Opening up new cognitive perspectives on sustainability transitions

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Including microbes in urban planning

How can we work with a new cognitive perspective to urban transitions?

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Abstract

This project seeks to open up the possibilities of cognitive perspectives for urban sustainability transition. In an effort to do so worldmaking is introduced as an artistic theoretical perspective. Urban nature is explored as a case for worldmaking and urban microbiome is chosen as an object of worldmaking. It thus strove to design an engagement to mobilise urban microbiome as an object of worldmaking for urban transitions. A speculative engagement was designed and facilitated to create worlds with urban actors and microbes as the principal object of the world. This was done in collaboration with an urban nature design studio based out of Copenhagen i.e. SLA. The project was successful in mobilising SLA by sparking interest in urban microbiome. Thereby demonstrating the mobilisation of worldmaking as an artistic cognitive approach to augment sustainability transition theories.

Keywords: sustainable transitions, worldmaking, art, urban nature, urban microbiome

Introduction

There is an urgent need to identify values, goals and paradigms which can help develop epistemologies, that guide us design and materialise sustainable futures (Hillgren et al., 2020). The multifaceted nature of the crisis in today's world demands the need for transformative change to mitigate the catastrophic effects of humans on the planet. Transformation here refers to the "fundamental changes in structure, function, and relations at the personal, political and practical spheres of interdependent social, ecological, and technical systems, leading to new patterns of interactions and outcomes" (Heras et al, 2021, p. 1876). This transformation requires the creation of new epistemological approaches to understand the world and make interventions (Tironi et al., 2022).

Sustainability transition theories, one approach to address the required transformation, provide frameworks to understand past transitions and design future ones (Sovacool & Hess, 2017). Socio-technical transition theory (Frank W. Geels, 2002) has a focus on systems (energy, mobility, agriculture) - conceptualised as socio-technicals: which cater to societal functions. Although the theory encompasses technology, cultural practices, markets, regulations and infrastructures, they are locked-in social science and techno-engineering tools and the other cognitive elements are very poorly understood (Unger 1987; Harvey 2000; Kirsey 2013). One of the least explored components of transition thinking is the cognitive elements. They are mentioned but they are not really developed. What I intend to do through this project is to open this black box. I challenge the ontological exceptionalism of the socio-technical perspective in planning and introduce a new epistemology from which the crisis can be addressed. I try to understand and provoke the cognitive components and mobilise them for urban transitions. Thus my research question is:

How can we work with a new cognitive perspective to urban transitions?

Here I introduce worldmaking as a new cognitive way to approach sustainability transitions. An approach that is grounded in artistic practices. It involves the cognitive constructivist view that uses art as a medium to construct and represent fictional worlds. It does not concentrate on fictional worlds per se but rather on exploring the fictionality inherent in actual worlds (DiGiovanna, 2007; Goodman, 1975).

It is important to clarify that this is not an attempt to refute the transition theories that are indispensable to sustainable transitions. Rather this is an attempt to augment the epistemologies and strategies that work toward sustainability.

I explore this using urban nature as a case as it is a cognitively open ended phenomenon. Ecology in itself cannot be pinpointed. It can be understood in a myriad ways. We all understand urban spaces in very different ways - it is very imaginative. Urban planning, however, includes very few non-technology based cognitive perspectives in its planning processes. Although it has been developing over the years, it's neither growing nor substantial (Borrup, 2017; Stevenson, 2005; Mills 2003).

Through my mapping and analysis of worldmaking efforts by urban nature companies I find urban microbiome as a potential object of worldmaking efforts. Subsequently, I explore this object to understand its potential to address urban transition. Through my findings I conclude that it adequately addresses concerns of urban sustainability mobilised by urban nature agents. I then go on to design a speculative design engagement to demonstrate the worldmaking potential of urban microbiome and their ability to address urban transition.

By collaborating with an urban nature company I was able to mobilise urban microbiome as an object of worldmaking for urban transition. In doing so I demonstrate the capabilities of a new cognitive perspective to urban transitions.

Reading guide

Theory

Worldmaking: In this chapter worldmaking is introduced as a cognitive, relativist and constructivist theory that can address urban transitions through artistic practices.
Worldmaking as a descriptive tool: Here I transform worldmaking into a descriptive tool to understand various worldmaking efforts at different stages throughout the project.
Worldmaking as a provocative tool: Here I transform worldmaking into a provocative tool to open up new avenues for urban governance

Analysis Established worldmaking efforts

Introduction: In this chapter I intended to map the existing worldmaking efforts by 4 different urban nature agents in copenhagen and identify a potential object of worldmaking for urban transition
Methods: I do this by firstly using worldmaking as a descriptive tool to map existing worldmaking efforts by urban agents.

Secondly, I use worldmaking as a provocative tool to provoke different worldmaking objects and analyse them to identify a potential worldmaking object.
Results: I could see different configurations of representations, mobilisation of concerns and action promoted by 4 urban agents in their worldmaking efforts.
Subconclusion: By mobilising worldmaking as a provocative tool I conclude that microorganisms are an interesting element missing in their worldmaking efforts and that their potential for urban transition, through worldmaking, needs to be explored.

Exploring urban microbiome as an object of worldmaking

Introduction: In this chapter I intended to explore the potential of urban microbiome as an object of worldmaking.
Methods: I do this by firstly looking for literature on worldmaking efforts by urban planners in the past, with microbes as an object of worldmaking. Here again I use worldmaking as a descriptive tool to map their representation, mobilisation and actions. I then look for literature on the latest findings and worldmaking efforts around microbes. I do this by 1) looking for concerns mobilised and 2) actions that are performed by various actors.
Results: I could see the configuration of representations, mobilisation of concerns and action promoted by urban planners in their worldmaking efforts in the past which mobilised a negative connotation around microbes. I could also see that the latest findings suggest that microbes could address the concerns mobilised by urban agents that I identified in the analysis section. Additionally, I found out that actions performed in the present, with microbes as an object of worldmaking are restricted either to global actors or to researchers and enthusiasts, but not urban planners.
Subconclusion: I conclude that urban microbiome is an important object of worldmaking to address urban transition.

Designing a worldmaking intervention

Introduction: In this chapter I intended to design an engagement to mobilise urban microbiome as an object of worldmaking for urban transitions, in collaboration with an urban nature agent.
Methods: I use speculative design as a method to design an engagement and collaborate with SLA (urban nature design studio in Copenhagen).
Results: I facilitated an engagement with SLA and mobilised urban microbiome. I present the findings from the engagement and review the design of the engagement to provide suggestions for improvement.
Subconclusion: I conclude that the engagement was successful in mobilising urban microbiome as an object of design with SLA.

Discussion

Here I look back and discuss the decisions and choices that I made at different stages throughout the project.

Conclusion

Here I conclude that I have demonstrated an approach to answering my research question i.e. I have, through the introduction of worldmaking as a cognitive theoretical perspective, mobilised urban microbiome as an object of worldmaking, to address urban transition.

Theory

Worldmaking

At the very onset the term 'worldmaking' might lead the reader to speculate and wonder its meaning. Is it the construction or building of the physical world that we inhabit? Or is this something of the likes of the creation of a J.R.R. Tolkien fantasy?

The world that we are born into is too large and too complicated for even the likes of us humans - geniuses as we may consider ourselves, compared to other species. In an effort to make sense of the world that we interact and engage with, we create different worldviews. Nelson Goodman in his 1978 pioneering text: 'Ways of World-making', argues that differing worldviews are in effect different worlds. We create or make worlds, based on our experiences and knowledge. It is our own way of understanding the world through activities such drawing boundaries, categorising and grouping.

This worldmaking is a cognitive phenomenon as opposed to a materialist one. There is no actual addition or physically putting together of stuff to create the world. They are products of our conceptual activities such as language or other representational systems or as Goodman puts it symbols and symbol systems. It is making not with hands but with minds. This, however, puts forth an implicit limitation to worldmaking by virtue of our intent, knowledge and cognitive abilities.

Goodman goes on to argue that we inhabit multiple worlds. At the first instance such a notion may seem counter intuitive. How can there be multiple worlds or even multiple cognitive products when there is one real world that we experience? There should be only one true description or representation of the world, like on the walls of the Sistine chapel as claimed by the church in the middle ages. However, since world-making is born out of the cognitive processes it is relativistic and subjective. We have different accounts of the world. Some of which contradict but are still right. An example of this can be seen in the sciences where there can be different theories to explain the same phenomenon. Newton's theories are used to explain phenomena in the physical world, forming the basis of middle and high school mechanics syllabuses. However, Einstein's theory of relativity, an equal or in fact better description of physical phenomena, co-exists with the former .

Even one's own understanding and hence making of the world evolves over time as one acquires new knowledge. It is continuously being constructed by virtue of our sceptical and analytical disposition. For instance, a description of the temperature of the surroundings will instantly vary after having a cold dip in the sea. Thus Goodman posits that the world we come to understand and make is not something waiting to be discovered but is created as we start making sense of it.

In this way worldmaking is neither physical nor fantastical; it is philosophical. Where varying worlds are ontological realms produced as a result of a cognitive relativist constructivist view.

There are thus several, as Goodman calls them, versions of the conceptual world. A version is any description, representation or depiction of reality consisting of symbols in any medium: words, pictures, numbers, etc. Different modes of inquiry such as scientific , economical or artistic can create versions which in turn comprise symbols that represent things in the world. Eg: Ptolemy's geocentric model and Copernicus' heliocentric model or Rayworth's doughnut model or Van Gogh and Canaletto's paintings. A version carves out the attributes and behaviour such as individuals, kinds, relations, etc. Once we acknowledge the existence of multiple valid versions, unity can still be achieved, not through some neutral foundation underlying these versions, but through an overarching organisation that encompasses them all.

A natural intuitive question which follows then is: what is the world like independent of its description or representation? The answer is: nothing can be said. There cannot be a world (conceptual) independent of the version. This radical argument could be too philosophical to grasp, hence Goodman provides us an example, where he asks us to imagine him in waiting room, where he makes out two speakers built into the bookcase, a receiver and a turntable in the corner cabinet and a remote control switch on the mantel, in other words he found a stereo system. This would seem like a version independent system. However, he draws our attention to the fact that he had to constructively isolate the component from other objects in the room and connect them together through prior knowledge. In sharp contrast a person from the deepest jungles would not be able to make the system because they would be even able to recognise the components as part of a larger whole. The person will not be able to construct the world. The person will not be able to make the world. To phrase more technically, they will not be able to create the system of symbols i.e versions. They will not be able to create the ontological realms i.e worlds.

Worldmaking thus refers to the ways we collectively make the spaces we inhabit through symbolic practices. It is a continuously evolving process which is propagated by the beliefs and values which individuals have, which are not questioned or challenged but assumed as a condition.

Why world-making for sustainability transition?

The call for transdisciplinary practices

Sustainability requires the creation of new knowledge for new ways of understanding the world and our agency in the same; and new knowledge is created when new relations are delved into (Heras et al, 2021). Several studies in sustainability science have highlighted the importance of arts in sustainability research (Pereira et al. 2019; Heras 2015) to bring about societal transformations and the need to address the lack of transdisciplinary practices (Heras et al, 2021). In this section I emphasise that socio-technical transition theories are rooted in technology studies and their cognitive elements other than technology are not substantially mobilised. I present worldmaking as an approach which mobilises artistic based practices.

Socio-technical Transition theory as a technical practice

The Multi-Level Perspective (MLP), also known as Socio-Technical Transition theory, asserts that persistent societal problems arise from unsustainable production and consumption practices. These issues cannot be resolved through technological fixes or incremental improvements alone. The development of new products, services, or systems is not considered a sustainable transition unless it moves towards a radically sustainable future. There is a necessity for a profound shift in socio-technical systems towards sustainability. Such shifts are referred to as sustainable transitions (Köhler et al., 2019).

The theory posits that "transitions occur through dynamic processes within and between three analytical levels": the regime, the niche, and the landscape (Köhler et al., 2019, p. 4). The regime encompasses the broader set of socio-technical processes, including established industry structures, dominant technologies and infrastructures, guiding principles and socio-cognitive processes, markets and prevailing user practices, public policies, political power, and cultural significance. The niche represents an alternative sustainable socio-technical system that, if it grows sufficiently strong, could supplant the current dominant system. Lastly, landscape influences are external forces acting on the regime, such as climate change, overpopulation, globalisation, etc. Niche innovations can rise to dominance if external pressures on the regime create cracks, tensions, and opportunities.

The analytical framework integrates concepts from evolutionary economics, science and technology studies, and structuration theory and neo-institutional theory (Geels, 2004; Geels and Schot, 2007; Geels and Schot, 2010). However, this framework has not yet substantively challenged the ontological exceptionalism of technology in planning. The demand for greater imagination is evident across many disciplines. (Unger 1987; Harvey 2000; Kirsey 2013).

Worldmaking as an artistic practice:

Worldmaking has been proposed as a uniquely intriguing art practice, distinct from traditional forms such as fiction, drawing, and painting, although it incorporates elements from all these mediums. While worldmaking is often an integral component of novels, stories, comic books, and visual art, it is crucial to recognize that in these contexts, it constitutes a part of the artistic creation (DiGiovanna, 2007; Goodman, 1975).

In contrast, Goodman's concept of worldmaking presents an epistemological model that operates in a fundamentally different manner. Goodman's worldmaking involves the creation of fictional worlds where art forms like maps or paintings are employed to construct and represent these worlds. This approach does not focus on fictional worlds per se but rather on exploring the fictionality inherent in actual worlds (DiGiovanna, 2007).

Intermediate conclusion:
In this sub-section I have introduced worldmaking as an artistic approach to sustainability transitions. This is presented as a new way to understand the world as opposed to socio-technical transition theories. It is important to clarify that this is not an effort to refute the transition theories

which are essential for sustainable transitions. Instead, it aims to enhance the epistemologies and strategies for addressing sustainability.

How is worldmaking used in the project?

Goodman chalks out 5 ways of worldmaking which are neither exclusive nor exhaustive and can happen in conjunction, through cognitive constructivist approaches of composition and decomposition to break down a greater whole to smaller tangible attributes; weighting to emphasise, ordering to organise the elements in neat categories; deletion and supplementation to fill gaps in the organisation & deformation to fit attributes together in a new system of whole (Goodman, 1975; Charlton & Goodman, 1980).

I transform these into two tools to make them mobilisable for urban transition in my project: 1) as a descriptive tool and 2) as a provocative tool.

Worldmaking as a descriptive tool

Worldmaking is used as a descriptive tool to read and understand urban reality. This is classified into 3 sets: representation, mobilisation and action.

Representation

This set of tools refer to the ways in which urban agents define the worlds. These are derived from Goodman's ways of composition, organisation and deletion & supplementation. Through these ways urban agents represent the worlds that they make. I break it down into 4 components:

Cognitive techniques: This refers to the ways in which actors illustrate worlds. Includes techniques such as making drawings, picturesque artworks, masterplans, written descriptions, conceptualisations, Augmented Reality (AR) holographic images, Virtual Reality (VR) holographic images, AI renderings, Hands-on models & mapping exercises. They are thus as varied as the medium of representation and visualisation: the arts - in its broadest sense, with its full spectrum of modes of expression.

Scale: This is based on size. I classify it on 4 levels:

- global: the city as part of global and regional ecosystems
- macro: cityscapes where humans interact with built environment like lakes and parks
- mini: very small ecosystems where insects and bugs thrive
- micro: city with the invincible micro organisms

Temporality: This is based on time.

- Past: mobilising the past to say that we should design like this today
- Present: mobilising the contemporary to say that we should design like this today
- Future: Mobilising the future to say that we should design like this today

Sense of Future:

- Utopian: worlds which are modelled as perfect
- Dystopian: worlds which are modelled as imperfect

Mobilisation

This refers to the set of ways in which urban agents mobilise concerns, involve or exclude actors. They are derived from Goodman's ways of: weighting to emphasise and deletion & supplementation. This is the way urban agents perform politics in their worlds. I break it down into 3 ways:

Mobilisation of concerns: This refers to the concerns i.e. matters of interest and importance that agents create through their worldmaking activities.

Actors

- Living
    - Humans
    - Trees & plants
    - Animals: birds, reptile, amphibians, fish, insects
    - microorganisms
- Non-living:
    - rocks, soil, water, air
- Buildings, facades, rooftops
- Ecosystems (eg: parks, lakes, etc.)

Actions

This refers to the set of ways in which urban agents promote urban engagements. They are derived from Goodman's ways of organisation and deformation. This is the way urban agents suggest what actors and resources should be used for.

Where is it used in the project?

At different stages of the project urban planning and design efforts are seen as different worldmaking efforts. Worldmaking as a descriptive tool is used to identify and study the present worldmaking efforts by urban actors in Copenhagen, worldmaking efforts of the past and also during the design engagement where the speculative efforts of the participant are also seen as worldmaking efforts.

Worldmaking as a provocative tool

Worldmaking as a provocative tool is used to open up new avenues for urban governance. I create 3 sets of provocative techniques as presented below:

Scale: refer to different types of actors as per their size

Instruments: refers to different techno-scientific instruments can be used to for interesting ways of knowing and interesting ways of representing

Senses: refers to dIfferent human sensory experiences:

Where is it used in the project?
Worldmaking as a provocative tool is used to find a potential object of design for urban transitions through worldmaking in the analysis of worldmaking efforts.

Limitations:

Worldmaking might be tricky to understand.

As touched upon earlier worlds are limited by one's intent, knowledge and cognitive abilities. The creation of worlds is rife with insufficiencies. There are no constraints on who can come up with what, people can stir things out of thin air. People can lie saying things, everything becomes too subjective! This position is radical relativism, radical constructivism and completely counter intuitive.

It is difficult for two people to agree on something as a version. And how do you testify what a true version is? This might also be a problem in the urban planning context when different actors understand the same phenomenon in different ways. It can also be a problem when people need to come together to agree to a plan. Not that different worlds cannot exist together but the inherent possibility of pluralism also creates tensions and wastes time in discussions over disagreements(Kukla, 2013).

There is also the question of authority. Who gets to decide what the world should look like? Is it the common folk or the experts or the government? Who decides the rules of the game?!

Analysis of worldmaking efforts

Introduction

The aim of this chapter of the project was to map the existing worldmaking efforts pertaining to urban nature and identify an object of design for urban transitions through worldmaking.

Method

Firstly, I Identified key urban nature agents involved in the promotion of urban nature in Copenhagen. In order to limit the analysis to a manageable level, I decided to limit my research to Copenhagen. Descriptive qualitative data from various agents in the form of plans, strategies, artwork, etc was collected and analysed. Worldmaking as a descriptive tool came in handy as a way to identify the different worldmaking efforts.
This data was collected by visiting the website of various agents and looking up for plans or projects or cases (as called by different urban nature agents). Details of the agents and websites visited are provided below.

Secondly, the data that I collected was analysed using the descriptive approach that was built through worldmaking, viz., representation, mobilisation and actions. This was done to understand the dynamics of the different worldmaking efforts. Further analysis of the data was done to identify a gap using worldmaking as a provocative tool.

The method, though, comes with its own limitation. This kind of data might be always present and is subject to change or vanish over time. Also, I haven't exhaustively looked at all the urban nature companies in Copenhagen. Interviews or surveys of different agents could serve as alternative methods.

Urban nature agents in Copenhagen

I identified the relevant agents and analysed their worldmaking efforts using worldmaking as descriptive tool along the following categories

Urban nature agents and their websites:

Urban nature agent	**website**
Copenhagen municipality	https://urbandevelopmentcph.kk.dk/urban-planning/urban-nature
SLA	https://www.sla.dk/cases/
Tredje Natur	https://www.tredjenatur.dk/portfolio/
EVM Landskab	http://evmlandskab.dk/projects/

Findings

The worldmaking efforts of Copenhagen Municipality

Representation:
The worldmaking efforts of the municipality of Copenhagen are in the form of written descriptive visions of what the city should be like in 2025. Copenhagen aims to be carbon neutral by 2025. The worlds can range from a solitary tree in the dense city to wild mashy nature along the fringes. They create two sets of conceptualisations: one is city likeliness which includes such spaces as: green bicycle paths, facades, rooftops, street trees, etc. This is further subdivided into urban & streetscapes and parks & cemeteries. The other is nature likeliness: this includes the likes of marshy areas, fringe lands, bird islands, etc. In their utopian worldmaking efforts they work across global, macro and mini scales while mobilising temporal elements not just in the future but also in the past. Preservation of old, culturally and environmentally valuable trees and green spaces also find a role in the efforts. Another important decision is called the 'Green Copenhagen' passed in 2009 which aims to preserve the green spaces as they were in 2008 to prevent them from being gobbled by construction activities.

Mobilisation:
The municipality through their multitude of efforts mobilise a range of concerns. They intend to create a carbon neutral city shows their effort to mobilise concerns on a global scale viz. climate change. Secondly there is also a mobilisation of human needs: well being, health, leisurely activities and aesthetic & spacial experiences. This is done through the creation of parks, harbour fronts, and lakes - which are indeed a noteworthy feature of the city of Copenhagen. They also mobilise biodiversity. With a focus on ecosystem services that nature provides in the form of temperature, air quality and noise reduction.

Actions:
The municipality's plans are way too many to cover here so I will mention some prominent ones. Planting trees is a major endeavour of the municipality. They plan to plant 100,000 trees in Copenhagen by 2025, among other urban engagements such as green terraces, facades and rooftops. They have spaces that they have identified for these actions: municipal areas, urban development areas, municipal land and non-municipal land. They have also developed a greening tool with which to assess the quality and quantity of urban nature in public spaces. It also assesses the economic benefits of such spaces. Additionally, they have created a catalogue of urban nature solutions that they use to disseminate knowledge, discourses and practices.

The worldmaking efforts of SLA

Representation:
SLA is an urban nature design studio. A quick scrolling through their website exhibits an assorted gallery of visions. From individual boulevards to people biking and running across a space with scattered trees, herbage and foliage. These are usually in the form of picturesque and poetic

images accompanied by description of location, size, year and collaborators (if any). The important part of their visions is a focus on all life. Their utopian worlds are meant on the global, macro or mini scale - ranging from master plans of cities to courtyards with fallen trees to be a host for multifarious tiny organisms. Their effort exclusively lies in mobilising the future to inform what we should do in the present. Moreover, they do analysis and mapping of existing species to create a database of species in a specific location, including creating a national plan for Denmark. This would serve as a useful tool with which to measure, compare and evaluate city nature.

Mobilisation:
Through worldmaking they mobilise various concerns. Master plans of cities and districts & also storm water management ecosystems are presented as solutions to climate change. Whereas human health and well being is addressed through the creation of streets, courtyards and commercial spaces. SLA intends to design for 'all life'. However, all life is not necessarily a conscious object of design. Although they do cover a lot of living organisms in their design of spaces, including: plants, animals, insects, birds and humans; yet aquatic life and microorganisms are not a conscious design object. In a way it can be argued that creation of ecosystems and wilderness hosts microbes but that can be argued for any space as microorganisms are ubiquitous. They are missing in the sense that they are not the object of design for designers. They do not mobilise any concerns through microbes. A similar argument can also be posited for harbour fronts and aquatic life.

Actions:
SLA promotes urban engagements in 3 ways. Through the construction of physical spaces in the form of master plans, landscapes (lakes, parks, gardens), courtyards, green rooftops and green facades. They also use their representation to disseminate knowledge & sparking debates and discussion. This serves them well as this results in the building of discourses which boomerangs back to them in terms of creation of new markets. They do this through exhibitions and community engagement. And finally, they also create plans and strategies for their clients who intend to have or expand green spaces.

The worldmaking efforts of Tredje Natur

Representation:
Tredje Natur, very similar to SLA, is involved in designing urban nature exploring the 'territory between buildings and landscapes'. They too make picturesque artworks and master plans with rich descriptions as part of their descriptive activities. Working mostly on a global and macro scale and creating utopian visions they present alternate futures and the world (physical spaces) that we should build. These can extend from parks or schools right up to complete districts, which they have already made or which are proposals for the utopic future.

Mobilisation:
Climate change concerns play a pertinent and prominent occurrence in the prolific worlds on their website. Mobilising not just plants and animals rather entire ecosystems - in effect presenting the city as a regenerative ecosystem. On the other hand, human well being and community building is also mobilised through the creation of worlds such as public spaces such as boulevards, hospitals

and stadiums. Their mobilisation of actors, though, is not as broad as SLA. Mobilising mostly living organisms and non living actors but missing out large on microorganism, aquatic life and rodents. Here again the argument is that organisms should be an object of design and at the same time be used to mobilise concerns.

Actions:
Their promotion of urban engagements although numerous - mostly building infrastructures coupled with green terraces or facades or gardens - are mostly limited to building infrastructural products to be sold. They also showcase their worlds in exhibitions to disseminate knowledge and create markets. Remarkably, the UN development programme had acknowledged and invited them to present a lecture on sustainable development.

The worldmaking effort of EVM Landskab

Representation:
Also an urban nature design studio, though relatively smaller than SLA and Tredje Natur and having fewer visions on their site, have a really innovative and democratic approach to urban nature by focusing on planting design. Besides the usual images, descriptions and drawings, they have taken things a step forward by creating an Augmented Reality (AR) hologram which allows one to see the 'possibilities and potentials of planting trees' in a selected space. This really stands out as other studios have not introduced anything like this. They restrict their utopian worldmaking to the macro scale - designing parks and gardens and do not work on the global - city scale.

Mobilisation:
EVM are focused on mobilising biodiversity as the chief concern. Mobilising knowledge from landscape architecture and biology they strive to build spaces for human nature interactions. This is done to demonstrate the magnificent role and genius of natural processes in cityscapes. Health and psychological benefits of green spaces are also highly emphasised, finding a place in all of the descriptions. Since they are new and work on a macro scale, specific focus on micro life, aquatic life and rodents are pacified in their worldmaking efforts.

Actions:
Construction of urban spaces like gardens and parks are the principal form of urban engagement that is promoted but at the same time is very well balanced by the knowledge dissemination and sparking of debates. They publish books and research articles on creating cities through landscapes, street trees and the value and building of cemeteries. They have also designed exhibitions where they introduce people to the wisdom they can get from gardens.

The worldmaking efforts of the 4 urban agents are summarised in the table below:

		Copenhagen Municipality	SLA	Tredje Natur	EVM Landskab

Representational	**cognitive techniques**	Green Copenhagen (2008)
		
		Written description of visions
		- more urban nature
		- improving the quality of urban nature
		
		Conceptualisation:
		- city likeness (eg: green facades):
		  - urban and streetscapes
		  - parks and cemeteries
		- nature likeness (eg: fringe lands)
		  - nature areas
			Visions:
			- picturesque images with descriptions
			- masterplans
			- Hands-on models
			- mapping city nature
			
			Mapping of city nature
				Visions:
				- picturesque images with descriptions
				- masterplans
					Visions:
					- picturesque images with descriptions
					- drawings
					
					- Augmented Reality (AR) holographic images

	scale	Global Macro	Global Macro Mini	Global Macro	Macro scale Mini
	temporality	Past (eg: preserving old and culturally valuable trees) Contemporary present (Green Copenhagen) Future green and blue spaces	Visions of future	Visions of future	Visions of future
	dystopian / utopian	Utopian	Utopian	Utopian	Utopian
Mobilisational	**concerns mobilised**	Climate change Health and well being Leisurely activities aesthetic and spatial experiences Biodiversity - Ecosystem services - Microclimate of city: temperature, air quality and noise	Climate change Health & well being Leisurely activities All life	Climate change Well being Balance of humans with nature	Biodiversity Human nature interactions Leisurely activities

	Actors who are being mobilised	Living: - humans - Trees (predominantly) & plants - Insects Non living: - rocks, soil, water, air - fringe lands Ecosystems (eg: parks)	Living - humans - trees & plants - birds - insects - fungus (eg: mushrooms) Non-living: - rocks, soil, water, air Buildings and bridges Ecosystems (eg: parks)	Living - humans - trees & plants - birds Non-living: - rocks, soil, water, air Buildings and bridges Ecosystems (eg: parks)	Living - trees & plants - birds Non-living: - rocks, soil, water, air Ecosystems (eg: parks)
	Actors who are pacified	Micro scale life Aquatic life (in lakes and along the harbour) Rodents	Micro scale life Aquatic life Rodents	Micro scale life Aquatic life Rodents	Micro scale life Aquatic life Rodents
Action	**urban engagements promoted**	Plans and strategies, more: - 100,000 trees by 2025 - green courtyards - green facades - green roof tops Green planning tool Urban nature fund Disseminate knowledge & spark debate and discussion - catalogue of urban nature solutions	Products to be sold - landscape architecture - courtyards - green roof tops - green facades Disseminate knowledge & spark debate and discussion - exhibitions - community engagements Plans and strategies	Products to be sold - Landscape architecture - regenerative cities Disseminate knowledge & spark debate and discussion - exhibitions Plans and strategies	Products to be sold - landscape design - planting design - garden and parks Disseminate knowledge & spark debate and discussion - exhibitions - community engagements - books and articles

Summary of descriptive analysis:

The numerous worldmakinging efforts have used various kinds of representations, usually in the form of but not limited to, images with descriptions to create worlds. The efforts are done from the point of view of future utopian spaces. The municipality focuses on global and macro scales whereas the studios work across global, macro and mini scales.

In their efforts there is a clear mobilisation of concerns. These concerns can be grouped into three categories: 1) climate change, 2) human health & well being, and 3) biodiversity. A clear inclusion of macro scale and land actor is visible, while simultaneously excluding the micro scale, aquatic life and rodents.

In order to address these concerns they promote various urban engagements. Four broad kinds can be identified: 1) physical spaces sold as products by urban nature design studios: Urban nature here is seen as a product in itself in the broader capitalistic scheme of things. Companies need to be selling stuff to make money. Nature here is sold for the ecosystem services that it provides. 2) dissemination of knowledge and the sparking of debates and discussion: Another function that these visions serve is creating a market. Before solutions are sold there need to be people willing to buy them. This requires educating people and creating discourses. Discourses about the various ways Copenhagen could be the coolest city on the planet. But not just limiting to that and going a step further to set discourses about values to live by and approaches to follow to make the values come to life. 3) creation of plans, strategies and tools (including financial instruments): these too serve as products which can be sold and at the same help propagate values that are marketed by studios.

Identifying a potential object of worldmaking

The aim here is to find an object of worldmaking for urban transitions.

From the analysis above it can be inferred that urban governance is parochial. It is entrenched in tradition and the only nature they can prominently see are trees, only advancing in recent times to add some more actors.

Provoking urban nature

I step in here as a designer and use worldmaking as a provocative tool to provoke urban nature and the different ways we can conceptualise worlds. Through this I intend to open up new avenues for urban governance.

I again present here the 3 sets of provocative techniques that I built in the theory section:

1. **Scale:** Different types of actors as per their size can be the object of design for urban designers and urban planners

    a. Global - to conceptualise cities as part of global and regional bio-physical metabolisms
    b. Macro - comprising lakes, parks, residential, commercial, official and industrial areas including plants, animals and humans
    c. Mini - living organisms that are very small but visible to human eyes, eg: insects
    d. Micro - living organisms invisible to the human eye eg: microorganisms
2. **Instruments**: Different techno-scientific instruments can be used to for interesting ways of knowing and interesting ways of representing
    a. Sensors - these include devices that can measure different physiological activities eg: fitbands, eyewear, anemometer (speed detection), GPS, camera
    b. Satellite imagery - for better ways of representation of data
3. **Senses:** Maps can be created by gathering different sensory data:
    a. Emotionscapes - to map areas where people have experienced stress
    b. Olfactory map - to mark areas in the city with foul or pleasant odours
    c. soundscapes - using sound to tell if a neighbourhood is peaceful
    d. light and darkness map - mapping lighting across the city (can be used to as an indicator of safety in cities in the night)

My approach to choose an object of worldmaking is to go back to the analysis and look for 2 things. Firstly, I look at the concerns being mobilised and secondly, I look at the various actors that are pacified in the existing worldmaking efforts. This way I intend to find a gap in the efforts of urban nature agents where I can intervene while simultaneously building alignment with the concerns that they mobilise - in effect aligning with them by making my project relevant and legitimate in their existing worlds.

From the table above it was evident that microorganisms, aquatic life and rodents have been pacified in the planning process. None of the worldmaking efforts had mentioned them. SLA claims that they work with all life however even they haven't mentioned these. Here, I mobilise scale to provoke alternative worldmaking efforts. I go down the scale to the micro level and explore it. Microorganisms are the actors that lie on this end of the scale. They seem like an overlooked object that could be worked with.
Also, it was known to me that microorganisms are a part of our gut microbiome and that they are essential for human health - which is also one of the concerns that is mobilised by all urban nature agents.

It therefore seemed like an unexplored area by urban agents and an avenue to further my project in a radical direction. In the next section I explore the potential of microorganisms as an object of design for urban governance and urban transitions through worldmaking.

Sub conclusion

In this chapter I mapped and analysed the worldmaking efforts of urban nature agents and summarised the findings in a table. I understood the representation, mobilisation and actions illustrated through these world. Subsequently I mobilised worldmaking as a provocative tool

and I identified urban microbiome as a potential object of worldmaking for urban transition. In the next chapter I will explore its potential & possibilities as a worldmaking object.

Exploring urban microbiome as an object of worldmaking

Introduction

The aim of this chapter is to investigate the potentials for rendering urban microbiome governable through world making.

Method

I start by looking at the worldmaking activities with microbes as the object of worldmaking by urban agents in the past. Descriptive data was gathered from academic sources. These descriptions were identified as established conceptions.
Thereafter I looked for building blocks of worldmaking. Here I creatively looked for the latest academic research to identify the concerns that were being mobilised through microbes. I also creatively searched for engagements that were propagated with microbes as the object of focus.
The data was collected as follows:

a. Database: Google and Google Scholar
b. Results reviewed: top 20 results
c. Langage: english
d. Period: February - May, 2024
e. Search within article title, abstract, keywords

Selection criteria: The articles and websites were independently selected based on their relevance to the project.
The data gathered was analysed to check for alignment with the concerns that were mobilised by urban agents and see if microbes could be an object of worldmaking for urban transition.
Since the data might not be comprehensive since articles were selected as per my discretion (keeping the research question in mind).
An alternate method could be to interview experts who are working with microbes.

Findings

Worldmaking effort of the past

In this section I explore the worldmaking efforts of the urban agents in the 19th century.

Representation:
With the inception, rapid growth and industrialisation of cities in the beginning of the 19th century there was a conspicuous decline in urban living conditions coupled with outbreaks of infectious diseases. Urban governance bodies felt the need for urgent action to mitigate this catastrophe (Gandy, 2004). Their worldmaking efforts can be seen making worlds in 2 ways:

Firstly through the cognitive constructivist approach of composition: the urban population was acquiescent to social control. The urban citizenry was gradually being fit into a world as a collective statistical entity by the governance institutions. New attitudes to privacy and social distinction were on the rise. Secondly the organisation of elements in neat categorises: a new form of urban governance involving the identification and scoping of spaces was being methodically recognised. Technical and managerial expertise was sought after for these activities (Gandy, 2004).

The time also saw development of the empirical sciences which were much better at explaining the patterns of mortality and morbidity, along with the cause of the epidemics and their underlying connection to microbes, than had been in the past. Also, the influx of capital into the city for grand construction activities of the built environment(Gandy, 2004; Gandy, 2006).

Mobilisation:
The growing troubles led to the mobilisation of various concerns as to the cause of the deterioration. The decline in public health and the rise of the empirical sciences led to the emanation of various discourse around hygiene. Thus health thus became the principal concern. As water came to be identified as the vector of diseases, water - and through it, microbes - became the object design for urban governance (Gandy, 2004).

The traditional reliance on wells for water was replaced with centralised water supply systems. This resulted in bringing diverse private actors under the control of the state (Gandy, 2006).

Capitalist urbanisation and the flow of capital became important actors that the governance bodies activated for tighter control (Gandy, 2004).

Actions:
Urban agents used water as an important object to promote engagements. Benefits of washing and exercise were encouraged as forms of hygiene as an effort to alleviate the health of the citizenry (Gandy, 2004).

The cleanliness of the cities became an important aspect in governance. This led to the cleaning of the city, sewage systems in cities & municipal water supplies. Since food in the cities was transported from rural areas, human waste was segregated from agriculture (Gandy, 2006).

The influx of capital into the cities interconnected urbanisation with finance. The generation of capital and financial instruments became an important factor to avert relinquishing the control that was established (Gandy, 2004).

Intermediate-conclusion:
Due to the worldmaking activities of the urban agents negative connotation around microbes have been mobilised.

Worldmaking efforts of the present by academics and research community

Here I present the recent research around urban microbiome. I organise my findings into 2 categories: mobilisation of concerns and actions.

Mobilisation of concerns:
The findings reveal 4 different kinds of concerns. After

Better human health: The discovery of microbes affecting human health through the gut microbiome has been a matter of significant attention (Eisen, 2015). Not only that microbiome has been shown to be important for one's overall health (Ravel et al., 2014) and humans as a holobiont (an assemblage of a host and many other species living inside and around it) was introduced (The MIT Press, Massachusetts Institute of Technology, 2024). Although our cities are cleaner than ever, there has been a rise in non communicable diseases (diseases that are not spread by microbes from one organism to another) (World Health Organization: WHO, 2023). Studies have shown that interaction with the soil and the wider environment is essential for the proper development of the immune system (Tischer et al., 2022). In fact of all the microbes on the planet that are known to us 99% of our genome is inherited from our parents and only 1% from our parents (Mouzo et al., 2023).

Biodiversity: Microbes are not only vital for human health but also indispensable for plant and animal health (Ma et al., 2023). Studies have shown how the diversity of microbes below the soil affects the health of plants above in functions like photosynthesis and carbon cycle (Liu et al., 2020). Consequently they have been shown to promote crop productivity and agro-ecosystem functioning in experimental microcosms (Romero et al., 2023). Absence or lack of microbial diversity causes legumes to have smaller plants, less chlorophyll and fewer flowers (Prudent et al., 2020). Health and well farm animals has also been shown to improve by improving their gut microbiota (Chen et al., 2021). The safety, resilience and survival of plants and animals also improves with a healthy and diverse microbial presence.

Nutrient / ecological cycles: On an even broader level microbes drive major biogeochemical cycles. Bacteria have been shown to drive the carbon and nitrogen cycles in the atmosphere (Ma et al., 2023). In fact when life began on this plant cyanobacteria triggered the Great Oxidation Event which led to the eventual evolution of other forms of multicellular life (Invisible City Life: The Urban Microbiome | Smart Cities Dive, n.d.).

Pollutant detoxification and ecosystem services: Apart from the above microbes also play an important role in terms of ecosystem services through biodegradation of wastes and pollutants (King, 2014). Microbes have also been discovered to sequester carbon in the soil (Mason-Jones et al., 2023).

Alliance with concerns identified in the analysis chapter:
It can be safely concluded that microbes are our friends and not foes. Also they have much more to offer to the sustainability of cities than we currently understand. Through their effects on human

health, biodiversity, ecological cycles and ecosystem service they contribute to addressing the concerns that were identified in the previous chapter. The well being and health of the people in the cities is addressed by a microbe rich environment. The resilience of the plants and animals is predicated in them having a healthy gut microbiome. Urban microbiome can also indirectly contribute to climate resilience by maintenance of plant health along the shorelines, as an example. Since microbes can help with these problems it seems like a very essential and ubiquitous part of the puzzle of urban sustainability remains under-explored. To relegate them to the footnotes of urban planning would be a major fiasco.

Actions:

Global level:

Mobilising the concern of health, the Healthy Urban Microbiome Initiative (HUMI) promotes urban engagements in the form of biodiverse urban green space for health improvements. They also intend to disseminate knowledge and initiate discourses around urban health and biodiversity with microorganisms as the object of discussion (Flies et al., 2018).

Another engagement is the mapping of microbiomes in city spaces such as New York mapped the subway system ((*Researchers Produce First Map of New York City Subway System Microbes*, n.d.; MetaSUB, 2024; Danko et al., 2021). They found that each city has its unique microbe footprint (*2021 Archive - Global Study of Microbes in 60 Cities Finds Each Has Unique Fingerprint of Viruses and Bacteria | University of Maryland School of Medicine*, n.d.).

Mini level:

There are also companies mobilising microbes to create products such as microbe cultures, beverages, dairy products and probiotics (*Chr. Hansen | Let's Better Our World With Biology*, n.d.). Microbes have also been promoted for the cleaning of clothes (Vijay, 2020), cleaning of homes (Novozymes, n.d.), cleaning of ancient architecture (*Microbes as Enemies and Allies in the World of Art Conservation | ASM.org*, n.d.), creation of art (Thaddeus-Johns, 2022; Conocimiento, 2020; New England Biolabs, n.d.; Hygienemuseum, n.d.), creation of music (STAT, 2017) to name a few.

Intermediate conclusion:
It can be concluded that engagement with urban microbiome happens on different levels on the global and mini. However, no practical work has happened to include them in the urban planning process by recognizing them as an object of design for creating sustainable cities of tomorrow.

Sub conclusion

In this chapter I explored the potential of urban microbiome as a potential object of worldmaking. I found that microbes have a negative connotation to them because of the worldmaking efforts of the urban planners of the past. I concluded that latest research suggests that urban microbiome is

important to address the concerns mobilised by various urban agents. They are also promoted by various urban actors on the global, and mini levels. However, no efforts have been made to make them a part of the planning process as an object of design. I see this as a point of intervention and intend to design a engagement

Designing a worldmaking intervention

Introduction

The aim of this chapter is to design an engagement to mobilise urban microbiome as an object of worldmaking for urban transitions, in collaboration with an urban nature agent.

Method

Speculative design

Speculative design, a term coined by Dune and Raby (2013) is a practice of exploring potential futures to elicit discussion on ethical, social and cultural implications. It is not not not concerned with predicting the future, it rather involves the exploration of multiple futures to ask what is the future that we would like to have and what would be the consequences of such a future. This frees designers from the gravity of a certain world, in effect wormholing them to a different time to create a different world.

Traditionally design has been seen as a problem solving practice. Speculative design turns it around and uses visual artefacts to spark thoughts. It is not about creating new products but about generating new ideas. Not about providing answers but asking questions. This way it is the perfect method for exploring radical ideas. Ideas which make little sense at onset to most people. Ideas which sound crazy to most people.

Speculative design also serves as a tool for social dreaming - a tool to provoke the imagination of people. It is a practice to involve and serve the society rather than serving industry. Rather than changing every aspect of the world around us it asks if we can change our practices to suit the world.

These characteristics make it the perfect fit with worldmaking. Most experiments designed for speculation involve worldmaking as an aspect of the process.

Why speculative design this project?
Speculative design is about

- Exploring radical futures
- Introducing an object and learning by asking questions
- Combining social fiction - artistic approaches

These aspects of speculative design make it a perfect fit for urban microbiome which is a radical object for worldmaking. It also fits well with worldmaking as both are involved in the creation of fictions.

Limitations

To begin with, the absence of a clear methodological framework becomes a pain for designers. While this does provide the designer with great independence and authority, one might also at some point feel lost.

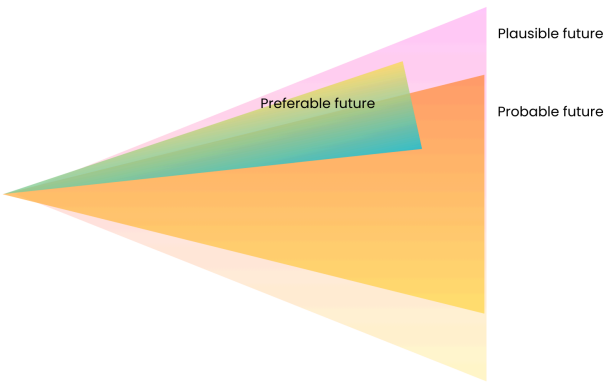
Social fiction brings together people of diverse disciplines in imagining a multiplicity of probable, plausible and possible futures. However, who gets to decide what the preferable future would be? Is it the government or the experts? For sure citizen voices would be suppressed or manipulative narratives be set by larger lobbyist companies that would work towards personal gains (Lalit et al., 2022).

Speculative design has also been criticised for being elitist. It rarely manages to reach, involve and serve the people who are actually affected by the consequences of the issue (Hillgren et al., 2020).

How was it used?

Since Dune and Raby do not chalk out a clear methodological frame on how speculative design process is to be performed, for the purpose of my engagement I have used a particular futures categorising diagram that they present in their book, as an inspiration (Dunne & Raby, 2013). The diagram starts from the present and diverges into different kinds of future. Each represents a different likely future:

The innermost cone is the cone of the 'probable'. It is the future that describes what might happen if things continue business as usual and if there aren't any extreme interruptions like economic reset or war or natural disaster. This is where designers traditionally operate. The next cone is one of the 'plausible' futures. This is where system level changes happen - political, economic or social. Designers here design for futures that might predictably happen. At the intersection of the 'probable' and the 'plausible' future lies the 'preferable' future. The future that we would like to have.



For the design intervention I collaborated with SLA, where I facilitated an engagement with a biologist. In the engagement we speculated plausible, probable and preferable futures on how urban microbiomes could be used as an object of design to create worlds of human - urban microbiome engagements. Specific details on how Speculative design is presented in the 'designing the world making engagement' section below.

Finding a collaborator

Of the diverse kinds of actors involved in urban nature planning elaborated in chapter 5, urban nature design studios seemed suitable ones to collaborate with. Whyy? As has been touched upon previously:

This is where the actual urban designing process takes place. They are the ones involved in worldmaking - not just on a cognitive conceptual level but also out there in the physical world. This is great as they could design the physical spaces where - in the future - people could come together to interact with urban microbiome.

Secondly, a focus on micro nature is certainly missing in their worldmaking activities, as evident from our analysis earlier. So this would be a nice new nugget of information for them to know, integrate and subsequently build upon in their planning activities.

Them working interdisciplinary, with people from design, architecture, biological sciences, anthropology and social sciences, could be conducive to bringing in myriad perspectives.

And finally, they are the nexus of various urban planning - worldmaking - efforts as they engage with stakeholders such as the municipality, real estate developers and the citizens. Hence they are at the perfect place to drive forward the urban microbiome agenda by mobilising various actors across various worlds.

I therefore reached out to a biologist in SLA for a joint interview and worldmaking engagement. SLA are not only involved in world making but also do biological baseline analysis (describes biological characteristics in a defined area) and citizen engagement activities - which are promising avenues and tools to amalgamate micro nature in. Fortuitously, Nico Pantaleoni (biologist) responded back and agreed to bring in a designer to be part of the engagement.

Designing the world making engagement

SLA agreed for a 2 hour meeting. So, an engagement - which is the process of facilitating a structured exercise with participants - was carefully crafted. The meeting was supposed to be 2 hours long: starting with a 40 min interview followed by a 1 hour 20 min engagement.

Aim of the engagement:
The engagement was designed with a two fold aim. To motivate and mobilise the collaborators to work toward integrating urban microbiomes in their world making activities and to improve the engagement process so that it could be replicated with other collaborators.

The focus was to create awareness about the importance of urban microbiomes, encouraging them to explore more and establish their possible positions and agency within it. This approach would empower them to actively collaborate within a broader network while independently seeking the knowledge and resources necessary for implementing changes in practices.

Understanding SLA
An initial semi structured interview was planned to verify my findings about SLA (as elaborated in the analysis section). Four groups of questions were prepared, inquiring:
what do they work with?
Why do they work with those things - what need are they selling?
How do they work with those things? How do they build markets?
And what was their plan for the future?

This would help reaffirm that they were not actively working with urban microbiome. It would also provide me with cues that I could use during the engagement facilitation process.

Introducing urban microbiome
After the interview a presentation was planned that would: introduce them to urban microbiome; inform them of the need of microorganisms for sustainability; align with the concerns they are trying to address and inform about the negative connotations around urban microbiome

The purpose behind this was to interest them in the object of worldmaking. This would help them understand the role of microbes better so that they could mobilise those concerns when they started the worldmaking exercise.

Setting the scene
A scenario was provided to the participant at the end of the presentation akin to introducing them to a new but void (empty) universe. It was to make the participant aware that they have been transported in time, that they are paired with another person who is from a different world and that they have to work together, to construct a new world in the new universe. This also where different aspects of the process to follow are delineated. The scenario is not a means to constraint the participant to a very narrow gravitational sinkhole. It is precisely the opposite! It serves as a portal between the participant's existing world and fictional elements of the new universe (Auger, 2013).

Structuring through Speculative design
The cone diagram of speculative design was used as an inspirational framework to organise the engagement. However, some customizations were make it fit with worldmaking
The engagement was divided into 3 stages:

1. creation of future worlds;
2. understanding the values, beliefs and assumptions of those times

3. exploring possible actions in the present by the participant / participant organisation.

These stages are inspired from the three aspects of worldmaking viz. representation, mobilisation and actions. The three stages are elucidated below: task for participant; learning for participants and learning for me (facilitator).

Board 1: The first session involved designing for a future sustainable world with urban microbiomes as the object of design. This stage is about imagining the visible practices of the world. These practices would be split between the 'probable' world and the 'plausible' world. Once this exercise was over they would be asked to choose elements and make the preferable world.

By taking the participant into the future I intended to free them from social, political and economical constraints. There by giving them the possibility to assess things from a third party perspective and become world makers.

From this I seek to understand the student's willingness and capabilities to envision something that is entirely different from the worlds that they already have in their minds.

Board 2: the second session was to take them deeper and think about the beliefs, values and assumptions of this world. This is no longer about visible practices but intangible mental processes. They would also be asked to think of the consequences of the belief that people had in those worlds.

Through processes I intended for them to identify deep rooted beliefs that people would have at that time. In the analysis chapter I had identified that microbes have a negative connotation attached to them. Participants would have to assign mindset and values that make people want to interact with micro natures.

With this stage I seek to bring them to the understanding - 1) concerns that would be mobilised in future and 2) existing entrenched values / concerns surrounding microbes. Discourses would have to be built and the participants should have the ability to understand what kind of discourses should be built among different urban actors.

This would be the hardest stage for the participant. Therefore a lot of guiding questions would be provided so that they would be able to think and imagine mindsets in worlds that they create.

Stage 3: in the third session the participants would be asked to create plans for the present in order to reach the preferable future. The actors that they would have to collaborate with and the resources that they would have to mobilise.

This would be done to provide them with a sense of agency. To identify, understand and explore their role in the urban microbiome mobilisation and also in the broader sustainable transitions.

> Through this stage I strive to understand the extent to which I had been to mobilise the urban nature design object and the receptance of the object by the participants (urban nature agents). Whether they are really mobilised as urban nature agents or not? Whether they are able to come back to the worlds that are presently part of and identify drivers and barriers to creating a preferable physical world.

None of the boards have any guiding structure. This would be done so that participants can feel the freedom of not having any constraints. Furthermore the idea was to scaffold the participants within the universe but also let them imagine the actors and resources that would be required. It would be an imaginative and analytical exercise. Additionally, the guiding question that I provide would serve as a scaffolding to their thought processes.

Guiding through artefacts & cues

The participant would be guided through the worldmaking process in a mixed way. I would sometimes be a co-worldmaker while at other times I would detach myself and let them do as they please. This would be a nice way to prevent them from being lost but also give the independence and authority to add and configure elements as they please (Auger, 2013).

They would be provided with an inspiration board showcasing recent developments with microorganisms and their presence in products, processes & applications. Additionally a lot of pictorial cut outs of some of these items would be provided. The purpose of the inspiration board would not be to restrict them to it, but to look at it and think over and beyond the information provided. It is there to give a sense of what is happening or can be done but is in no way exhaustive.

I would keep the guiding semi structured questions (cues) with me, though. Since the participants will already have a lot in front of them to grasp. Also, it would provide me not only the means to flexibly restrict the discussion with limits and also fluidly jump across discussions as required.

Killing some of the ideas

Can't have it all! Not all the cool things that I had discovered during my research could be included in the engagement. First of all the time limit meant that larger and deeper ideas on the level of socio-economic and socio-imaginary level could not be included. It would simply eat up a lot of time. Less deeper but random isolated ideas such as animism (attributing living souls to plants and animals) might just be overlooked as a practice. And finally some ideas seemed like they would make too much of a structured engagement, taking away the imaginative character of the engagement (eg: solarpunk: artistic movement towards actualising sustainable futures).

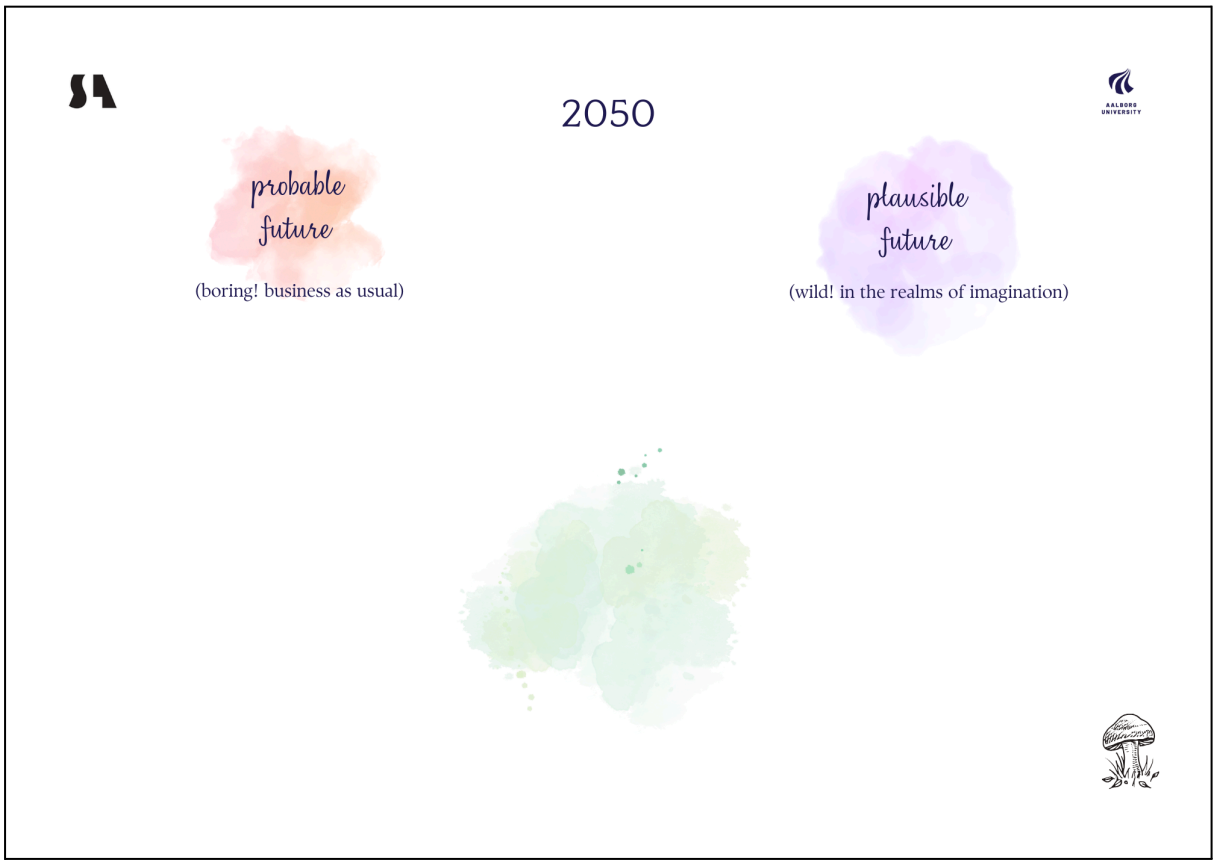
Engagement description

The engagement (after the interview) took place in 5 stages. Unfortunately the designer could not join due to urgent work - so it was 2 of us: Nico and me.

Stage 0: Greetings were exchanged. Recording device was placed on the table to record the conversation. Interview was conducted.

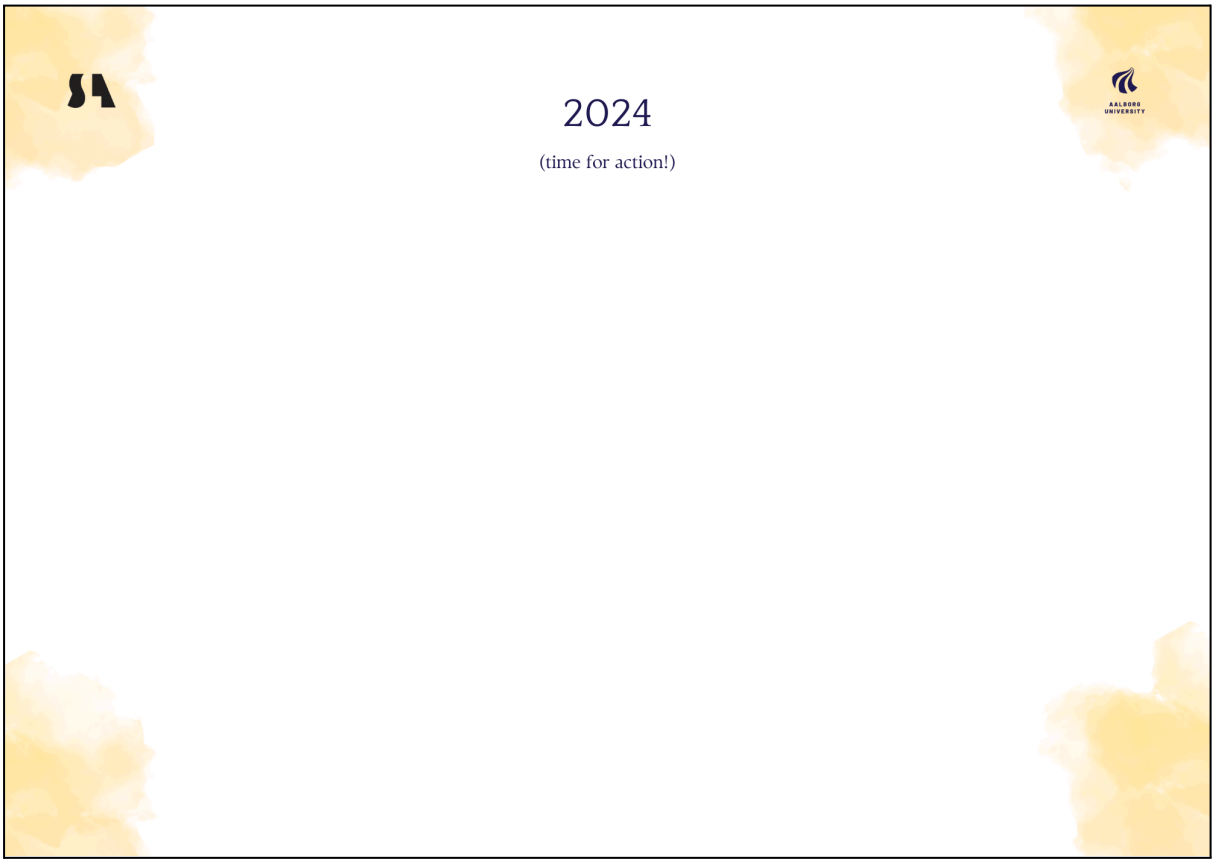
Stage 1: presentation was delivered to build alliance with Nico by delineating the importance of urban microbiomes.

Stage 2: Board 1 (APPENDIX A) was introduced in detail by vividly elucidating the aim and the task. Here we engaged in creating practices for the world and grouping in different categories of plausible and probable future. The green blob on the board would be the preferable future. It would emerge as the probable and plausible future were written down.



Stage 3: Board 2 (APPENDIX B): The participant was introduced to the broad and then we started speculating the beliefs, values and assumptions that people from the preferable future would have.

Stage 4: Board 3 (APPENDIX C) was introduced and participant was left to think what actions SLA could do in the here and now to achieve the preferable future.



Findings from the engagement

The audio recording from the engagement, the boards and personal observation served as ways to analyse and distil findings from the engagement. Due to the multi-level insights from the findings have been analysed and compiled into groups below:

The first important finding that needs to be elaborated on is that the participant was understanding and thinking about the information provided from a biologist's (in an urban nature design studio) perspective. This shaped a lot of the interview and the engagement responses from him.

Alignment with the idea urban microbiome

It was helpful that he had some idea of microorganisms. He explained that SLA has already been looking at how microbes could be used to make building material. In UAE, they had discovered that sometimes when the water level rose sand would become hard. SLA had researched if they could use this as a building material. He also knew that microbes were required for plant and animal health, pollution detoxification and human health. Therefore mobilisation of concerns was not difficult to achieve.

Good at speculating worlds

One of the great things about the engagement was that after having a look at the artefacts and the inspiration board that were provided he decided not to limit himself to them. Instead he started to wonder what else - beyond the inspiration provided - could be done. He started to speculate if in the future we could produce energy from microbes. This was something that I had seen during my research: building materials have been created that have microbes in them and can produce small quantities of energy. But I hadn't included it on the inspiration board.
This was a very indication that he understood the objective of the engagement at a very early stage and went a step further than directed. Other ideas such as sand sheets made by microbes and

animism (which were explained in the report) were also speculated by the participant without him being told about those things.

Need to mobilise a positive image of microbes
The participant emphasised the need to work on the present understanding and perception microbes. He suggested 2 ways to improve this. The first was to introduce another name for microbes that would provoke a different understanding. And secondly he suggested creating a practice around microbes - much like animism (which is the practice of worshipping living and non living objects).

Emphasised the mobilisation of health through microbes
Another important suggestion from the participant was the use of microbes for improving human health. That microbes have been able to survive millions of years without extinction suggests that they had biological and genetic material which needed to be understood. This could be used for rejuvenation and health.

Difficulty planning actions in the present
On the other hand the biologist's perspective limited some activities like in the 3rd board where actions that SLA could take now to achieve the preferable future were speculated. He didn't have a good idea of all the types of urban nature products that SLA sold. Hence, he had some difficulties planning actions that they could mobilise in the present and in identifying actors that could be reached out to.

Inclination towards research
He did come up with ideas that made much sense from a research and philosophical (ethical) context which were really insightful and deep. Further research into the subject of microorganisms and collaboration with research institutions and think tanks were some of the good ideas suggested.

Financial constraints
The participant also showed awareness of the financial constraints. While speculating on the things that would make practices possible he came up with: financial feasibility. The products and services which exist in these worlds need to be within the purchasing capacity of ordinary people. This should not be something elitist. This is quite true of a lot of products in today's world where there are products which are closer to sustainability but which are too expensive for the masses.

Engagement review

In this section I assess the engagement in terms of its aim, speculative design as a method, the use of artefacts and cues as a guide and provide suggestions for improvement.

Aim of the engagement - mobilisation of collaborator

The aim of the engagement was to motivate and mobilise the collaborators to work toward integrating urban microbiomes in their world making activities. The participant seemed very interested in the idea of working with microbes. He elaborated how they had tried working with microbes on some occasions. He also found the ideas from the inspiration cards very interesting. At the end of the engagement he asked and took some of the cards with him so he could look them up in more detail on the internet. I can thus conclude that the idea of urban microbiome certainly reinvigorated interest and that the engagement was successful at mobilising the collaborator to look more into urban microbiome.
(I cover the 2nd aim in 'Suggestions for improvement' - section below)

Use of Speculative Design

Structuring the engagement with speculative design worked very well. The structure and the task in different boards were clear to the participant and with the help of some additional guidance he was easily able to work his way through the boards. The participant was clearly engaged in reflections and showed great interest. Not having a board with very clearly defined sections was a good decision. This made the participant think rather than just pull out artefacts from the inspiration board and place them on the board like a jigsaw puzzle.

However, when one board 1, on some level he was still thinking it as a predicting exercise rather than a creative exercise. This means that for future engagements it would be nice to not talk about 'preferable' and instead only mention that there is a range from possible to probable rather than 2 categories. This would be a suggestion for improvement.

Guiding through artefacts and cues

The engagement was facilitated with the help of a semi-structured list of questions. Having a semi-structured list allowed me to jump back and forth between them and also improvise based on the needs of the situation. The engagement, for example, was supposed to progress as a series from one board to another, but since the participant continued to have ideas of what could be done in the future, he was allowed to go back and forth between the boards. Another learning for subsequent engagements.

Suggestions for improvement

The 2nd objective of the engagement was to test it as an idea before taking it to the people out there. The engagement panned out well, as the engagement was with a biologist who was interested in microbes. It would be required to be tested with participants across other domains / disciplines of knowledge to take this to actors who are closer to practical engagements. This would make the engagement richer and also at the same mobilise publics across various domains.

Sub-conclusion

In this chapter I intended to design an engagement to mobilise urban microbiome as an object of worldmaking for urban transitions, in collaboration with an urban nature agent. I collaborate with SLA, which is an urban nature design studio, based out of Copenhagen. I designed a speculative

design engagement where Nico Pantaleoni of SLA and I speculated on the different ways in which we could create worlds around urban microbiome. Through the engagement I was able to mobilise urban microbiome as an essential component for urban transitions. I have presented the findings from the engagement and presented a review of the engagement mentioning ways in which it could be improved.

Discussion

In this project I set out to introduce a new approach to sustainability transitions. This discussion will analyse the decisions made in this project. It will critically evaluate the success of the engagement and the potential impact of the intervention.

Engaging in an art based approach - a project of radical decisions

It is relevant to discuss whether it was too ambitious to do a project like this. At the onset of the project I was exploring art based research practices to approach sustainable practices. However, they were really difficult to come by as most of the time art is used to represent or mobilise concerns. I intended to use art as a tool for engagement.

However, this radical choice led to worldmaking and that provided some ground to see things in a different light. It provided a chance to introduce an approach which was radically different to the ones that are in use. To incite, introduce and mobilise a new epistemological practice for sustainable transitions.

Worldmaking

Worldmaking as a theory was introduced to answer the research question. It was presented as a new cognitive approach to sustainability transition. An approach that is based in arts. Worldmaking was transformed into 2 set of tools: as a descriptive tool and a provocative tool.

The sheer bulk of information on urban design and planning efforts is gargantuan. Worldmaking brought in some order and helped to map and analyse urban nature worldmaking efforts by 4 different urban nature agents. Worldmaking as a descriptive tool helped to bring in some order to the numerous ways in which these worlds are represented, the concerns they mobilised, the actors they activated, the actors they pacified and the engagements they promoted. Worldmaking as a provocative helped to identify a potential object of worldmaking, which had not been mobilised by urban agents.

Worldmaking as a descriptive tool also helped organise and understand the world making by urban agents in the past. It provides the means to understand how microbes got a negative connotation to themselves. Mobilisation of concerns and the actions served as means to look for data on the present research and enthusiastical activities around microbes.

Worldmaking also proved helpful to find a method - speculative design - for designing an intervention, which requires worldmaking as a part of the speculation process. Storytelling as a means of making a world helped with the speculations as it did not require the participant to have special painting or drawing skills. The participant did not have any difficulty in imagining and creating worlds from the artefacts that he was provided with.

Finally, worldmaking provided elements with which to assess the finding of the engagement and structure them.

Urban nature

For a significant time the project did not have a phenomenon to mobilise. As worldmaking, although an old concept, is so new to transitions that it was difficult to have a structure to assess any system with. Urban nature was suitable to analyse using Worldmaking because of the sheer amount of information in various forms available, especially beautiful artworks. Thus a framework for understanding and making sense of the worlds was reverse engineered by looking for patterns in the worlds created by various urban agents and mobilising the 5 ways of worldmaking presented by Goodman (1975).

The profusion of information helped identify quite a few potential objects of worldmaking like aquatic life, rodents as well as microbes that had been excluded as actors from the urban planning process.

Urban microbiome

The first and foremost here is whether microbes were too radical an object of worldmaking to explore. Indeed it was radical as quite contrary to urban nature which has umpteen number of visions and a lot of information available, knowledge on microbes was relatively difficult to find. Most of the research was done in niche research communities or done by enthusiasts. In some cases there were absolutely no research papers available to read. Information was presented in YouTube videos or random online news articles. Therefore it was required to not limit the search to scientific research literature providing websites.
There were lots of mind boggling things to discover and this was really useful when facilitating the external engagement. It provided the perfect object for worldmaking as the participant could not recall knowledge he had already read or seen somewhere. It really helped mobilise the imagination.

Speculative design

Speculative design was the perfect radical method for this project of radical decision making. Initially it was incredibly difficult to work with speculative design as it doesn't really provide any framework like some transition theory. I was lost for quite some time after I had planned the engagement with the biologist at SLA.

What Speculative design doesn't provide in terms of structure it makes up by providing a lot of interesting questions as inspiration. It was really helpful to take these questions and remould them into suitable questions for the engagement.

Choice of collaborator

I would like to add that it was indeed difficult to find collaborators not just in urban nature companies but across other domains such as art. I reached out to a number of art based folk high

schools however, none responded except Jonas Borup high school. However, they didn't have time. Establishing common ground is a task in itself.

It was also a challenging exercise because these urban nature companies exist in a world that they have cultivated themselves that are successful. It is difficult to penetrate their world and suggest something that does not seem to provide immediate financial returns.

Impact of the engagement

To start with, the participant greatly appreciated the effort in its entirety. The entire engagement stretched well beyond 2 hours although we had agreed to meet for 2 hours. Starting from reaching out to them, conducting the interview, presenting the need to look at urban microbiome and facilitating the engagement.

It was very effective in raising critical questions, challenging established values and concerns, and fostering systemic and sustainable thinking. As a result, the engagement can act as a catalyst for change, motivating the participant to question traditional practices and search for alternative solutions. However, as I mentioned earlier in the report, the worlds created were from the perspective of a biologist in an urban nature design studio.

Through the engagement I have been able to spark the imagination of the participant, making him curious enough to look for urban engagement and concerns to address through urban microbiome.

Expanding impact of the engagement

Ideally the engagement should have been done with a group of people from different disciplines. This could be done because art, and specifically storytelling, as a means to participate breaks down barriers. This would make it truly interdisciplinary and bring forth multifarious ideas onto the boards.

It would also spark rich debate and discussion on the various concerns that could be addressed through microbes. The presence of a designer or a sales representative would be completely different from that of the biologist.

The engagement should also be repeated iteratively so that the different boards, artefacts and cues could be improved and made to accommodate people from different disciplines. Since the engagement was with a biologist it proved easy for him to work through the boards without them having any guiding elements. However, with people from other disciplines a lot of additional guidance may be required.

Expanding reach of engagement

The engagement will also be repeated at Spor10, Janebanebyen, who are developing a neighbourhood where previously there were a lot of railway tracks. However, now the tracks are not in use and the area is being developed as a new residential area. They have community building engagements every Wednesday where a lot of people come. It will be really interesting to test the

engagement with a completely different set of actors.

Conclusion

This project intended to address the overlooked cognitive perspectives in sustainable transition. In an effort to do so I have outlined a cognitive strategy for pushing transitions in new ways.

More specifically I have introduced a new way of looking at the world in a way that is different from the way transition theories with their concept of Multi Level Perspective & Socio technical systems do. I have presented worldmaking as a theoretical approach. Subsequently, I mobilised this approach by using urban microbiome as an object of worldmaking. I designed a design engagement using speculative design as a method to bring this object into action with an urban nature design studio. Through this process I have demonstrated a new cognitive perspective and approach for sustainability transitions.

On Sustainable Design Engineering master programme, AAU CPH

Sustainable Design Engineering as an education has been absolutely fascinating. It provided me with the opportunity to address different sustainability challenges using various transition theories and methods informed from social science. But at the same time the education is cognitively limited in its methods. What about art? There should be a focus on identifying the undeveloped and developing it. I have tried to demonstrate an example of this by working with something that is not taught to us. There is a need to continuously explore new ways of engaging for transitions. How can we use cognitive perspectives to engage in transition differently? This is what I have tried to answer through this project.

Why do we need cognitive strategies for transitions?

Technology based transitions are obsessed with making - the smart: smart energy, smart mobility, smart cities, etc. However technology is not an end in itself. It’s not about only making smart things. It's also about seeing phenomena that we've not even considered so we can use them much more radically. Different cognitive techniques can be blended, much more creative than we normally do. If we want to make creative transitions and creative worlds, we need to take the scientific argument and link them to the artistic representations and artistic ways of working. We need to establish institutions that break free and work across compartmentalised epistemologies.

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