrastructure no longer in use.

Street use varies throughout the day, week and year, as do weather and climate conditions and maintenance routines. The incompleteness of urban environments, and the value of not trying to close and control, but open up for change becomes even more present and visible with the street tree as the main actor. A tree is a living thing, growing and changing with the climate and its environment throughout its lifespan. This may help making streets and cities more resilient and for example help handling extreme weather events, but may be in conflict with technology-oriented ways of thinking about and developing infrastructure, and ambitions to monitor, control and optimise the performance of urban systems. Inadequate landscape design or species selection may lead to higher maintenance costs, and species not native to an area can influence local flora and fauna negatively, as can the lack of diversity in tree populations [34,39].

2.3 Politics

In participatory design, politics has traditionally been about equalising power relations and giving the invisible or weaker a voice [22,40]. Halskov and Hansen [22] find the meaning of politics to have expanded with changing contexts and user constellations. Binder et al. [26] argue that working with broad societal issues of public concern challenges assumptions about stakes and stakeholders, legitimate participants and selection criteria. They suggest to re-envision collaborative design as democratic design experiments with politics and power at the core, advocating a designerly approach where making proposals contributes to the co-evolution of issues and publics.

The rights of nature have been subject to debate for decades. In 1972, Stone proposed to give legal rights to "natural objects" such as forests, oceans and rivers, finding nature to essentially be rightless [41]. Ecuador recognised the rights of nature in 2008 [42]. Since then, countries such as Bolivia have followed, rivers in New Zealand and India have gained legal rights, and in 2018, the Amazon was recognised as a subject of rights [42-43].

In addition to debates about rights and development of approaches such as nature-based solutions for environmental management in science, policy and practice [e.g. 44], within urban development green areas and structures are in many contexts also a concern in legal frameworks, master plans and zoning plans. This is an area subject to conflicts, for example between goals about densification and conservation of green areas and structures, and between different motivations for urban greening, such as recreation versus biodiversity concerns [45].While greening cities by planting trees, much like participation, may be thought of as a taken for granted good, there is more to it. Trees may contribute to urban sustainability, but urban environments may also threaten them and undermine their ability to provide benefits [9].

How can democratisation of urban design respect the intrinsic value of ecosystems and enable conservation and restoration so cities can benefit from their services? Democratisation is no guarantee for sustainable urban development, but giving ecosystems a place at the table and using participatory design methods to co-create with them is a starting point for addressing complex dilemmas, balancing concerns and interests and exploring and making the most of site-specific potentials. Trees are demanding participants in urban development. Late in a

process of street design it is difficult to accommodate their dynamic needs. The consequence can be that trees are removed from the plan, and perhaps replaced with less troublesome greenery, such as flowerboxes. A commitment to urban ecosystems will thus require that trees are taken seriously as co-creators, rather than approached as token greenery.

2.4 Methods

Methods for participation and co-creation are seen as means for "users" to gain influence [22]. Ways of enabling participants to express their needs and alternative visions, e.g. in games, workshops and activities of making, are continuously explored. Making, for example through probes, generative toolkits, visualisation and prototyping, is seen as key to accessing tacit knowledge, understanding the present and making sense of and developing proposals for the future [19,46]. Different domains, constellations and conditions may require different methods.

Rice [21] suggests that nonhuman participation may happen in three ways: through substitution, mediation and communication. Nonhumans may substitute or work as a proxy for human action, as in how speed bumps replace humans. Non-humans may further mediate human behaviour, in the way that phones enable talking over distance. Finally, they may communicate with humans, be signs that tell them information and messages, as in semiotics.

Here, we propose taking the tree as method, both as means for trees to gain influence [cf. 22], and, as an entry point for working across systems. Working with nature highlights the continuously changing urban environment. Different strategies may be needed to give trees a voice, to study and work with relations between trees, different species, and between ecosystems and other elements, and learn about how trees cope, what they need and can offer. Site visits can be made to study trees living under different conditions at different life stages. Trees can be represented in workshops, or be temporary installations in urban experiments to see what new street elements and layouts open up for over time. Using the tree as method for co-creating with urban ecosystems also entails engaging the tree's capacity for interspecies communication. Urban ecosystems consist of a plethora of species and biological processes. Many of them, such as microbes or the photosynthesis, are invisible to human beings. Others, such as rats and fungus, often evoke disgust. In contrast to this, trees are highly visible, they are rarely aesthetically offensive to people, and they are commonly used as symbols for positive phenomena. Hence, trees can serve as a proxy for species and processes that humans find it difficult to relate to, and this capacity for spanning the boundary between the socio-cultural and the natural realms makes them valuable allies in co-creation with urban eco-systems.

2.5 Product

Tree-centric cities can benefit from improved air quality and increased biodiversity. Green streets and parks can also boost citizen satisfaction. An important product that can come out of using the tree as method for co-creating with urban ecosystems is cities where green structures are included from the very beginning of planning processes. Including trees early can for instance result

in underground structures that let root systems unfold without damaging underground pipes or cables. Such interventions can be difficult or impossible to include when water utilities and telecom providers have finalised their underground architecture. Trees given the opportunity to co-exist in harmony with their built environment are likely to be a lesser budgetary burden than trees needing frequent maintenance and replacement due to ill-health.

The outcomes of participatory design are not always products, but can be a change of mindset among participants [22]. Foregrounding ecosystems in design of urban space can be an intervention into a dualistic worldview that sets human beings apart and above their material and natural surroundings. Infrastructure constitutes an artificial environment that provides city dwellers with a domesticated version of properties of nature [47]. This adds to a sense of being in control of nature that has fostered an exploitative attitude to the environment. Inviting trees to set the agenda in street development can provoke articulations of implicit assumptions about human-nature relations. Such articulation is an important step towards much-needed change.

3 CONCLUSION

Participatory design emerged from the idea that those affected by decisions should have a say in the process of design [19,22]. Sustainable development, also in the urban context, requires respecting and working within planetary boundaries, and with ecosystems. In this paper, we have challenged the lack of attention to nonhumans, and more specifically ecosystems, in participatory design. Departing from fundamental aspects of participatory design, we have argued that seeing nonhumans as participants may enhance understanding and open up for innovation. We have illustrated how taking the tree as method can be an entry point to uncover and explore the interrelatedness of social, technical and ecological systems, associated conflicts and synergies, and opportunities for sustainable urban development.

In line with some human participants, ecosystems cannot voice their opinion on their own, and it is up to their co-designers to find ways of inviting them. Participation alone does not guarantee a sustainable development. Given the complexity of sustainability challenges and the actual agency of ecosystems, initiatives run the risk of failing and missing out on opportunities for learning and developing successful interventions if they are excluded or not listened to. We see taking the tree as method as a promising avenue for future exploration, and one that, taken seriously, would have implications for research, education, policy and practice. When no longer working to decouple ecosystems from urban society but emphasising the interdependencies, what new opportunities can open up? What would the implications be for processes and practices of urban design and planning? What could a tree-centred road engineering curriculum look like? What visions for urban futures will emerge, with trees involved? What services, experiences, practices and species communities may collectively reimagined streets open up for? We will continue exploring such questions, and hope that our contribution can broaden the debate on nonhuman participation and the challenges and opportunities of designing and living with urban nature.

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