



Online-Workshop

# Transformative Research in Cities: Present and Future

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UNIVERSITÄT  
DUISBURG  
ESSEN

*Offen im Denken*

 Joint Centre  
Urban Systems

  
UA RUHR



Kompetenzfeld  
Metropolenforschung



# Agenda

12.00–12.30 pm

## **Welcome & Introduction**

Dr. Klaus Krumme & Dr. Julia-Lena Reinermann, Urban System Group, Essen

12.30 – 13.00 pm

## **Transition Research & Complexity Science**

Prof. Dr. Derk Loorbach DRIFT, Rotterdam

## **Transition Perspectives North & South**

13.00 – 13.30 pm

## **Sustainability transitions in the Global South and Global North**

Katharina J.F. Schiller, Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe and Sustainability Transitions Research Network (Group: Sustainability Transitions in the Global South)

13.30 – 14.00 pm

## **Assessment of the transformative capacity of nature based solutions to climate change adaptation**

Sean Goodwin, BC3 Basque Centre for Climate Change, University of Almería

14.00 – 14.20 pm

## **Discussion**

14.20 – 14.40 pm

## **Break**





# Agenda

## Transition Methods

14.40 – 15.10 pm

15.10 – 15.30 pm

15.30 – 15.50 pm

## Transition researcher

15.50 – 16.10 pm

16.10 – 16.30 pm

16.30 pm

### **Simulation, Visualization, and Discussion: Decision Theatre**

Dr. Sarah Wolf, Department of Mathematics and Computer Science, FU Berlin

### **Merging the digital and the analogue: Transformative research in digital urban twins**

Rico Herzog, City Science Lab, HafenCity Universität Hamburg

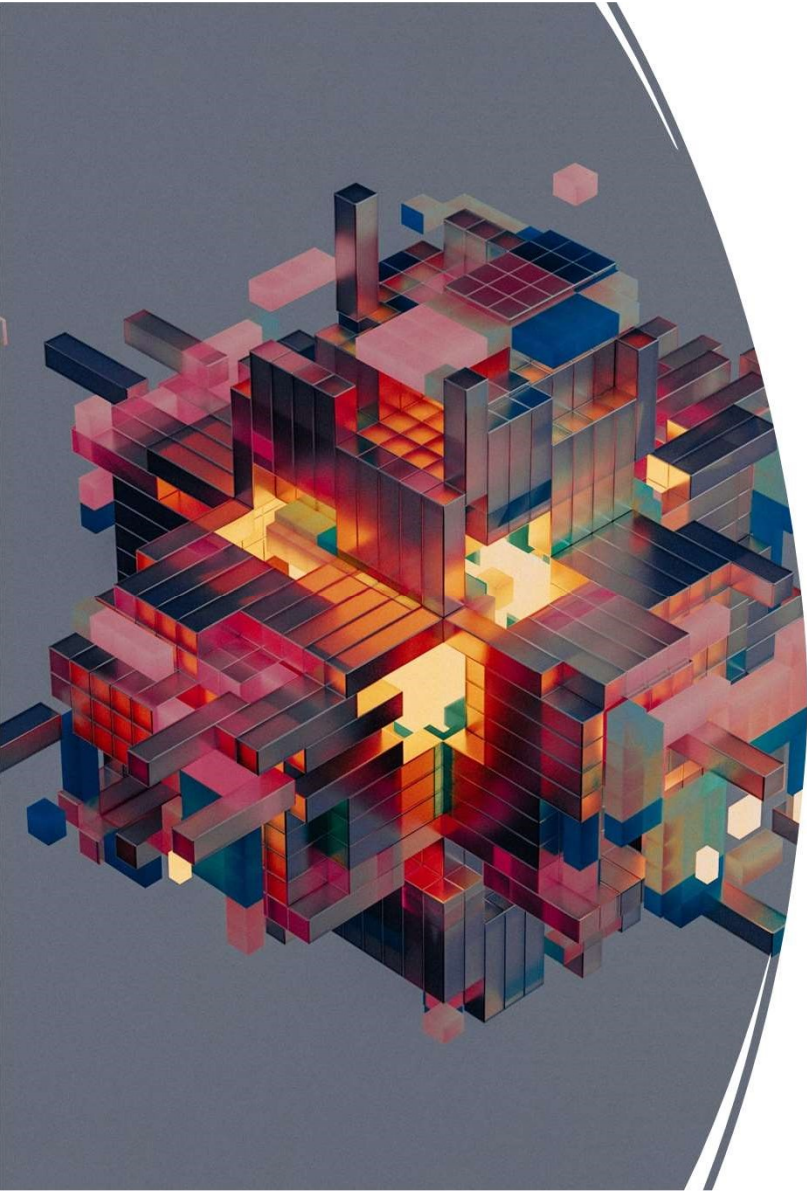
### **Discussion**

### **Transformative Research: Increased agency in times of increased complexity**

Ass. Prof. Kristina Bogner, Copernicus Institute of Sustainable Development, Utrecht University

### **Discussion**

### **Wrap-up & next steps, Urban Systems Group**



# Transition Perspectives North and South



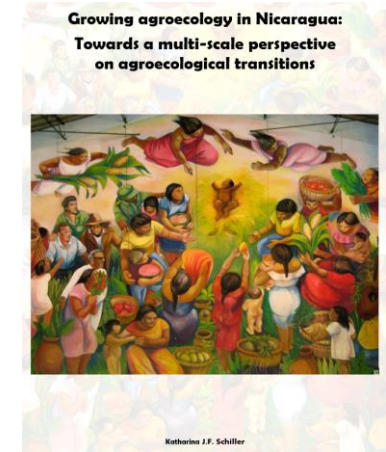
# Sustainability transitions research in the Global South and Global North

Katharina Schiller  
University Alliance Ruhr  
Workshop: Transformative Research in Cities  
Nov. 29, 2022

# Hello!

## Background

- PhD in sustainability transitions (Wageningen University, NL)
- Foci: agri-food transitions & transitions in the Global South
- Extensive international experience in different institutions and different parts of the globe



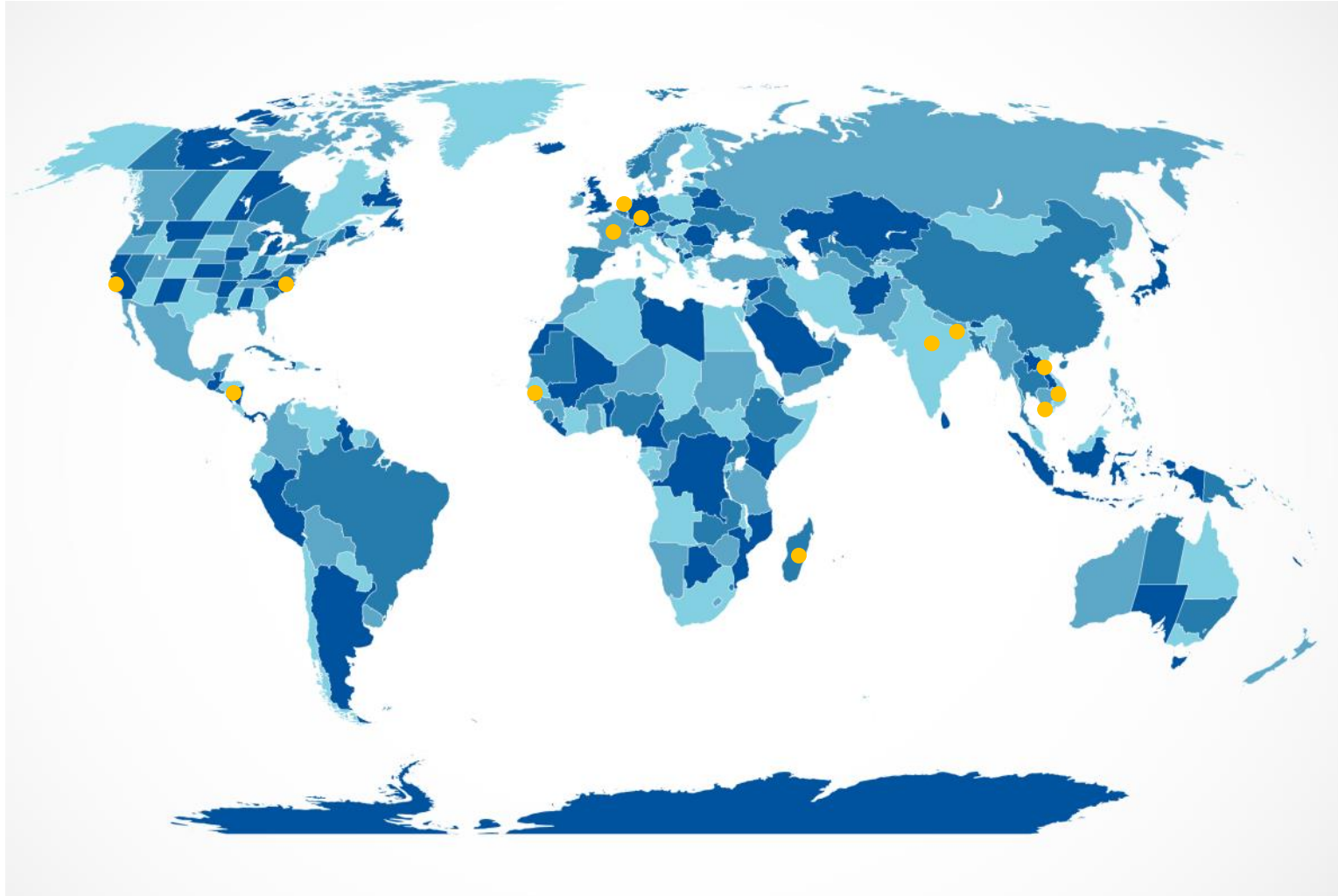
## Current

- Lead of in-house project on 'SYStem TRAnsformations' ([SYSTRA](#)) @ Fraunhofer ISI
- Active in Sustainability Transitions Research Network ([STRN](#))
  - core member of Transitions in the Global South thematic group
  - lead organizer of 12th International Sustainability Transitions conference ([IST 2021](#))
  - 2020-2022: STRN steering group
  - as of 2022: STRN Board member

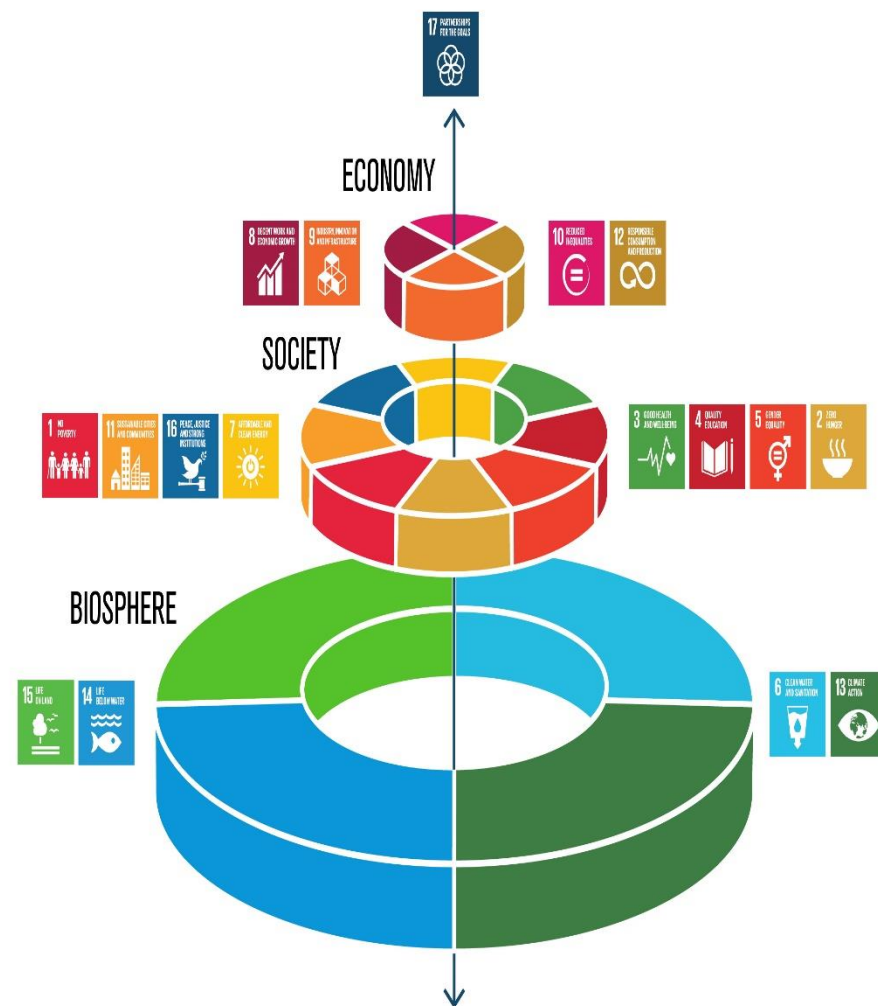
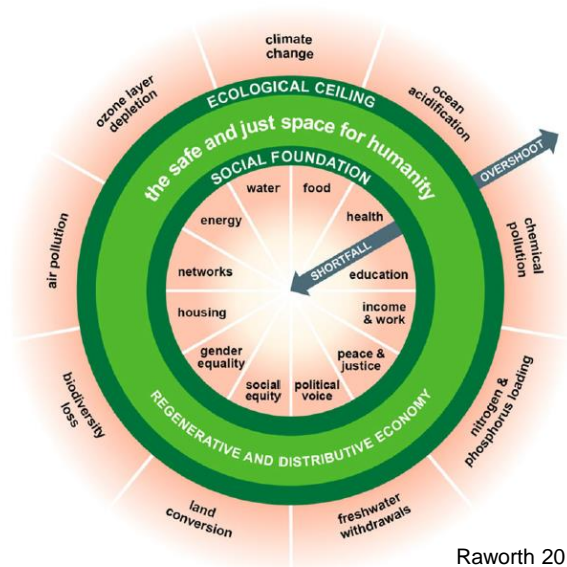
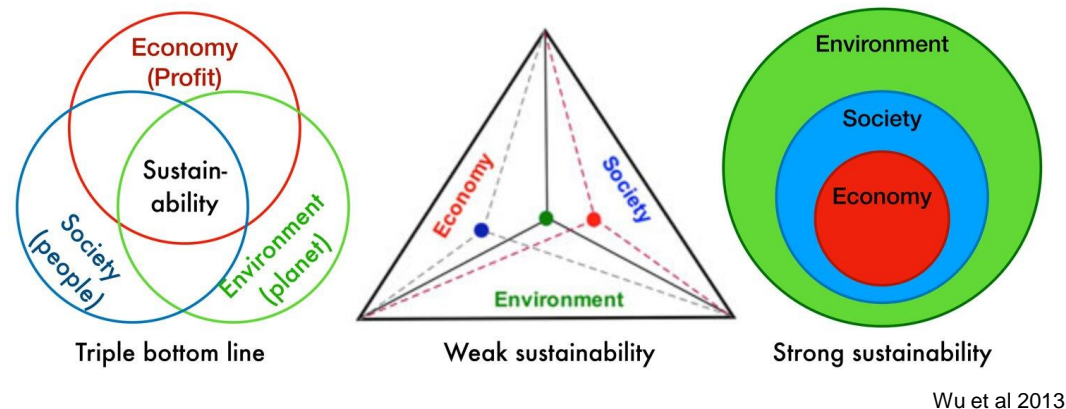




# What does 'sustainability transition' mean in different contexts?



# Different framings of sustainability





# Getting from sustainability to sustainability transitions

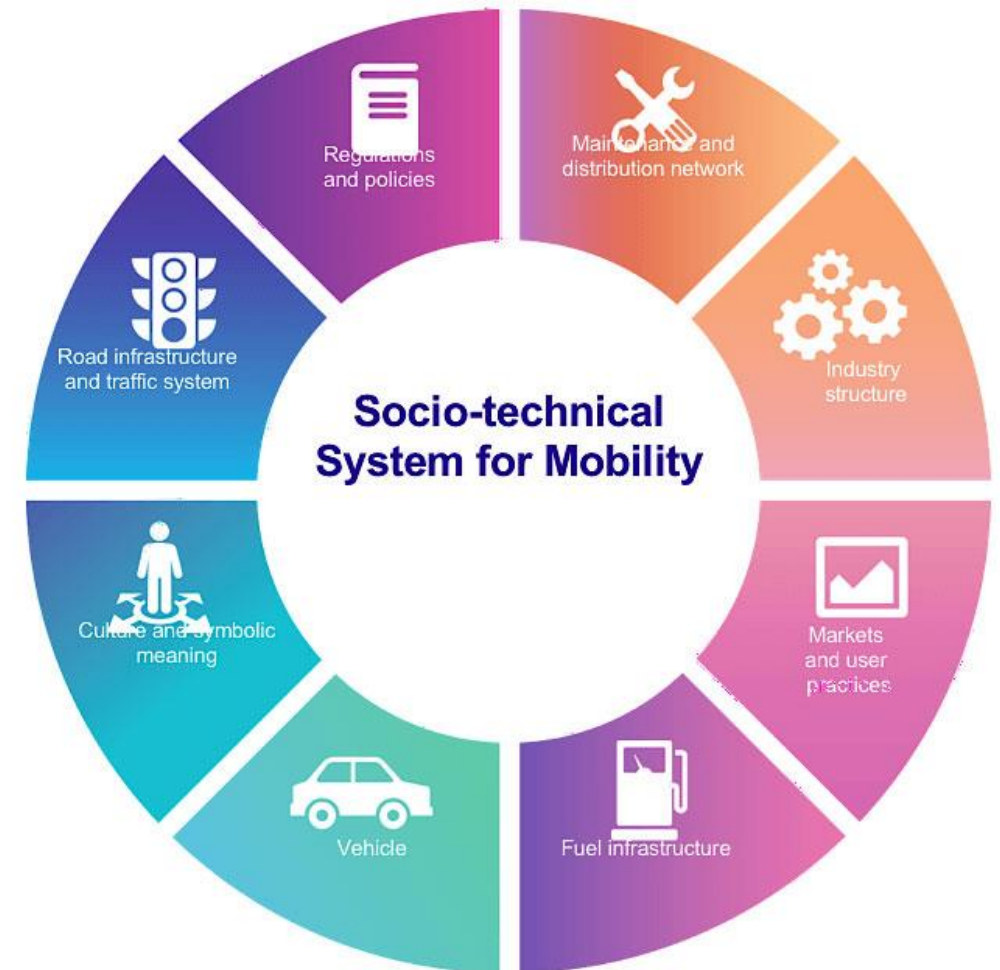
How do we 'get to sustainability'?

How do we get 'more sustainable' faster?

-> Innovations

- Technologies: new tools
- Socio-political: new ways of doing things

-> Socio-technical *systems* need to transform to be more sustainable

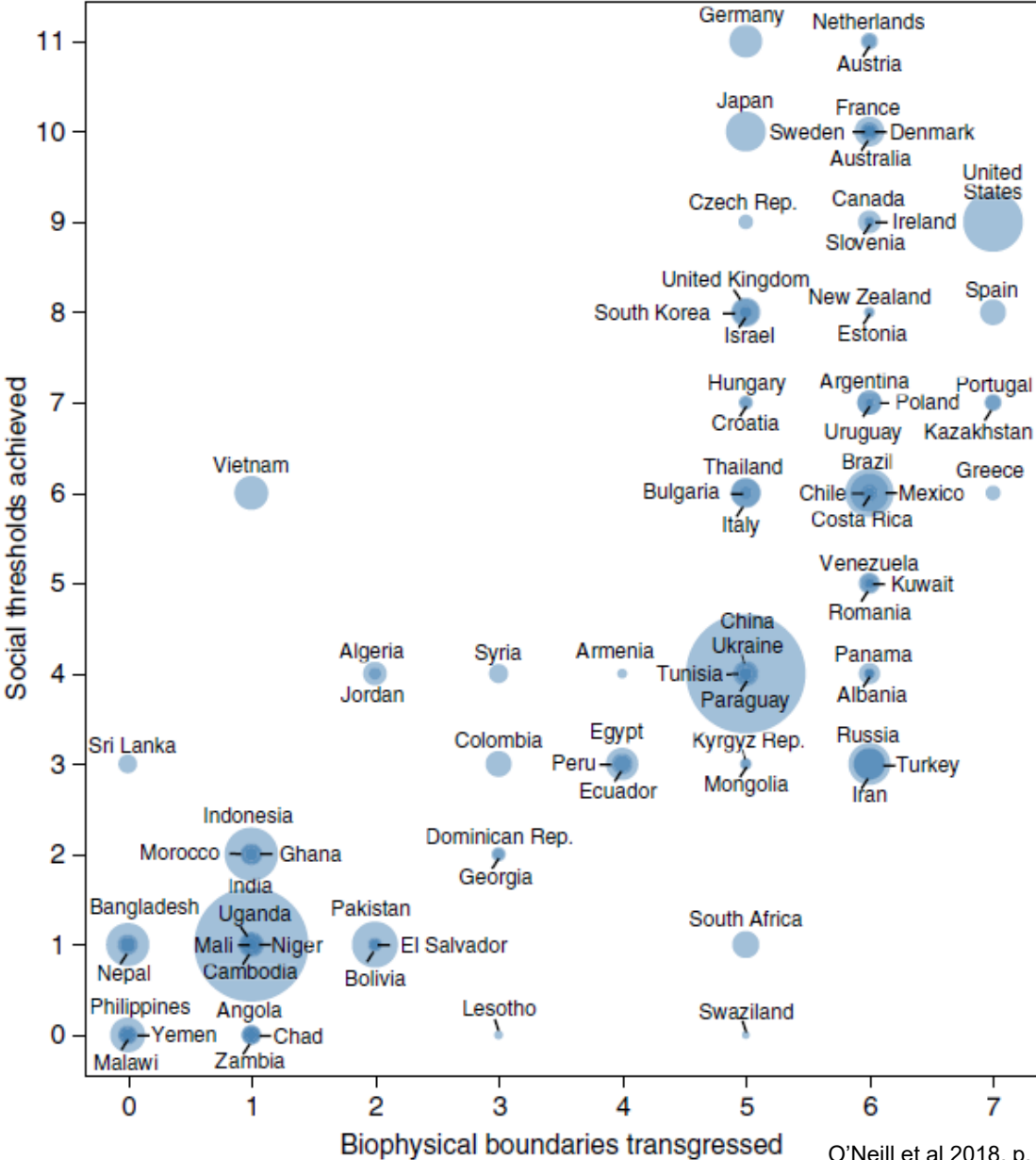


<https://www.tipconsortium.net/the-theory/>

# What is “the Global South”?

## Distinction between ‘developed’ and ‘developing’ countries is problematic

- Implicitly refers to continuation of colonialism in modern times by other means
- When Human Development Index is adjusted for ecological impact, top three countries change from Norway, Ireland & Switzerland to Cuba, Costa Rica & Sri Lanka (Hickel, 2020)



O'Neill et al 2018, p. 90

Hickel, J. 2020. Quantifying national responsibility for climate breakdown: an equality-based attribution approach for carbon dioxide emissions in excess of the planetary boundary. *The Lancet Planetary Health* 4(9), e399-e404.

O'Neill, D. et al. 2018. A good life for all within planetary boundaries. *Nature Sustainability* 1(2), 88-95.



# Heterogeneous perspectives from the Global South

## “Global South”

- Captures a deterritorialized geography of capitalism’s externalities (Mahler 2017)
- “Multiple Souths” – heterogeneous, not monolithic
- Is as much a contextual as a geographic designation
  - e.g. informal economies; splintered regimes; diverse epistemologies
- Perceived shortcomings (e.g. splintered regimes) can be facilitative for transitions
  - lack of path dependency and lock-in effects
  - space for innovation and experimentation
  - search for radically disruptive but affordable solutions



-> heterogenous perspectives on what is important in sustainability & sustainability transitions – and how to achieve it!

# Decolonizing transitions & transitions research: Why & what does it mean?

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Heterogeneous perspectives -> enrich & enable faster, more just sustainability transitions

Decolonizing transitions =

- Embracing emancipatory processes based on local contexts and worldviews
- Understanding & challenging existing power structures to make room for alternative pathways of socio-technical systems change
- Reflecting on one's roles and positionality in transition processes & on assumptions behind plans and actions





# Decolonizing transitions & transitions research (1)

## 1) Focus on everyday struggles

- Everyday struggles as
  - strategy and capacity for transformative resilience
  - social reality of transition processes -> changing social practices to transform socio-technical systems
- Informal institutions that are in constant contestation and negotiation with formally imposed rules -> complex steering of transitions from grassroots

## How?

- Acknowledgement of contextual realities and how they shape transitions
- Acknowledgement of how (daily) conflicts shape transitions
- Proactive engagement with many different stakeholders to understand multiplicity of perspectives on everyday struggles



# Decolonizing transitions & transitions research (2)

## 2) Focus on nuances of local dynamics and power

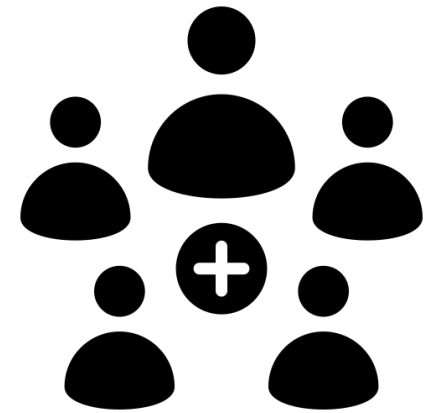
- Weak or fragmented institutions
  - > power issues may be central to whether transitions will entail social and environmental justice
- Power relations (not only in the Global South) may be complex & better tackled by relational approaches than technocratic approaches
- Example: Smart city projects in Brazil & India follow missions & strategies copied from West
  - > hide social exclusion & deep structural inequalities in their local contexts (Tambelli 2018; Ghosh and Arora 2022)

### How?

- Understand power issues & inequalities from local grassroots/citizen perspectives
- Reflect on assumptions & lenses from the Global North



# Decolonizing transitions & transitions research (3)



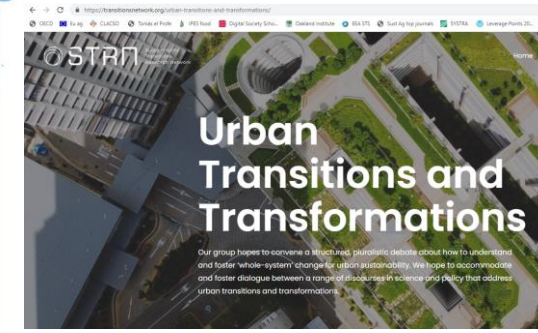
## 3) Focus on meaningful & empowering participatory research methods

- Much project planning is dependent on funding cycles, which tend to be shorter-term
- Often, local communities' needs are identified in top-down, not bottom-up, manner, or goals pre-determined without involvement of local community
- Local capacities and knowledge often not sufficiently accounted for in project planning
- Insufficient understandings of complex & nuanced local social power dynamics
- Different skill sets and training required to account for local sensitivities & socio-political and cultural conditions

## How?

- Develop and implement methods that are participatory, action-research & transdisciplinary
- Involve local stakeholders over whole project life-cycle, from agenda-setting to implementation and readjustment
- Recognize, embrace, value, and build on local knowledge and capacities to support not just immediate, but also future transformative changes
- Reflect on, recognize, and change one's own practices that may be implicitly colonial
- Foster culture and practice of appreciation of diverging worldviews





**UTT mailing list:**  
[urban-transitions-strn+subscribe@groups.io](mailto:urban-transitions-strn+subscribe@groups.io)



**SUSTAINABILITY APPROACH**

WE USE THIS TERM TO INDICATE ALL KINDS OF SUSTAINABILITY PROCESSES. IT CAN BE A PROJECT, A TOOL, A PLANNING PROCESS, A VISION, A MISSION, A POLICY, AN EVENT, OR ANY OTHER ACTION FOR SUSTAINABILITY IN YOUR CITY. YOUR APPROACH CAN FALL UNDER ANY URBAN SUSTAINABILITY THEMATIC FIELD: ENERGY, MOBILITY, BUILDINGS, INFRASTRUCTURE, CLIMATE, BIODIVERSITY, ETC.



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GRAPHIC DESIGN: CARLOTACATCOM & BLANCHE ILLUSTRATES





# Contact

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Fraunhofer Institute for Systems and  
Innovation Research ISI

# Thank you for your attention!

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# Questions?



# ASSESSMENT OF THE TRANSFORMATIVE CAPACITY OF URBAN NATURE-BASED SOLUTIONS TO CLIMATE CHANGE ADAPTATION



**Sean Goodwin**  
Basque Centre for Climate Change (BC3)  
University of Almería  
[sean.goodwin@bc3research.org](mailto:sean.goodwin@bc3research.org)

# Agenda

1. Research context
  - Nature-based solutions and climate change adaptation
  - Research questions
2. What we mean by capacity for (transformative) change
3. Key findings on transformative capacity across regional contexts
4. Examples from the Global South



# 1. Research context

Urban nature-based solutions to climate change adaptation



# Nature-based solutions (NbS)

- Actions to restore, protect, or sustainably manage ecosystems that provide co-benefits for people and the planet
  - Simultaneously climate change, biodiversity, and social challenges
- Strong pro-NbS agenda
  - “NbS are *multifunctional, powerful, and must play a critical role in addressing global challenges, especially climate change*” (Melanidis & Hagerman, 2022)



Leo Hickman ✓  
@LeoHickman

...

For the first-time ever - it was removed at last moment in Glasgow - a COP cover decision includes the term "nature-based solutions" - and a dedicated section on "forest"

## XVI. Forest

80. *Recalls* Article 5, paragraph 2, of the Paris Agreement, whereby Parties are encouraged to take action to implement and support, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention<sup>36</sup> for: policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches;

81. *Encourages* Parties to consider, as appropriate, nature-based solutions or ecosystem-based approaches, taking into consideration United Nations Environment Assembly resolution 5/5,<sup>37</sup> for their mitigation and adaptation action while ensuring relevant social and environmental safeguards;



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# What's the problem?

- Little work synthesising empirically how currently applied NbS are “multifunctional” and “powerful” in the context of urban climate change adaptation
- Two main questions:
  1. How does current practice on NbS to climate change adaptation address the **climate, biodiversity, and society**-related challenges cities are facing?
  2. Is this current practice of NbS helping cities to promote necessary **transformational changes**?



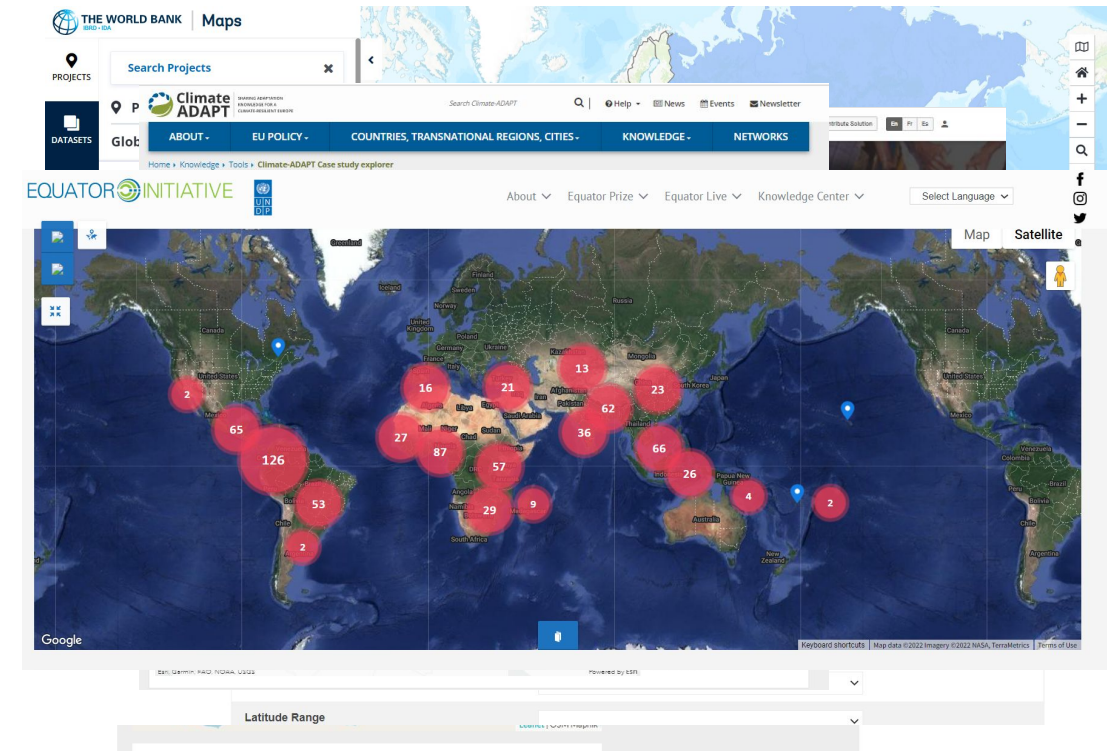
# Our work – systematic mapping

Search

- 823 projects globally from 9 different databases

Screening

- Application of inclusion criteria (applied nature-based solutions + climate change adaptation + urban area)





# Our work – systematic mapping

## Search

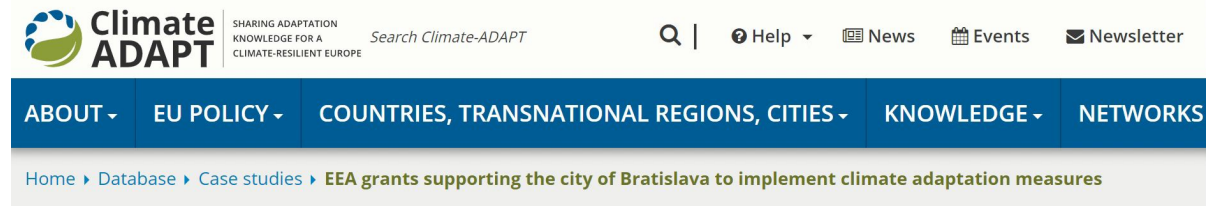
- 823 projects globally from 9 different databases

## Screening

- Application of inclusion criteria (applied nature-based solutions + climate change adaptation + urban area)

## Analysis

- Critical analysis of how they address challenges faced by cities relating to (i) climate change, (ii) biodiversity, and (iii) society
- Evaluation of the **capacity for change** evidenced



### Case studies

## EEA grants supporting the city of Bratislava to implement climate adaptation measures



Bratislava has received funding from "EEA Grants and Norway Grants" (hereafter called EEA Grants) for an urban climate adaptation project. The project entitled 'Bratislava is preparing for climate change' implements measures to enhance the resilience of Bratislava city to the adverse impacts of climate change, in particular intense rainfall and heat. These measures include tree planting, green roofs and rainwater retention facilities. The benefits are primarily for the most vulnerable inhabitants of Bratislava: elderly people and children. The € 3.3 million project is for 85% funded by EEA Grants. The remaining 15%



## 2. What does “capacity for change” mean?

Levels of change across city systems

# What kind of “change”?

- *Incremental change*
  - Actions that maintain the system status quo
- *Reformistic change*
  - Addresses underlying drivers that worsen problems addressed, though do not alter system features that create them
- *Transformative change*
  - Fundamental changes to patterns, elements, and interrelations of the city system

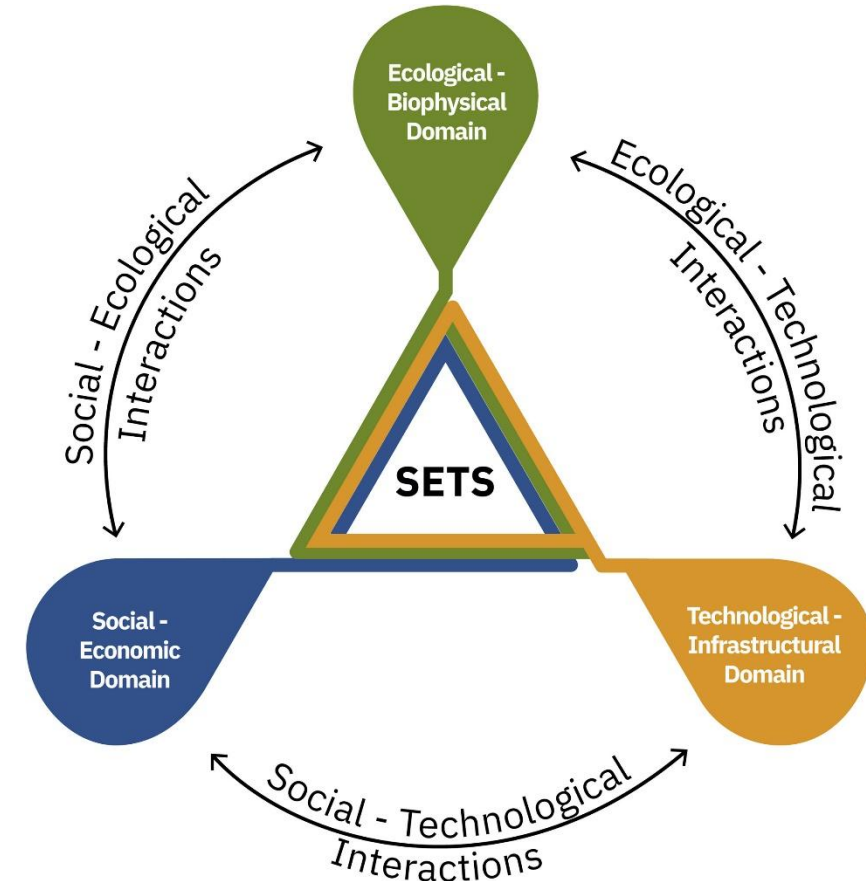
Heikinnen et al (2019)



# Dimensions of city systems

- Analysed change in three dimensions of cities as social-ecological-technical systems
- Social
  - Governance, behaviour and decision-making, employment and recreation, community relations...
- Ecological
  - Quality of biophysical components (air/water/soil, etc), ecosystem health, biodiversity, land use practices...
- Technical
  - Infrastructure (buildings, water/transport/industrial systems), planning systems...

Markolf et al (2018)



McPhearson et al (2022)



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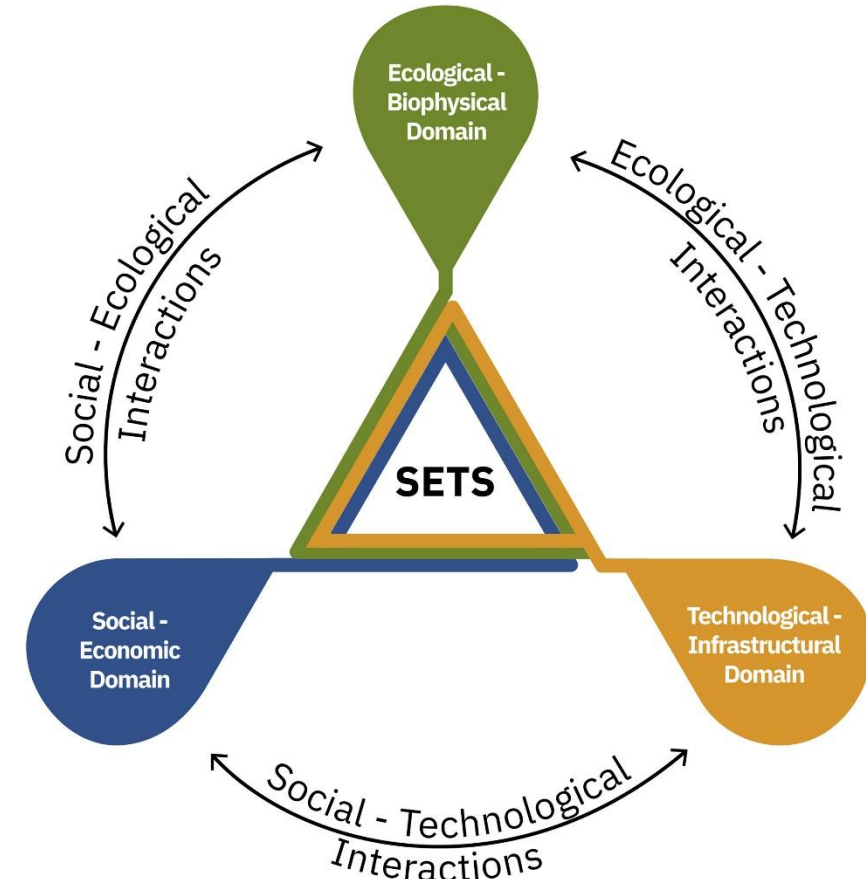
# What does “capacity” mean?

- Inspired by the work of *Hölscher (2020)*
  - Stewarding
    - Anticipating/responding to long-term change/uncertainty/risk
  - Unlocking
    - Recognising/dismantling unsustainable pathways/path dependencies/maladaptation
  - Transformative
    - Creating/embedding novelty
  - Orchestrating
    - Coordinating multi-actor processes to create synergies/avoid trade-offs



# “Transformative capacity”?

- Social
  - Creating new sectors of sustainable employment that benefit whole communities (*stewarding, orchestrating*)
- Ecological
  - Implementing green infrastructure city-wide, replacing large areas of sealed surface with open green space against flood risks (*stewarding, transformative*)
- Technical
  - Mandating all new roofs in the city be fitted with green roofs, changing the rules of urban design and further redefining what “roofs” are for the city (*unlocking, transformative*)



# Key considerations

- Scale
  - Dealing with SET systems across the scope of the city
- Time
  - Projects analysed according to current information, difficult to assess future outlook
- Novelty
  - Whether the implementation of this kind of project was something new for the city
- Data availability/source
  - Mostly self-reported information, with varying levels of detail

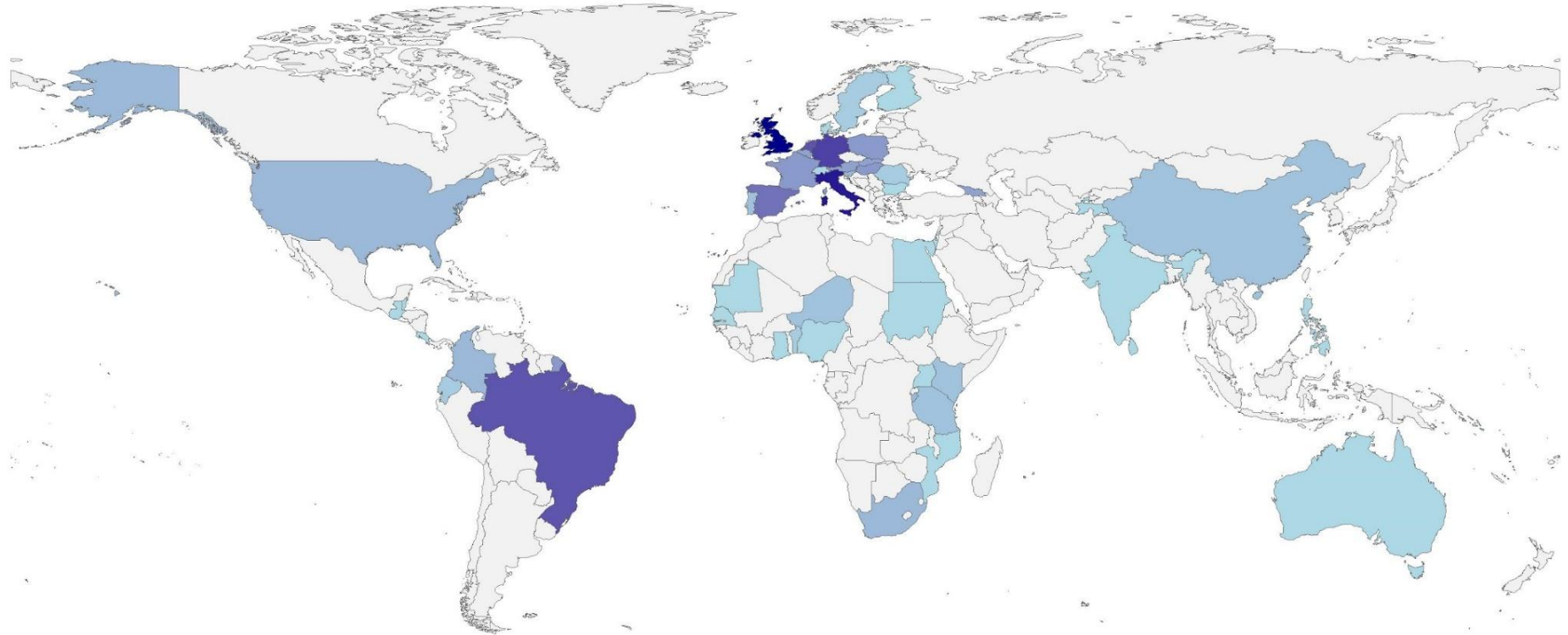
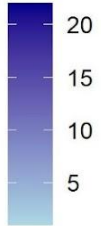


# 3. Key findings

Global and regional trends

# Global map

Intervention count

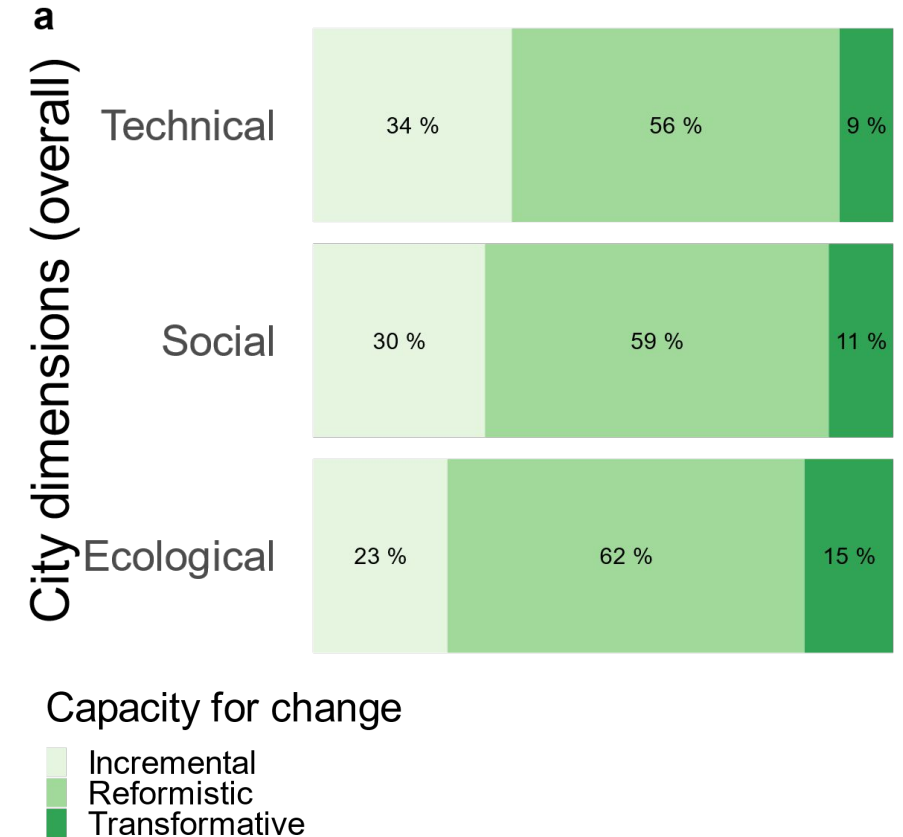


**216** interventions from **130**  
cities in **55** countries over **6**  
months



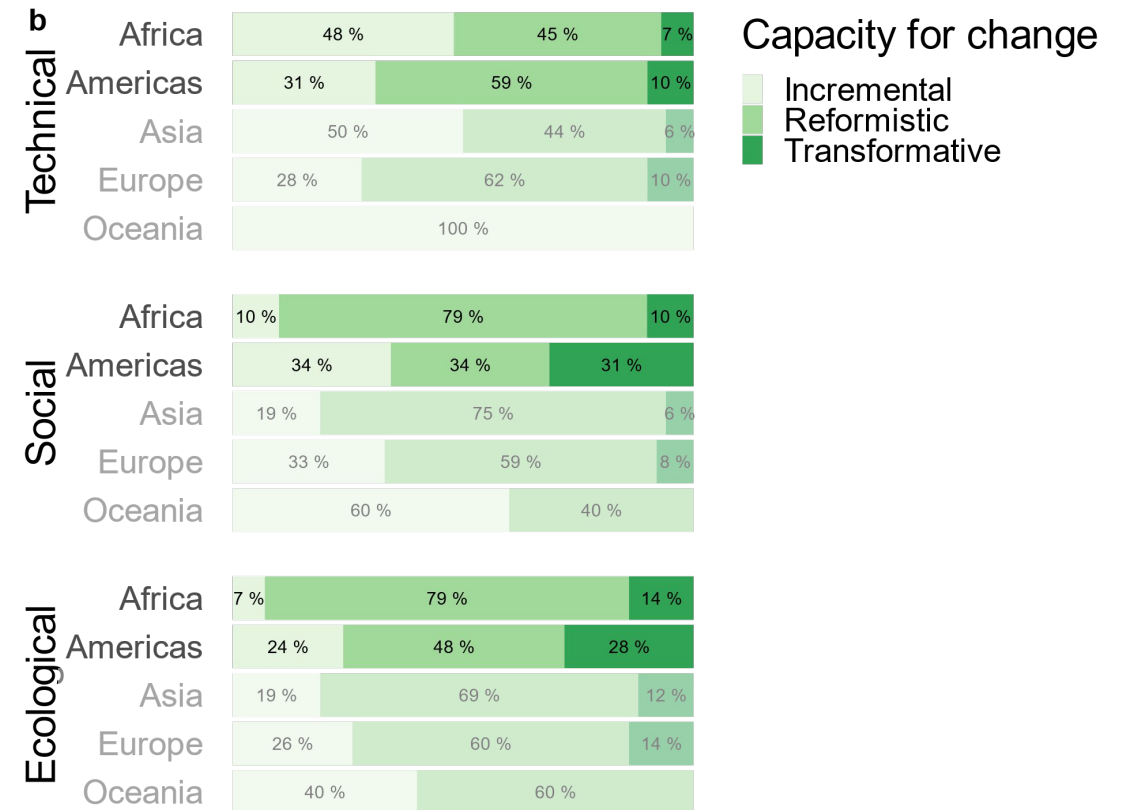
# Key findings - overall

- NbS evidence higher transformative capacity in ecological over technical dimensions
  - Value proposition rests on “nature” based aspects
- Social
  - Many projects lacked evidence of robust social engagement, especially with social justice (*orchestrating*) and climate vulnerability (*stewarding*)
- Ecological and technical
  - Lacked novelty or scale aspects (*transformative*)



# Key findings - regionally

- Americas (LA&C) and Africa leading social and ecological transformative capacity
  - Tie in technical dimension between Europe/Africa
- Evidenced many of the transformative capacities missing overall
  - Social
    - Address comprehensively social justice (*orchestrating*) and climate vulnerability (*stewarding*)
  - Ecological
    - More robustly implement novelties across the scale of the city (*transformative*)
- Lack of data in Oceania and Asia

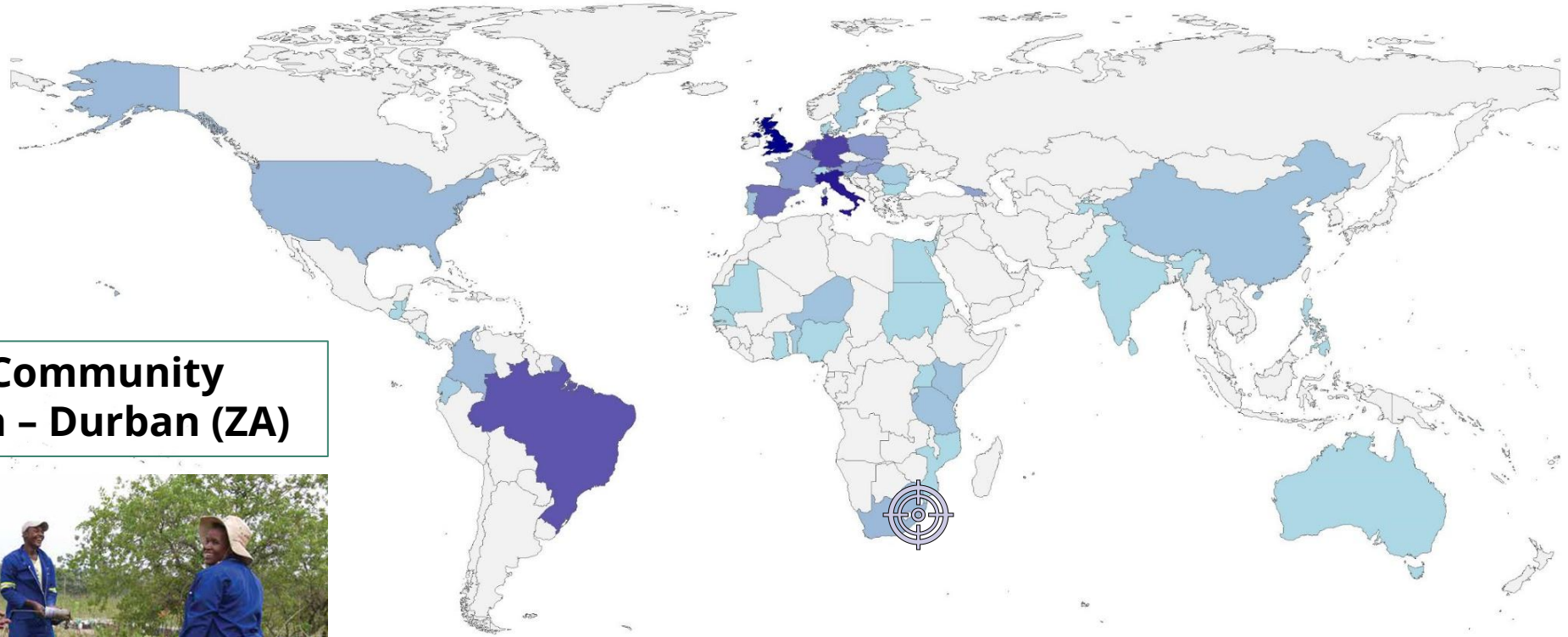
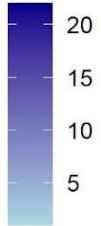


# 4. Examples from the Global South

“Bright spots” of transformative capacity

# Social transformative capacity

Intervention count



## Buffelsdraai Community Reforestation – Durban (ZA)

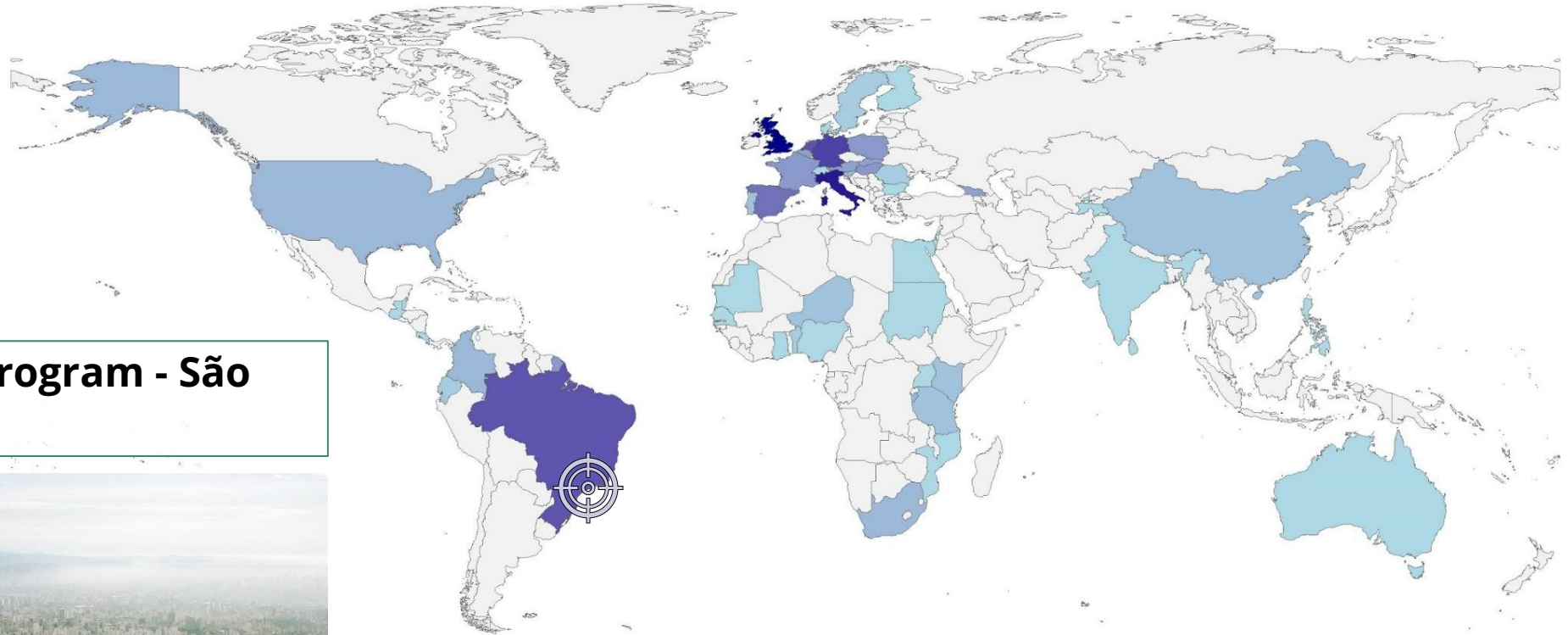
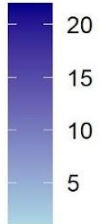


Created novel forms of employment that were shown to benefit whole families/communities across the city (*stewarding, orchestrating*)



# Ecological transformative capacity

Intervention count



**“100 parks” program - São Paulo (BR)**



Significantly increased the coverage of plants/unpaved areas in the city over the course of decades in the entire city system (*stewarding, transformative*)



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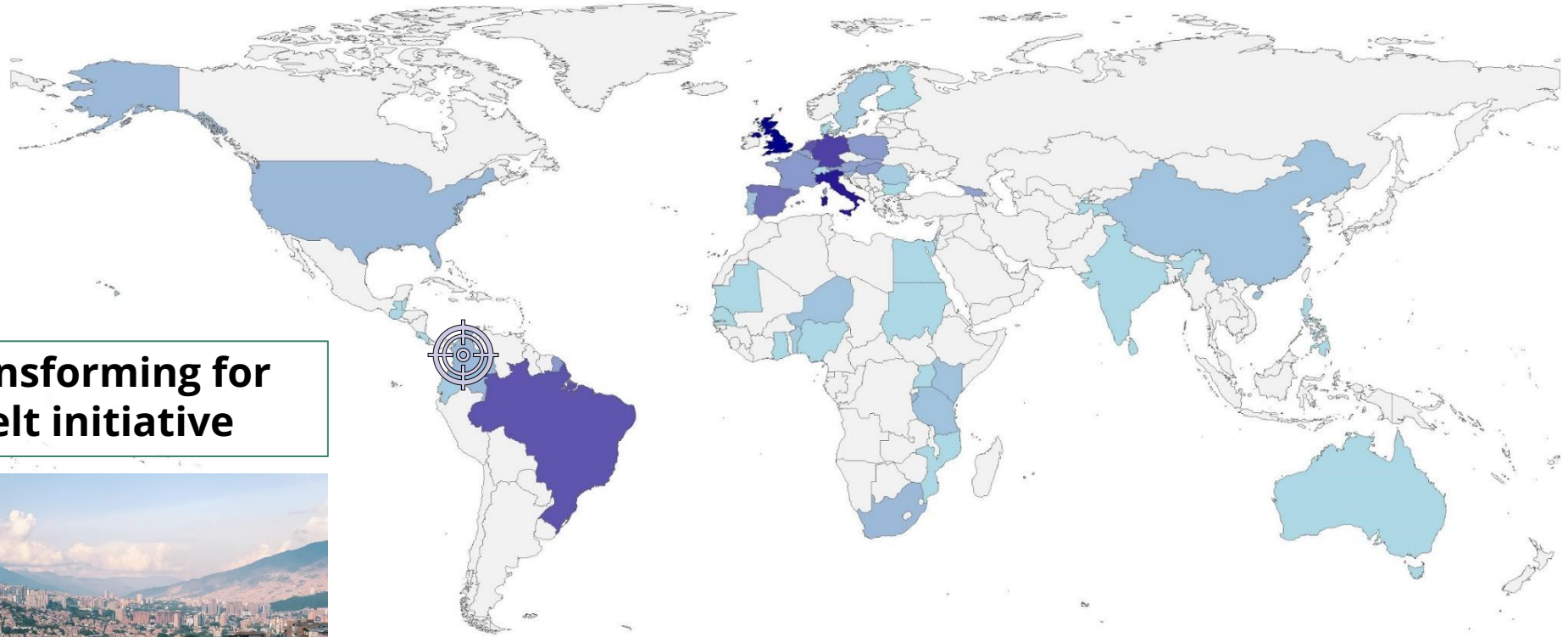
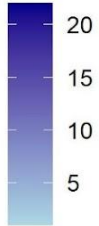
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# Technical transformative capacity

Intervention count



**Medellín: Transforming for life – green belt initiative**



Reinvigorating public spaces across the entire city while also attempting to guide the future infrastructural development of the city  
*(unlocking, orchestrating)*



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# Conclusions

- We applied a three-tier understanding of capacity of change
  - Incremental (shallow) leading to transformative (deep)
- We adapt leading understandings of transformative change and contextualise them to apply to cities as SET systems
- Overall few examples of interventions that reflect these definitions, though this varies regionally depending on SET dimensions considered







ESKERRIK ASKO  
THANK YOU  
GRACIAS



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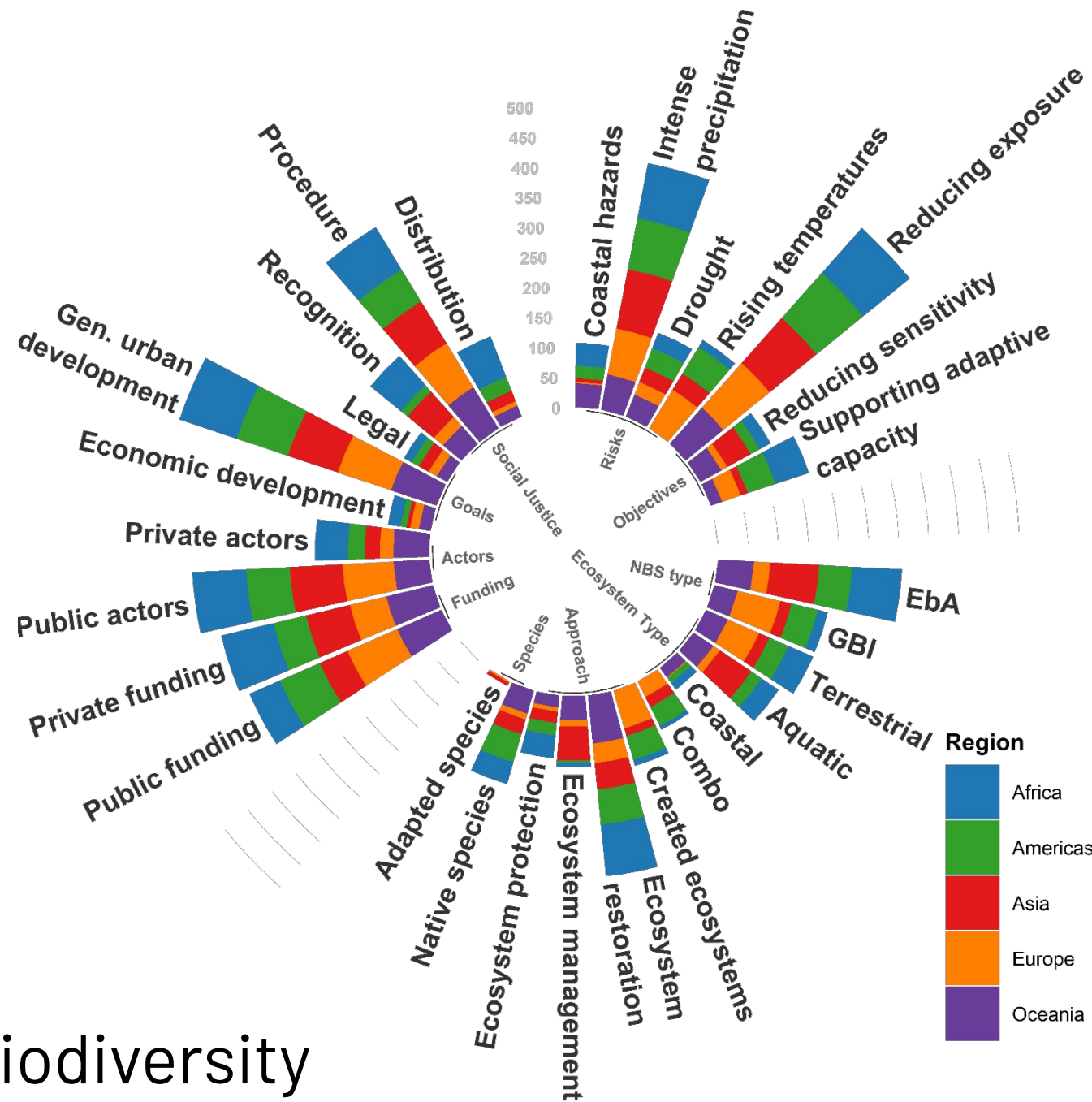
# Key literature

- **Heikkinen**, M., Ylä-Anttila, T., & Juhola, S. (2019). Incremental, reformistic or transformational: What kind of change do C40 cities advocate to deal with climate change? *Journal of Environmental Policy & Planning*, 21(1), 90–103. <https://doi.org/10.1080/1523908X.2018.1473151>
- **Hölscher**, K. (2020). Capacities for Transformative Climate Governance: A Conceptual Framework. In K. Hölscher & N. Frantzeskaki (Eds.), *Transformative Climate Governance* (pp. 49–96). Springer International Publishing. [https://doi.org/10.1007/978-3-030-49040-9\\_2](https://doi.org/10.1007/978-3-030-49040-9_2)
- **Markolf**, S. A., Chester, M. V., Eisenberg, D. A., Iwaniec, D. M., Davidson, C. I., Zimmerman, R., Miller, T. R., Ruddell, B. L., & Chang, H. (2018). Interdependent Infrastructure as Linked Social, Ecological, and Technological Systems (SETs) to Address Lock-in and Enhance Resilience. *Earth's Future*, 6(12), 1638–1659. <https://doi.org/10.1029/2018EF000926>
- **McPhearson**, T., Cook, E. M., Barbés-Blázquez, M., Cheng, C., Grimm, N. B., Andersson, E., Barbosa, O., Chandler, D. G., Chang, H., Chester, M. V., Childers, D. L., Elser, S. R., Frantzeskaki, N., Grabowski, Z., Groffman, P., Hale, R. L., Iwaniec, D. M., Kabisch, N., Kennedy, C., ... Troxler, T. G. (2022). A social-ecological-technological systems framework for urban ecosystem services. *One Earth*, 5(5), 505–518. <https://doi.org/10.1016/j.oneear.2022.04.007>
- **Melanidis**, M. S., & Hagerman, S. (2022). Competing narratives of nature-based solutions: Leveraging the power of nature or dangerous distraction? *Environmental Science & Policy*, 132, 273–281. <https://doi.org/10.1016/j.envsci.2022.02.028>

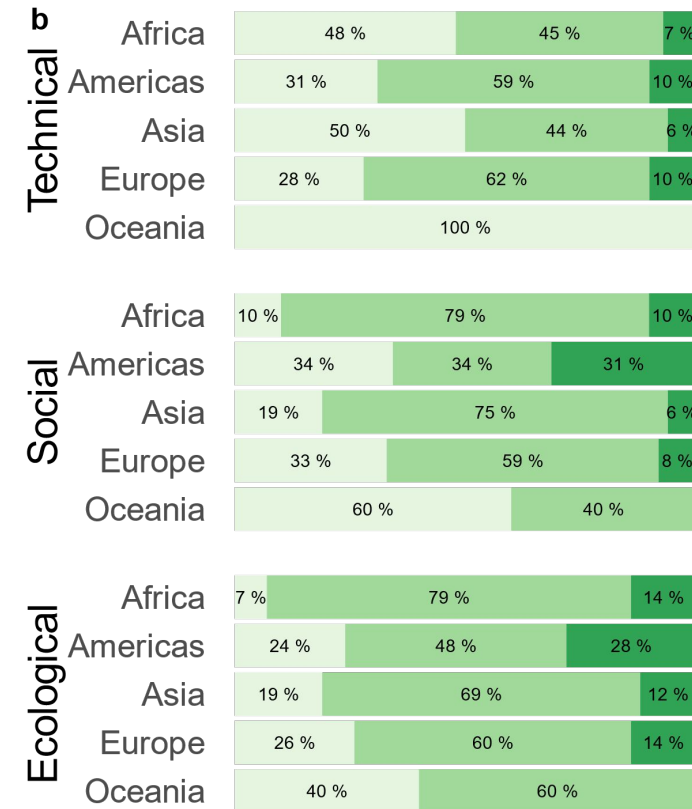
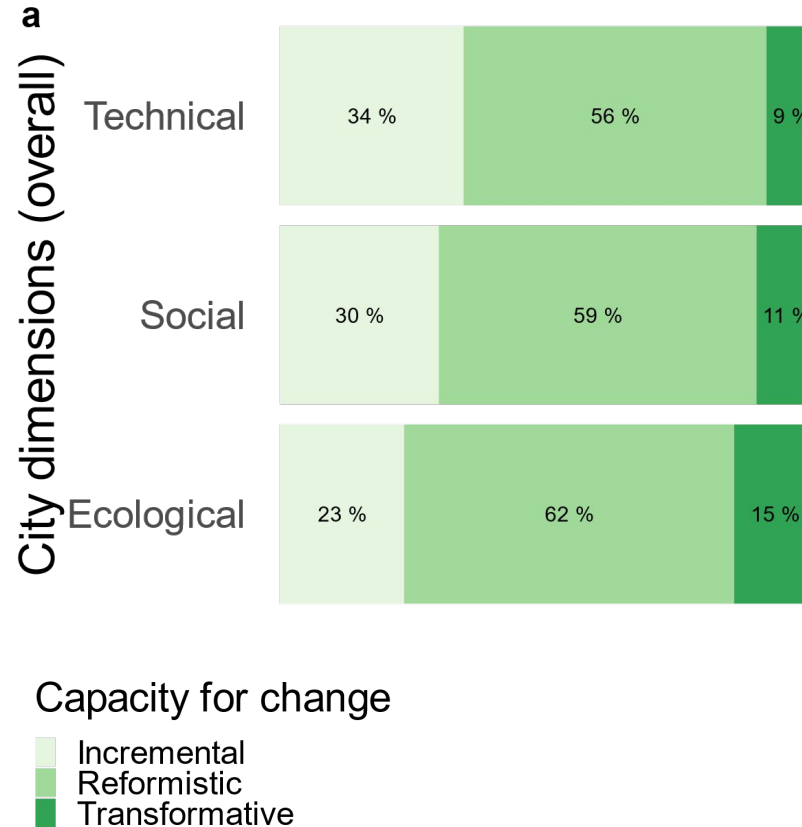
Society

Climate

Biodiversity

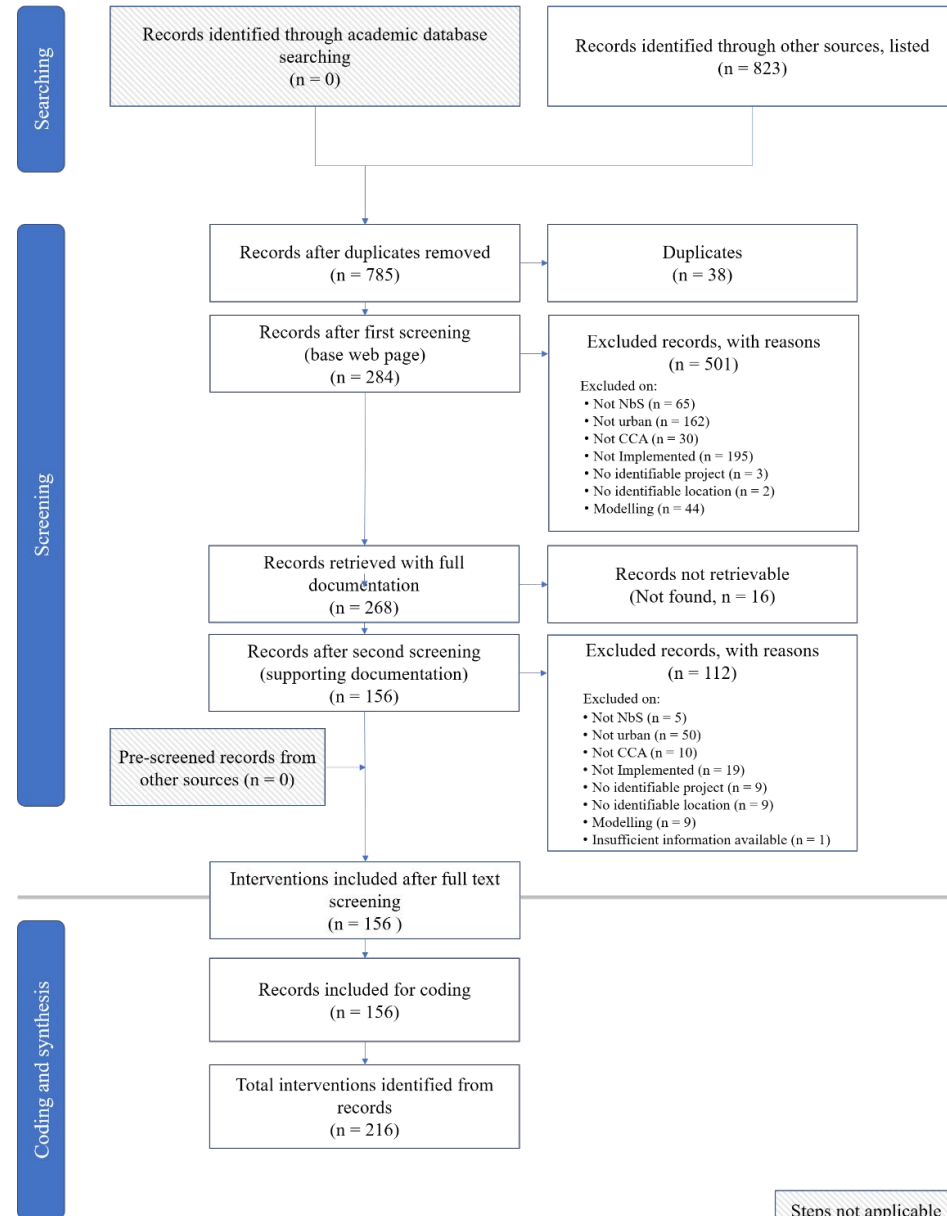


# Degree of change globally and regionally



# Review results

ROSES flow diagram





# All databases used

- Global Climate Fund – Project Portfolio
- Adaptation Fund – Project & Programs
- International Climate Initiative – Project Map
- World Bank – Nature-based Solutions data
- Climate ADAPT
- Oppla Nature-based Solutions database
- Panorama Ecosystem-based Adaptation solutions database
- Urban Climate Change Research Network – Case study docking station
- Equator Initiative – Nature-based Solutions database

# Definition of NBS

- **"...actions to *protect, sustainably manage and restore* natural or modified ecosystems, which address societal challenges effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits" (IUCN)**
- "Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience." (EC)



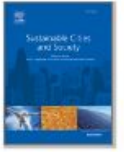
# Definition of NBS – cont.

- Four key characteristics:
  1. Broad definition of nature
  2. Multi-functional and solution-oriented
  3. Require implementation through holistic and integrative governance and planning approaches
  4. Must be adapted to local conditions





Sustainable Cities and Society

Volume 49, August 2019, 101620



## Urban greening through nature-based solutions – Key characteristics of an emerging concept

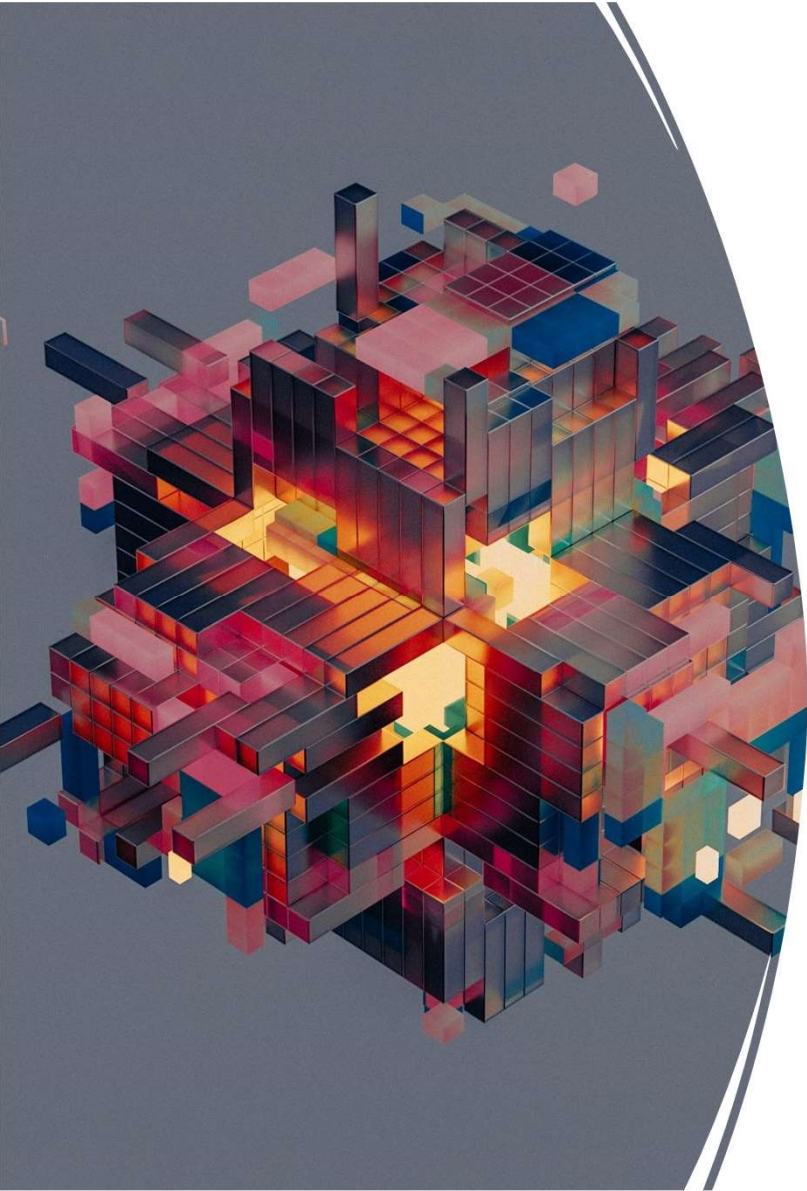
Hade Dorst <sup>a</sup> , Alexander van der Jagt <sup>a</sup> , Rob Raven <sup>a, b</sup> , Hens Runhaar <sup>a, c</sup> 

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<https://doi.org/10.1016/j.scs.2019.101620>

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# Transition Methods



# Simulation, Visualisation and Discussion: Decision Theatre

**Workshop: Transformative Research in Cities**  
**29.11.2022 online**

# Decision Theatre

IT-supported stakeholder dialogue format  
for decision or research processes



visualisation, empirical information,  
mathematical modelling and simulation



participants  
interact with  
models



## some background

- 1970ies: first decision theatre in **management education** to simulate and observe decision processes (see Roach, 1986)
- from 2000s: **decision support**
  - Arizona State University and other places (Mexico, China, UK, ...)
  - strengthen role of quantitative modelling and data analysis in complex decision processes (Bush et al, 2017)
  - offer stakeholders the possibility to evaluate alternative options from their perspective (interests, preferences etc.) (Boukherroub et al., 2016)
- recently: **co-production**
  - interaction of people (creativity, intuition) with data, models, and with each other facilitates common assessments and creation of solutions (Boukherroub et al, 2016; John et al, 2020)

# Decision Theatre on sustainable mobility

- since 2018
- Global Climate Forum, ASU, MATH+
- mobile set up
- based on Mobility Transition Model
  - agent-based model of mobility demand in Germany up to 2035
- workshop (1.5h – a day)
- DT-team covers roles of problem-expert, model-expert, visualisation-expert, IT-expert, moderator
- 5-20 guests (practice experts, decision makers, citizens)



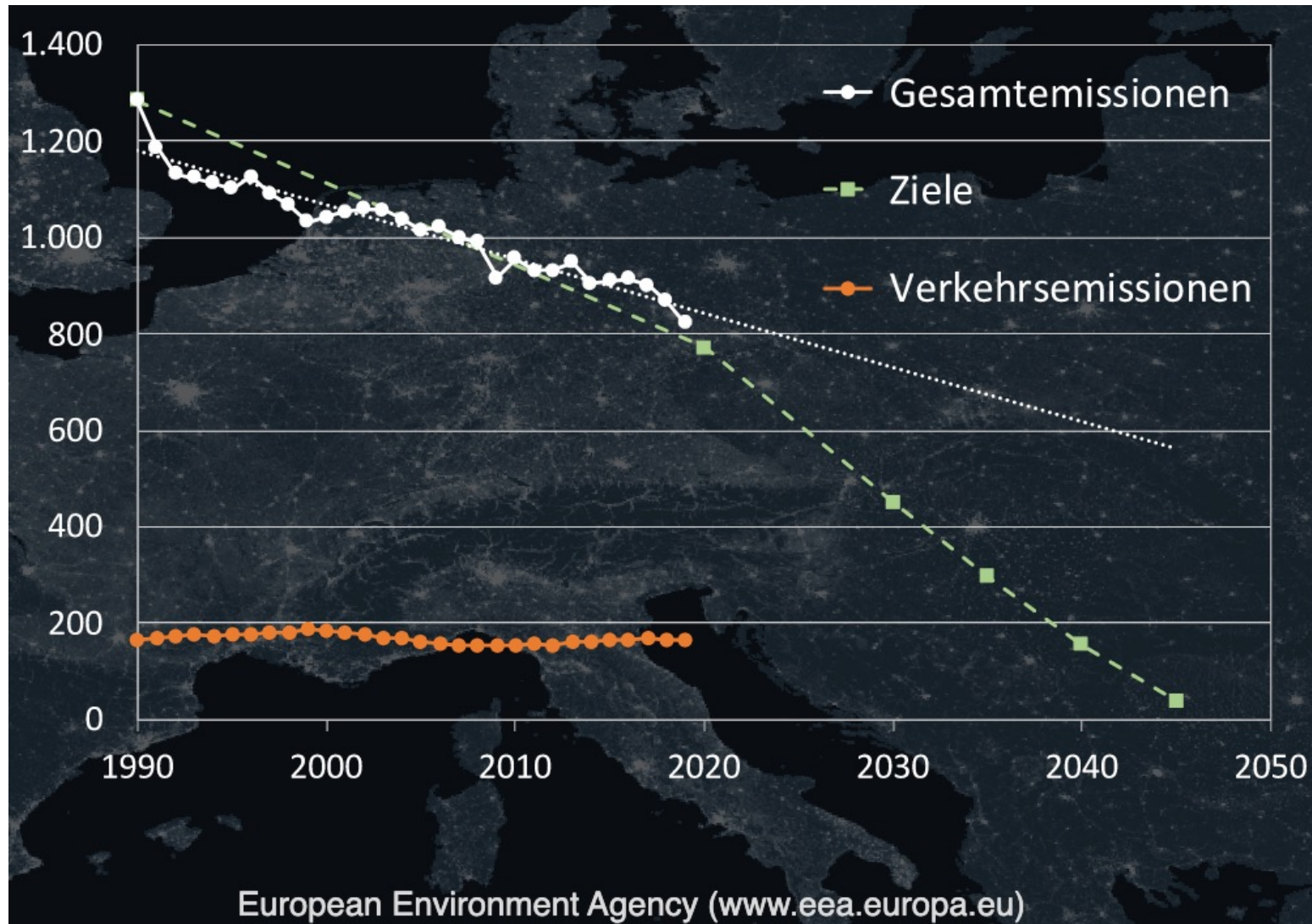


# DT event structure

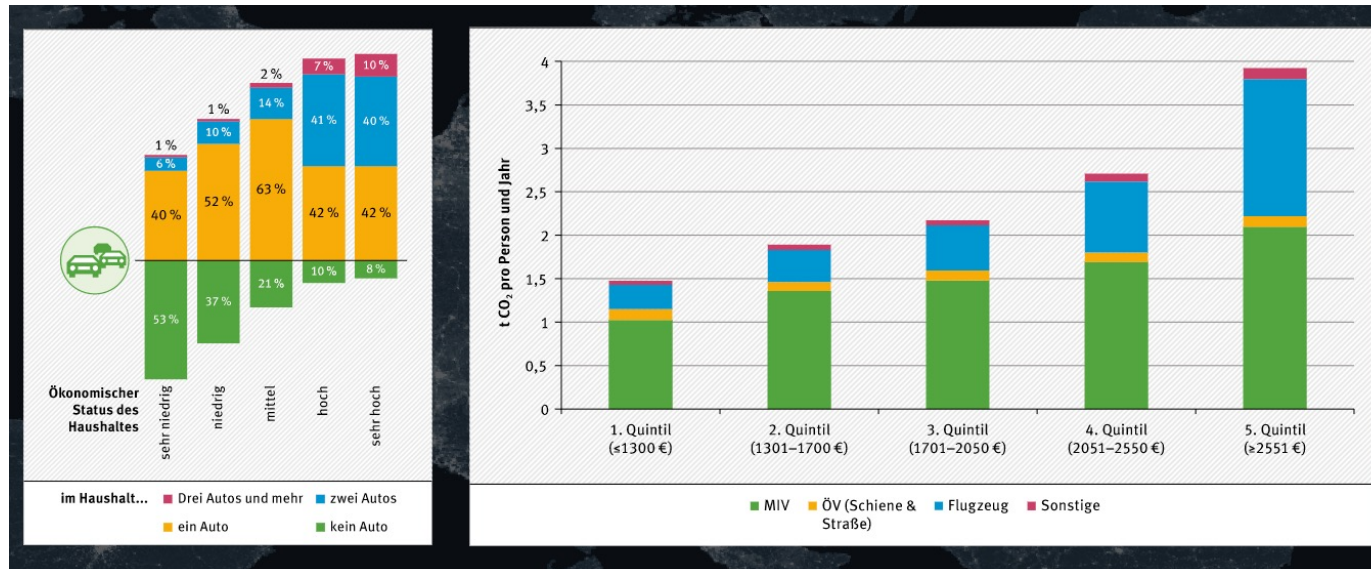
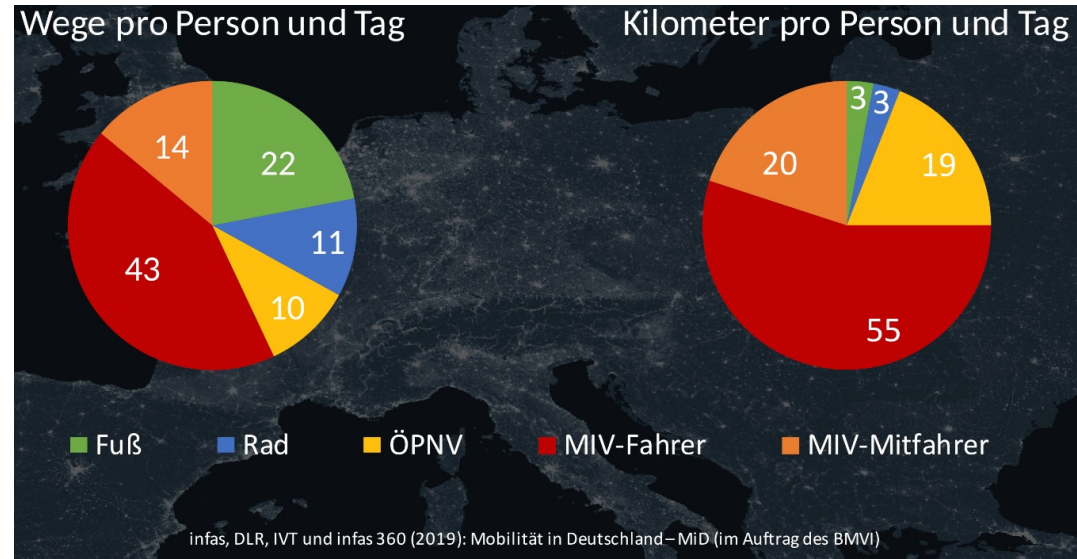
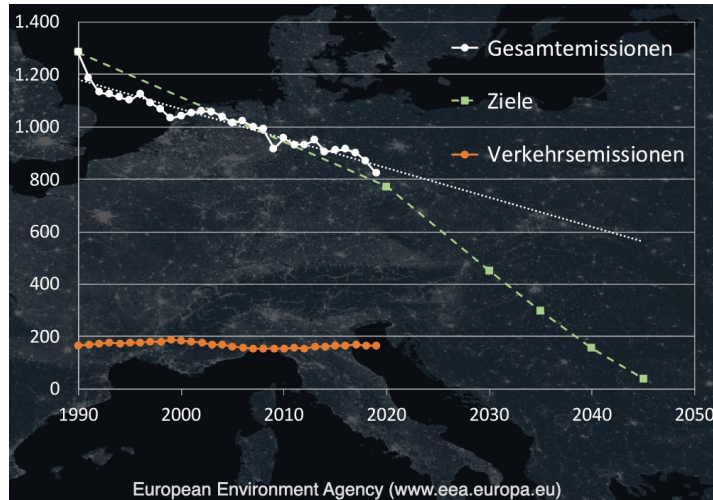
- briefings
  - situation (empirical information on status quo, goals, possibly discrepancy)
  - exchange of visions, expectations, what is plausible, desirable
  - model (structure, assumptions, interaction possibility)
- decision situation
  - participants in small groups define a choice of options, produce a scenario
- exploration of consequences (compare and analyse simulated scenarios)
- reflection (learnings about the problem discussed, model improvement)



# status quo



# status quo

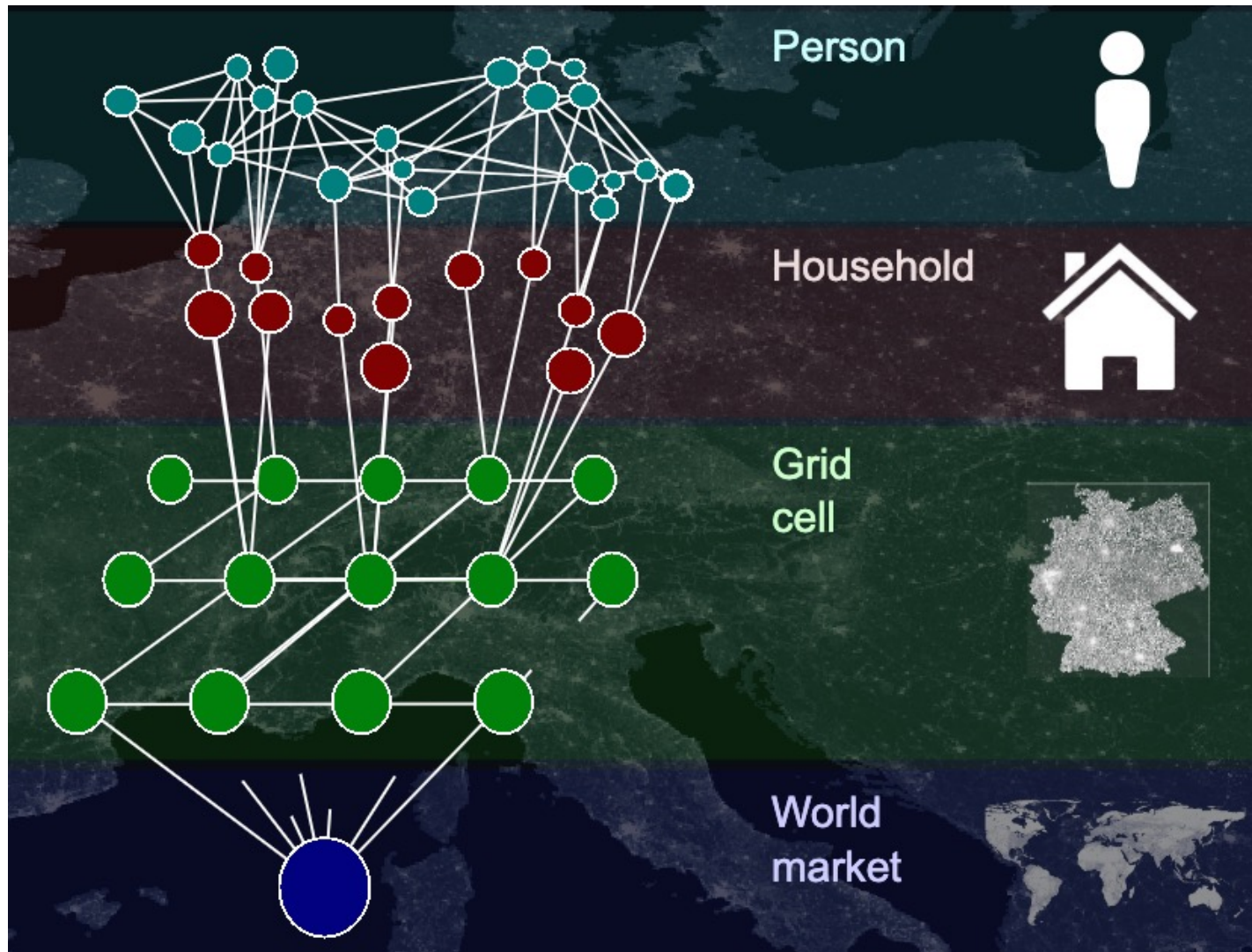




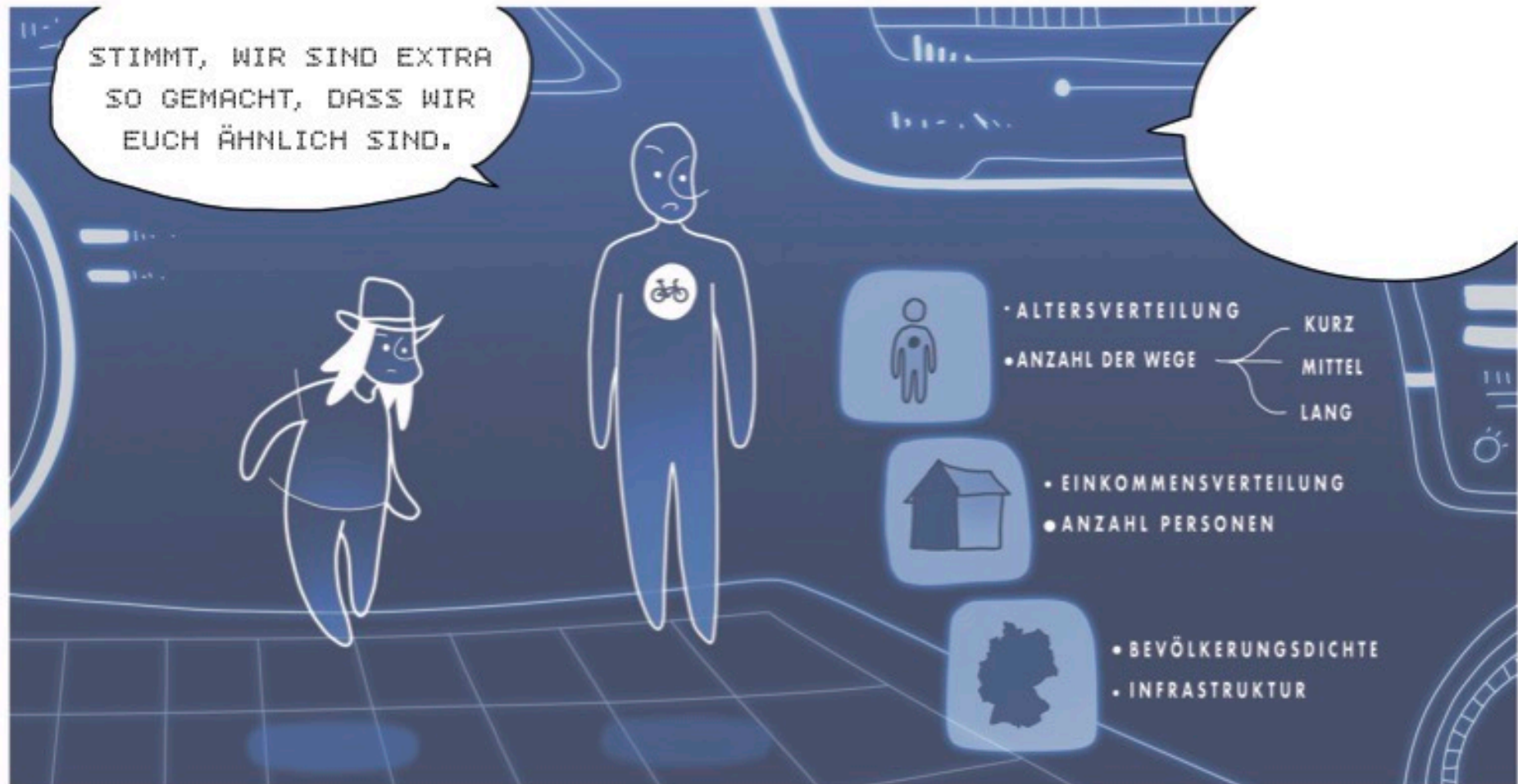
# visions?



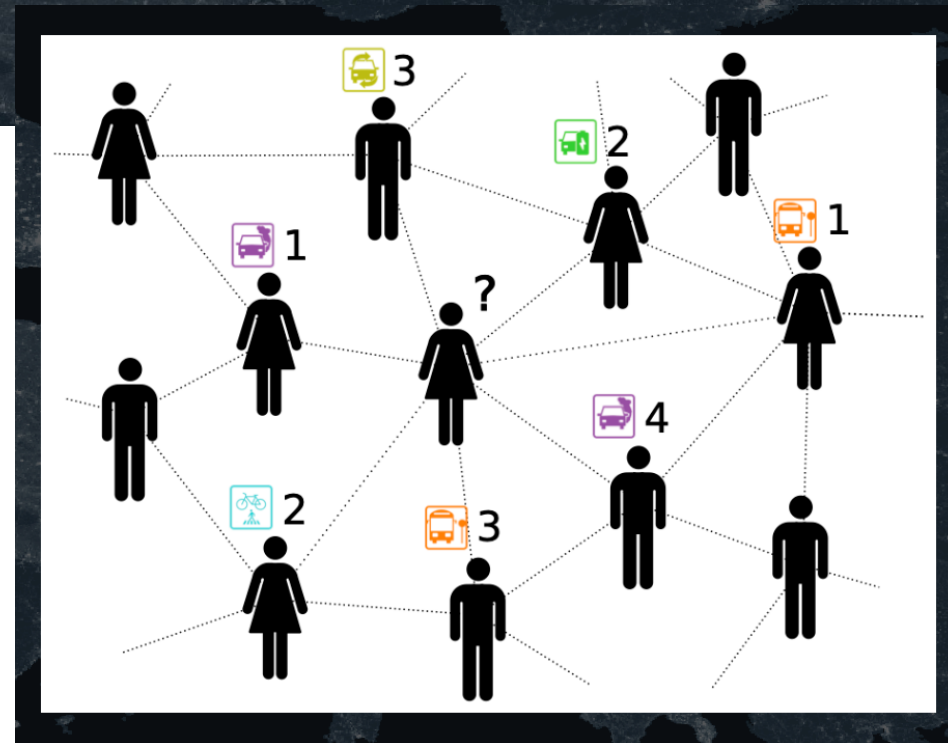
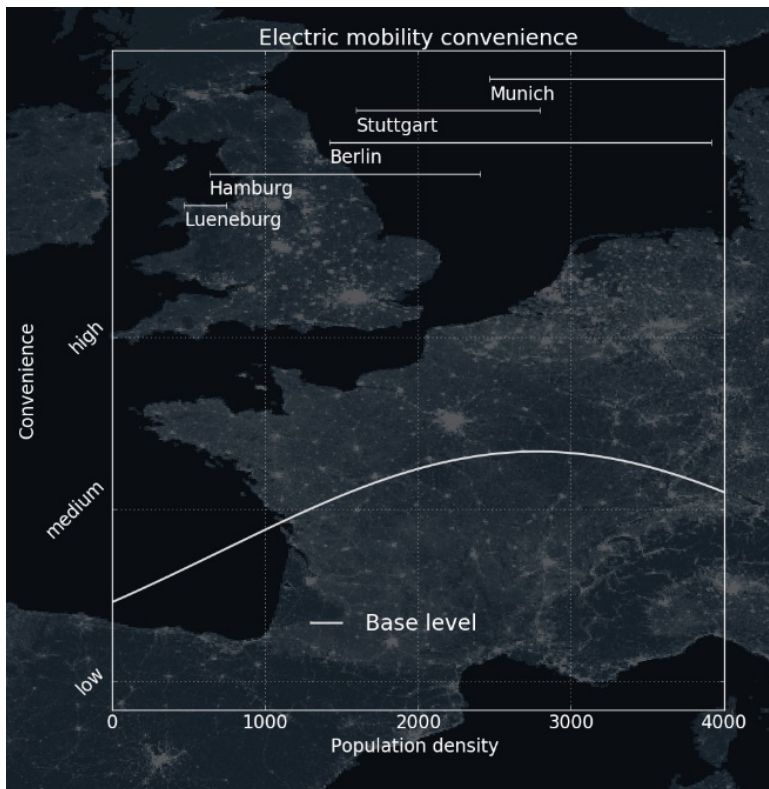
# Mobility Transition Model



# “we are made to be like you”



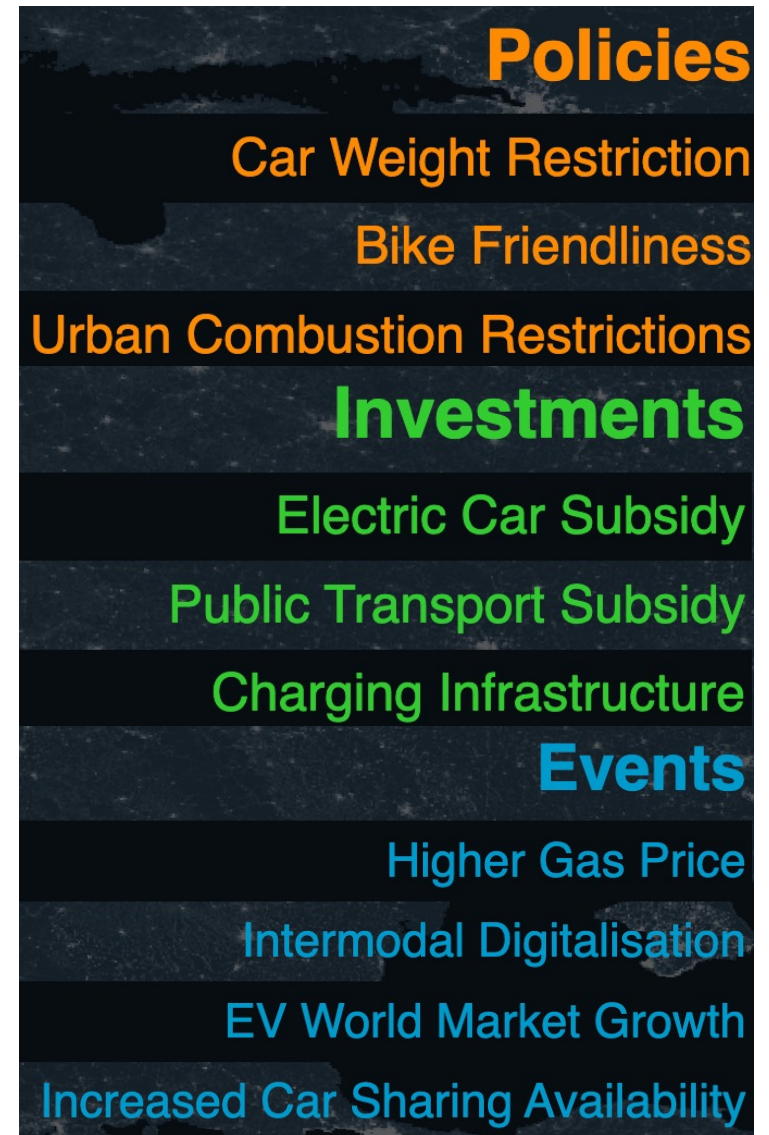




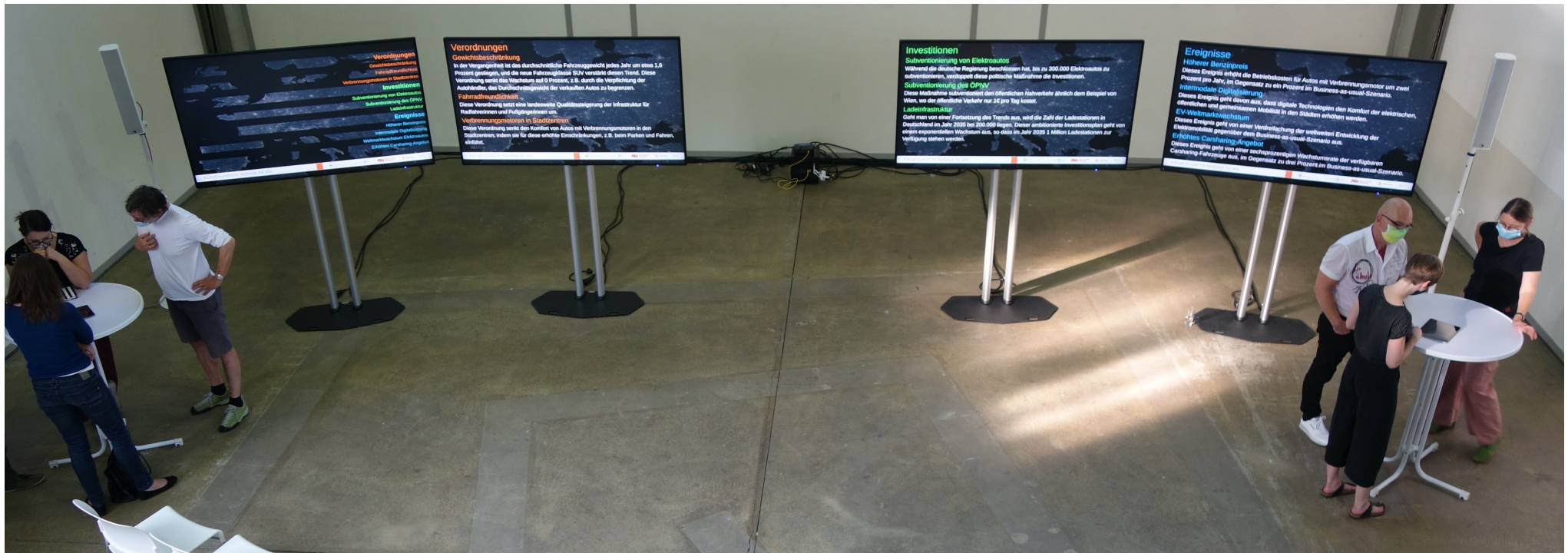


# BAU and options

- monthly timesteps 2005-2035
- about 1.5 mio agents
- runs a few hours...
- business as usual: current trends extended
- options for scenario choice



# compose scenarios





# explain goals & choices, compare outcomes



# transition method? DT as a tool for...

... decision support

- participants bring different perspectives, expert knowledge on different aspects
- make assumptions explicit in the model
- "what if?" play through different scenarios
- platform for discussion, common understanding, reasoning



# transition method? DT as a tool for...

... science communication

- interactive
- ABM
  - participants can (somewhat) identify with agents
  - no expertise in modelling required from participants
- (fictitious) decision situation
  - framing, focus on specific points
  - make preferences, objectives, assumptions explicit
  - illustration of constraint: have to decide within limited time and under insufficient information

# transition method? DT as a tool for...

... co-production of research

- feedback on questions, methods, results
- ABM
  - participants can suggest improvements of assumptions at the micro level (agents, local environment, ...)

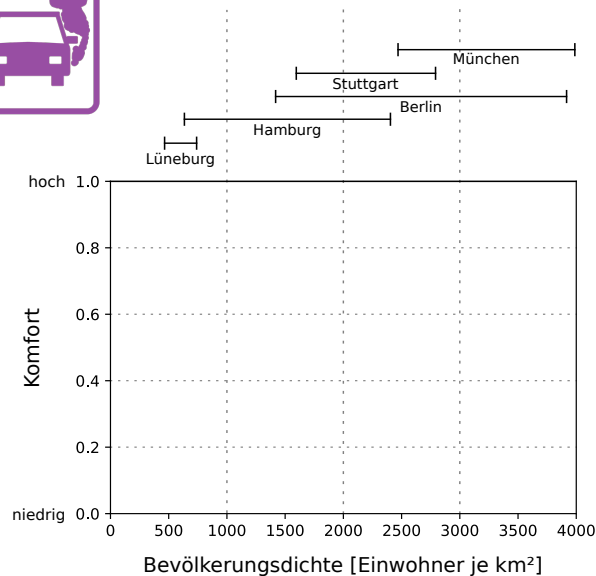
# participants as modellers

## Komfort (Mitarbeit von L. Blech, T. Brandes, R. Retterath)

Der Parameter Komfort soll viele Faktoren eines Verkehrsmittels, wie z.B. Fahrzeit, Verfügbarkeit, Reichweite oder Zuverlässigkeit, vereinen und als Zahl greifbar machen. Oftmals lassen sich Unterschiede dieser Faktoren in Abhängigkeit von der Bevölkerungsdichte feststellen.

Diskutiert wie der Komfort Eures Verkehrsmittels von der Bevölkerungsdichte abhängt. Skizziert anschließend eine Kurve, die diese Abhängigkeit darstellt. Nutzt dazu das vorgegebene Diagramm. Die Städte dienen als Orientierung, um die Werte der Bevölkerungsdichte besser einschätzen zu können.

Euer Verkehrsmittel:



- draw a convenience curve for the mobility choice shown
- would this curve change – and if so, how – with a speed limit of 100km/h on highways and 80km/h outside cities?

# transition method? DT as a tool for...

... co-production of research

- feedback on questions, methods, results
- ABM
  - participants can suggest improvements of assumptions at the micro level (agents, local environment, ...)
  - unexpected results may enlarge space of futures under discussion
- model + dialogue
  - outline futures with a quantitative core
  - discuss/assess their plausibility and desirability
  - consider fundamental change? transformative solutions...

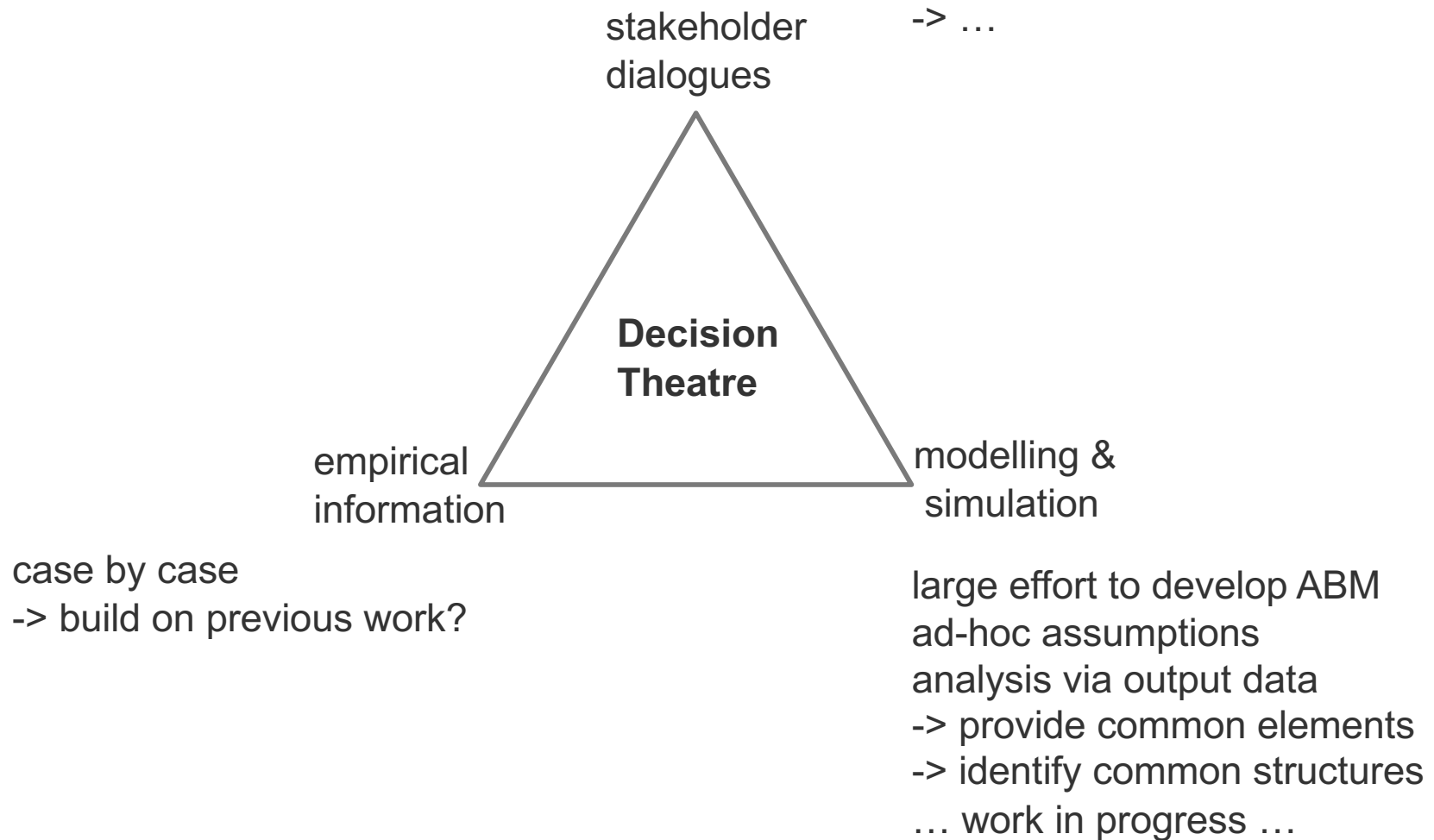


**“why do they change  
your future?”**

**“it helps them think  
about their own  
future”**



# difficulties: set up a DT

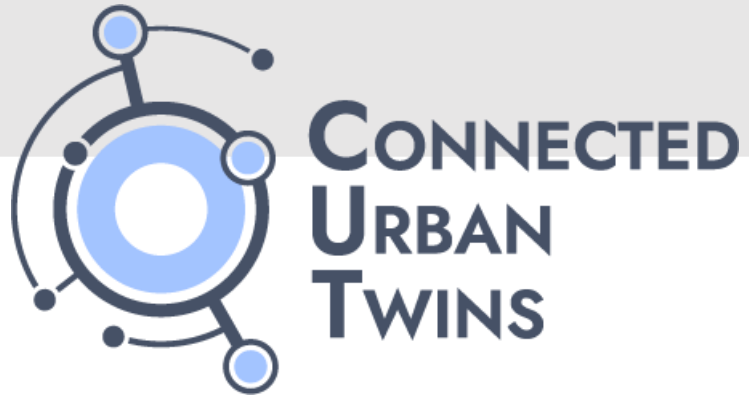


**thank you**

**questions?**

# references

- more detail on what was presented:
  - <https://globalclimateforum.org/2021/04/15/new-gcf-working-paper-02-21-the-decision-theatre-triangle-for-societal-challenges/> (newer version submitted, can be shared upon request)
  - <https://globalclimateforum.org/comic>
- DT history:
  - Boukherroub et al, 2018 <https://doi.org/10.1016/j.jclepro.2018.01.084>
  - Bush et al., 2017 <https://doi.org/10.1016/j.jclepro.2017.01.129>
  - John et al., 2020 <https://doi.org/10.1016/j.futures.2020.102614>
  - Roach, 1986 [https://doi.org/10.1016/0007-6813\(86\)90026-1](https://doi.org/10.1016/0007-6813(86)90026-1)



**City Science Lab**  
A Cooperation with the MIT Media Lab



**Rico Herzog**  
M.Sc. Engineering and  
Policy Analysis

# Merging the Digital and the Analogue

Transformative Research in Digital Urban Twins

Partnerstädte:



Landeshauptstadt  
München

Gefördert durch:



29.11.22





## Project Background

I.



## Research Design

II.



## Case: Faircare Verkehr

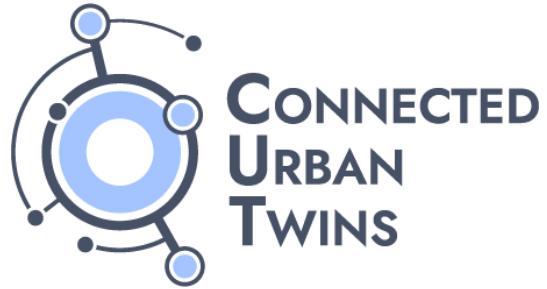
III.



# Project Background

Connected Urban Twins

# CUT Project Overview



Participating project cities:



Landeshauptstadt  
München

Sponsored by:



<b>3</b> project cities	<b>70</b> team members	<b>73</b> Smart City pilot projects („Modell Projekte Smart Cities“, MPSC)
<b>5 years</b> project duration: January 2021 to December 2025	<b>32,4 M €</b> € project volume	<b>BMWSB</b> Sponsor: Federal Ministry of Housing, Urban Development and Construction



Senate Chancellery, Office for IT and Digitalization

Department for Urban Development and Housing (BSW), Stadtwerkstatt

Agency for Geoinformation and Surveying (LGV)

CityScienceLab at the HafenCity University Hamburg (HCU)

HPA - Hamburg Port Authority

Dataport



**Stadt Leipzig**

Digital City Department

Agency for Geoinformation and Land Use Planning

Agency for Statistics and Elections

Agency for City Planning

Lecos GmbH

L-Group

Center for Scalable Data Analytics and Artificial Intelligence (ScaDS.AI)



**Landeshauptstadt München**

Municipal Department

IT Department

Department for Urban Planning and Building Regulations (PlanTreff)

Technical University of Munich (TUM)



- Joint technological and conceptual development of urban data platforms and urban Digital Twins in Hamburg, Leipzig and Munich
- Digital Twins as innovative tools for future-oriented integrated urban development and transparent participation of urban society
- Active knowledge transfer and replication of project results into other cities and municipalities
- Standards for Germany: development of a modular system for the use of urban Digital Twins
- New technologies, benchmark data governance and data sovereignty as integral components of the system

# 5 Sub Projects

**1: Urban Data  
Platforms and  
Digital Twins**

**2: Innovative  
use cases of  
urban  
development**

**3: Rethinking  
participation of  
urban society**

**4:  
Transformative  
experimental  
urban research**

**5: Replication  
and knowledge  
transfer**

**AR/VR/MR**

**Citizen  
Co-Design**

**Sensor  
Technology**

**Models and  
Simulation,  
AI, ML**

**Standards**

**Evaluation**

# What's a Digital Twin?

## Key concept of the Industry 4.0

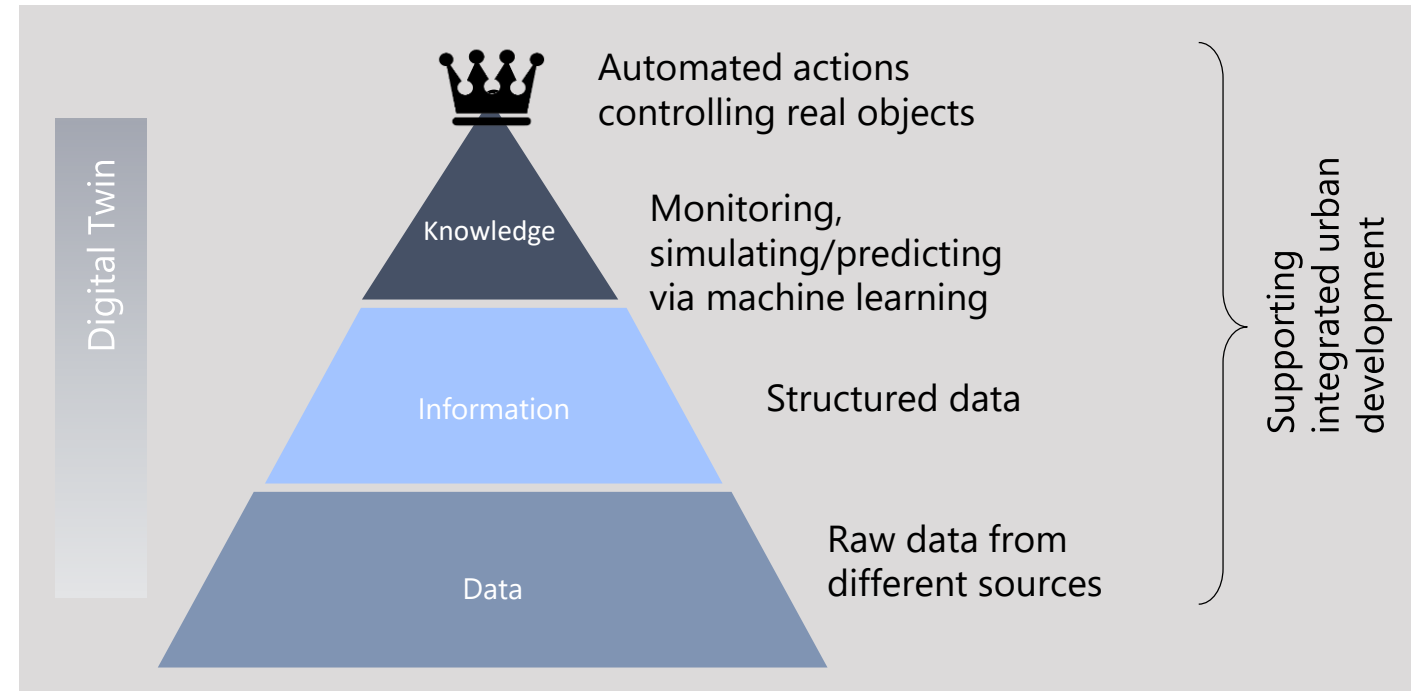
- Digital Twins: a virtual copy or image of an existing object or an intangible process chain
- Created by data and algorithms, connected to the real world via sensors
- Originating from the industrial sector, the CUT-Projekt transfers the idea of a Digital Twin to the field of integrated urban development



Quelle: [GE.com](https://www.ge.com)

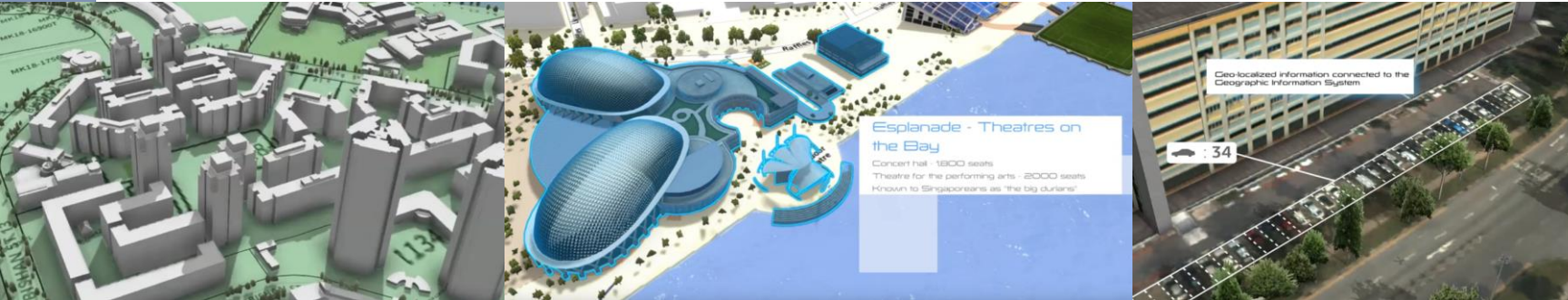
## Digital Twins for cities and local communities

- Concept of organizing and creating usability of various data about cities. Such data includes a city's physical components, its logical structures, stakeholders and their environment - meaning all digital resources of a local community.
- Taking into account all technical, organizational and legal aspects



*From data to information to knowledge to the supreme discipline of impacting the real world*





Images: ZOAN Virtual Helsinki  
(<https://www.viveport.com/aaf7f609-f457-4349-9588-ce71daa85132>)

# Digital Urban Twins Worldwide



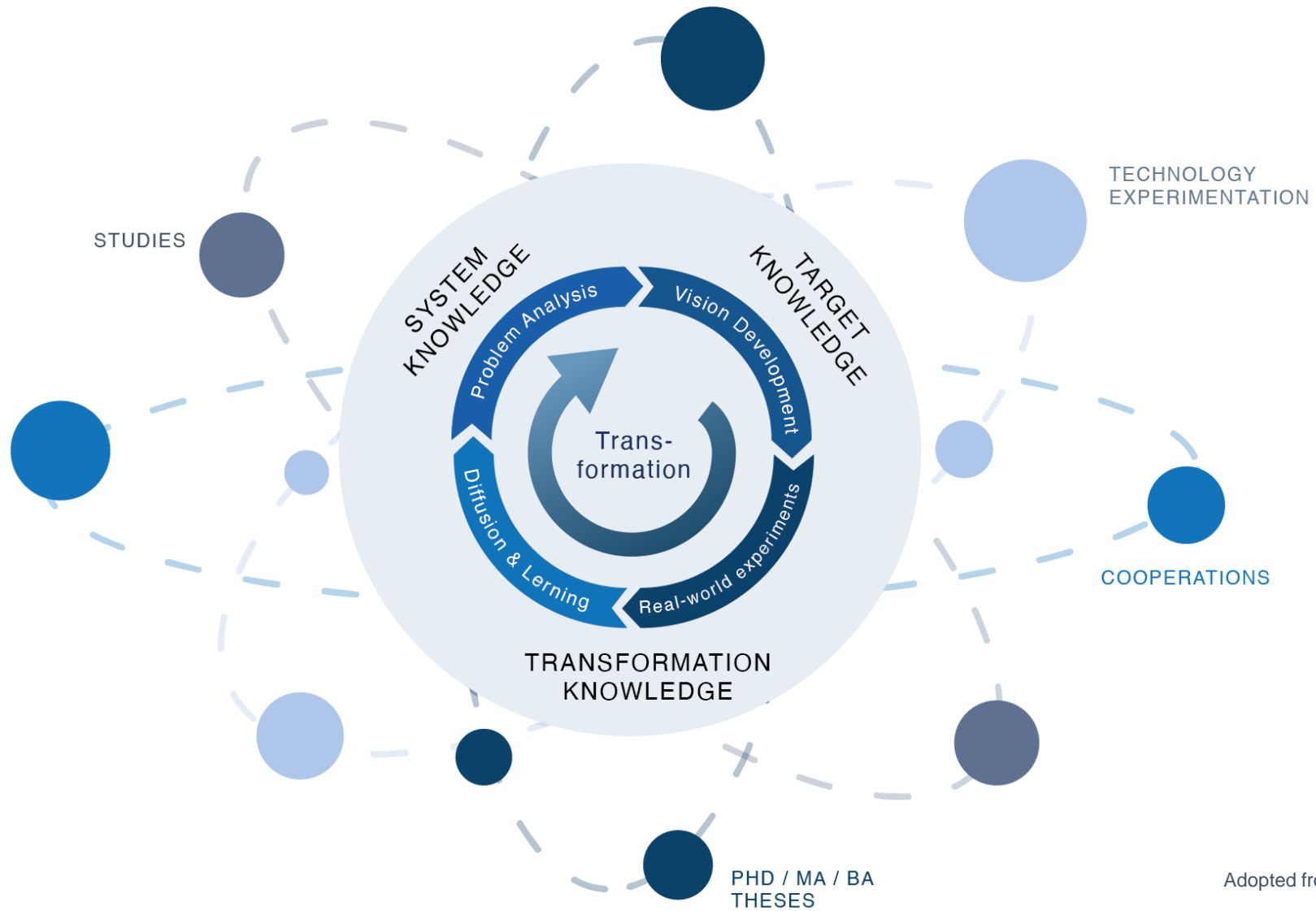
Images: Cityzenith  
(<https://vimeo.com/312641882>)



# Research Design

Transformative Experimental Urban Research

1. How should digital tools and technologies be integrated into Hamburg's CUT architecture and urban development practice in order to support transformations towards the sustainability of various socio-ecological-technical subsystems (SETS)?
2. How should digital tools be designed in order to specifically support or encourage actors from the fields of politics, administration, civil society and science in their actions for an urban transformation?
3. How can digital tools be used to expand participation opportunities and promote direct cooperation between citizens, politics and administration so that measures for urban transformation can be (jointly) implemented (co-creation and co-design)?



Adopted from Wuppertal Institute (2022)

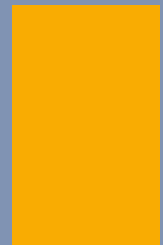


# Hamburg as a real-world laboratory

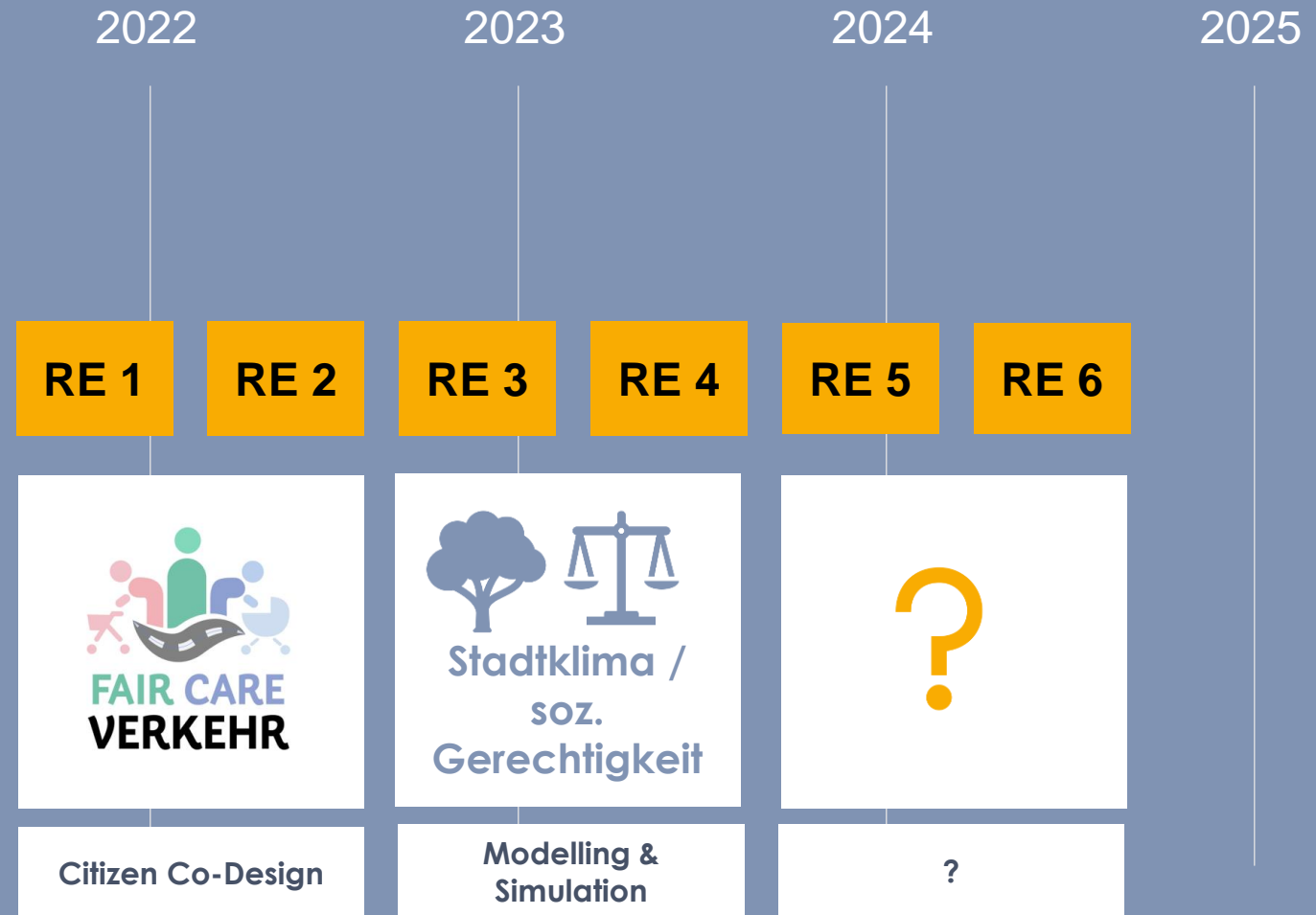


- **Hamburg**
  - 2nd largest city in Germany, > 1.8M inhabitants
  - One of three city-states
- Multiple real-world experiments planned that build onto each other





# Research with use cases



## Research Process

1. (Further) develop digital prototypes (as possible modules of the digital twin)
2. Present prototypes and test them with partners (administration, citizens, companies)
3. Reflect on the process and generate transformation knowledge

## Aim

- Incorporate the prototypes as an integral part of Hamburg's digital urban twin and its urban development process
- Use these tools to identify conflicts and possible solutions for better and more sustainable planning in the future
- Foster cooperation with and between civil society and public administration



# Faircare Verkehr

Research Case

## Case: Unpaid Care Work

- Includes care work for upbringing, education, household, nurture, ...
- Total societal benefit of care work exceeds the amount of gainful employment (BMF, 2021)
- Gender Care Gap (Winker, 2021)
- **At the same time:** Western European Cities are largely planned for full-time gainful employment



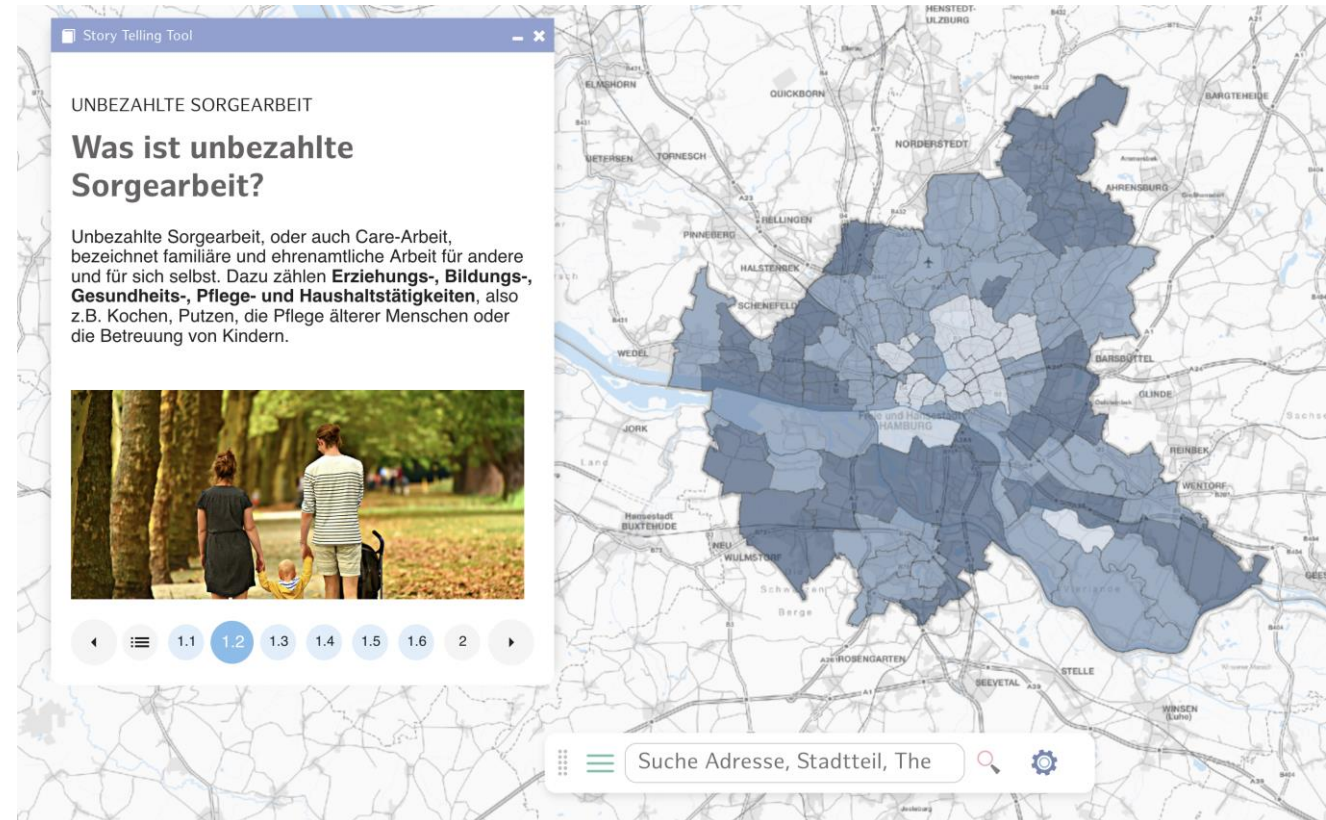


# First real-world experiment



## Data Narration Tool

- Connect and contextualize open data
- Tell the story of unpaid care work



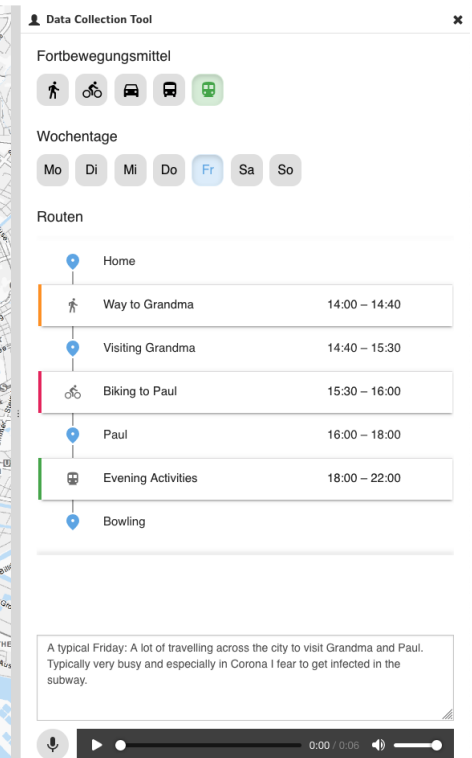
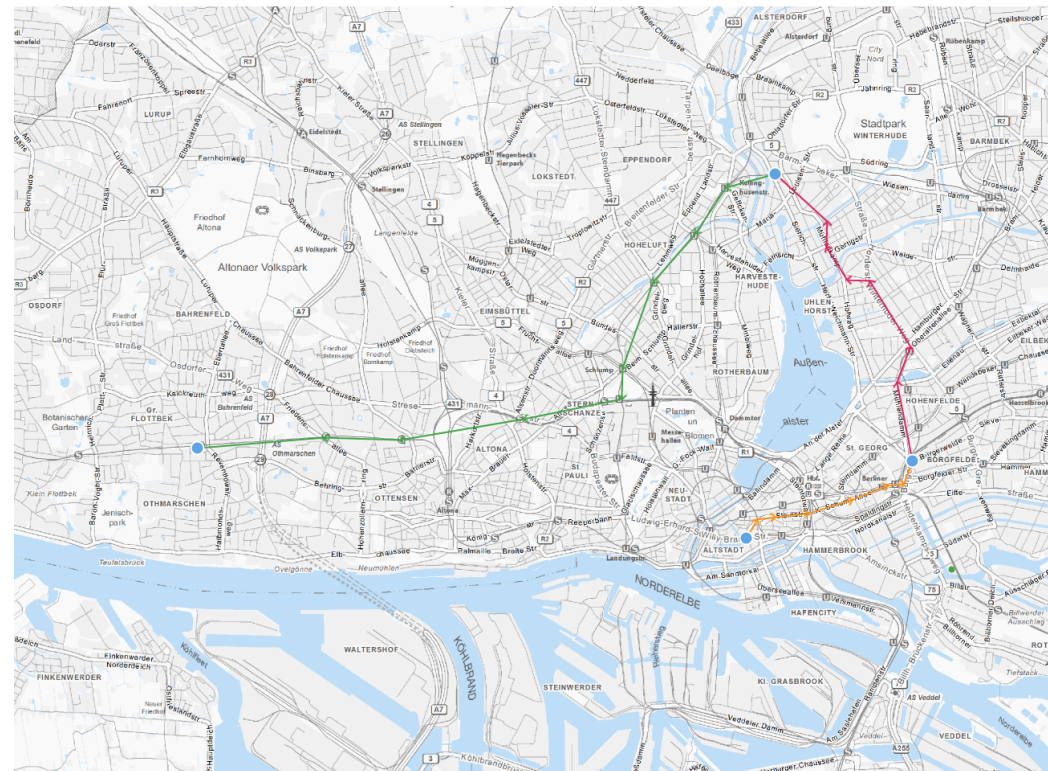


# First real-world experiment



## Data Collection Tool

- Tool to collect mobility data of unpaid care workers
- Low-threshold mapping & annotations

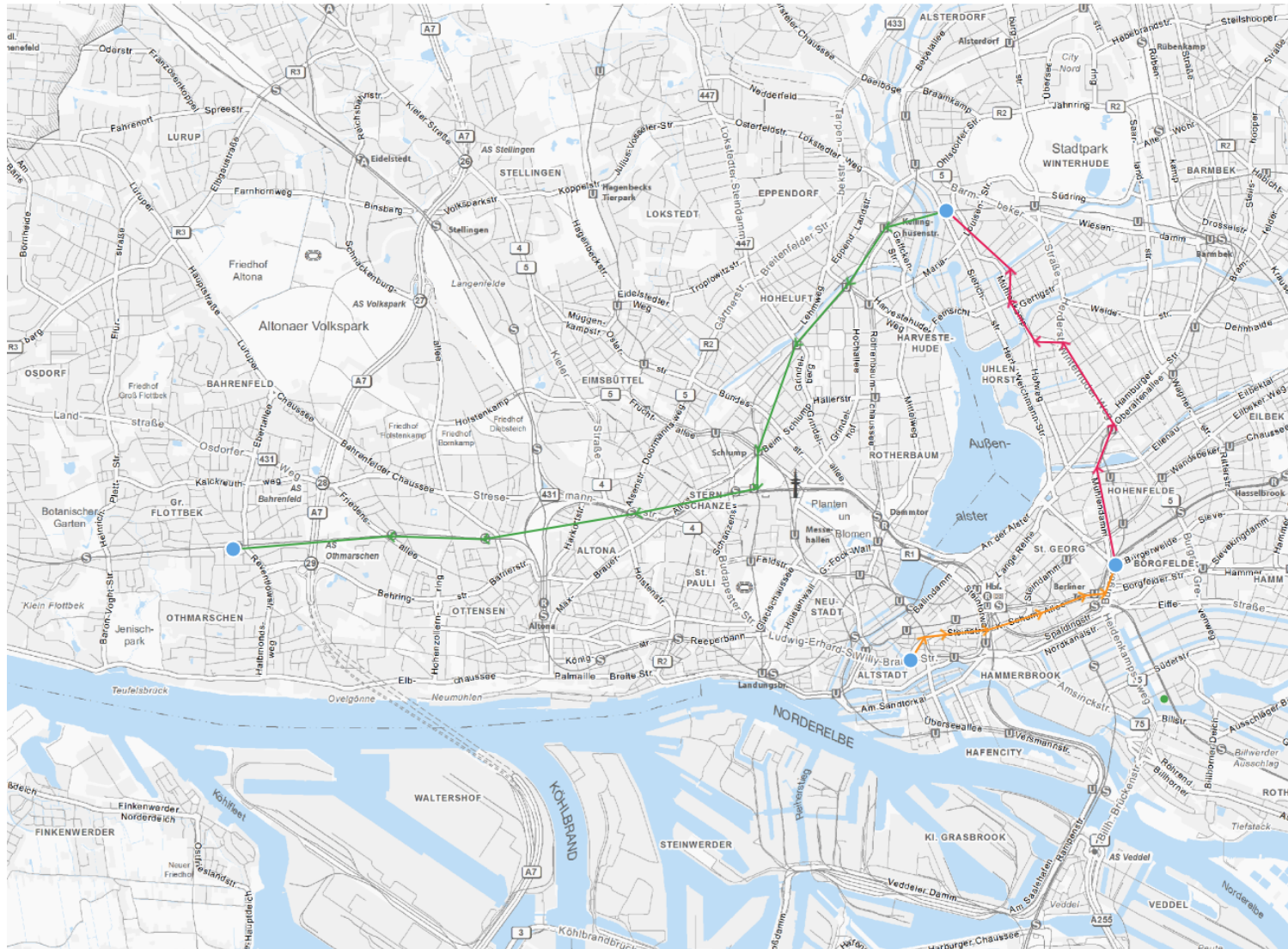




## Data Collection (I)

- Invitation of >15 unpaid care workers, mainly from individual networks (Dec 2021)
  - Individual, facilitated data collection (> 1h each)
  - Collection of mobility patterns, annotations (POIs, LOIs, AOIs), text and speech
- Highly detailed qual + quan data













**Data Collection Tool**


**Fortbewegungsmittel**




**Wochentage**

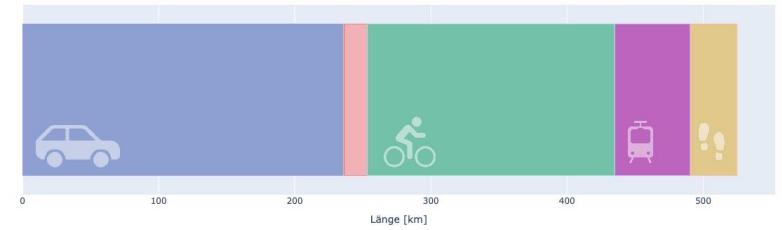
Mo Di Mi Do **Fr** Sa So

**Routen**

- Home
- Way to Grandma 14:00 – 14:40
- Visiting Grandma 14:40 – 15:30
- Biking to Paul 15:30 – 16:00
- Paul 16:00 – 18:00
- Evening Activities 18:00 – 22:00
- Bowling

A typical Friday: A lot of travelling across the city to visit Grandma and Paul. Typically very busy and especially in Corona I fear to get infected in the subway.

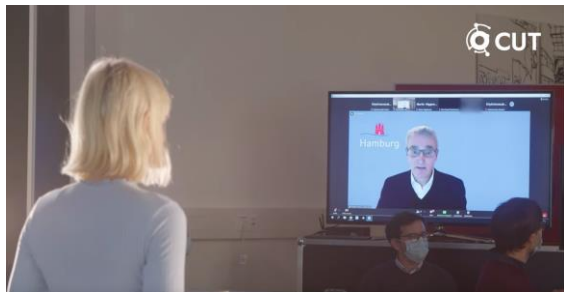


0:00 / 0:06




## Data Collection (I)

6.-12.12.2021





Rewatch [here](#)

29.11.22

Transformative Research in Cities – Online-Workshop | Rico Herzog | City Science Lab Hamburg

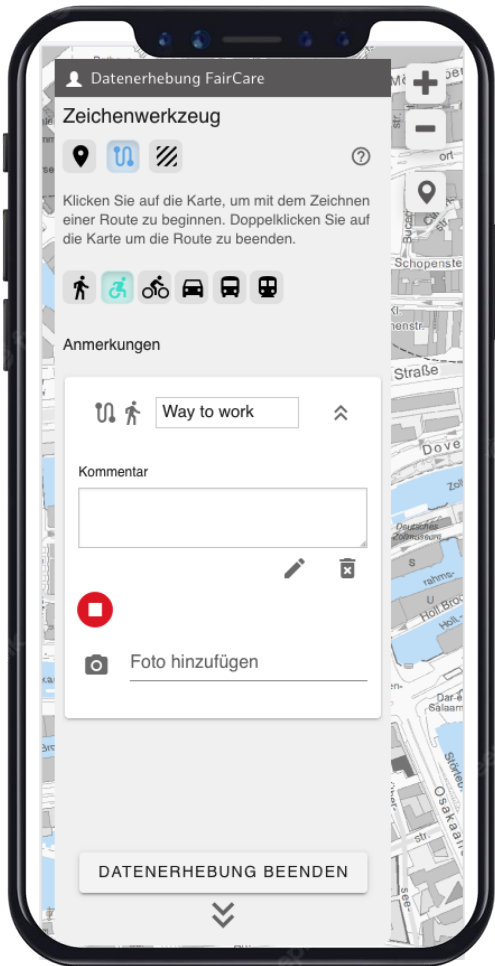




## Data Collection (II)

- Cooperation with the „Alliance for caring relatives“
- Adaption of the tool for mobile data collection
- 3-months of collection of geolocated data (sound, text, image)
- Currently under analysis





# Media coverage

- Broad coverage of the project in local and supralocal news (newspapers, TV, newsletters etc.)
- Raised the interest of public administration and politicians

ZEIT  HAMBURG  
elbvertiefung am Mittwoch

Mehr als 2,2 Milliarden Euro für Entlastung der Bürger • Hamburg ist die smarteste Stadt Deutschlands • Größtes Containerschiff der Welt ist gerade im Hafen • Und: Runter vom Sofa und ab in die Clubs!



Liebe Leserin, lieber Leser,

eigentlich hätte meine Freundin Alice unsere Trauzeugin sein sollen. Ich habe vor bald zehn Jahren in New York geheiratet, und zwar, nun ja, eher spontan. Mein jetziger Mann und ich



MOPO.



Wer mit Kinderwagen oder Rollstuhl unterwegs ist, ist oft mit Problemen konfrontiert, die andere gar nicht bemerken. (Symbolbild)

Foto: Image/Boh Krenning

10.08.2022 / 06:22

NICOLA DAUMANN  
(<https://www.mopo.de/autor/nicola-daumann/>)

## Mit Rollstuhl oder Kinderwagen durch Hamburg: Das soll jetzt helfen

Artikel vorlesen

02:08 1X

BotTalk (<https://bottalk.io/>)

Ein schmaler Bürgersteig oder E-Scooter mitten auf dem Gehweg: Was den meisten um etwas ausmacht, kann für diejenigen, die mit Kinderwagen oder mit Angehörigen in einem Rollstuhl unterwegs sind zu echten Hindernissen werden. Ein Forschungsprojekt der HafenCity Uni-



*(Still in the phase of analyzing all the data collected)*

- Combination of two topics (social component + technology) worked exceptionally well ▪ lots of “open doors” and good feedback on the case selection
- Using cases to test the tools brought the message across ▪ Issue: finding cases
- Setting topics early in the project phase helped in conveying our role and in terms of acceptance

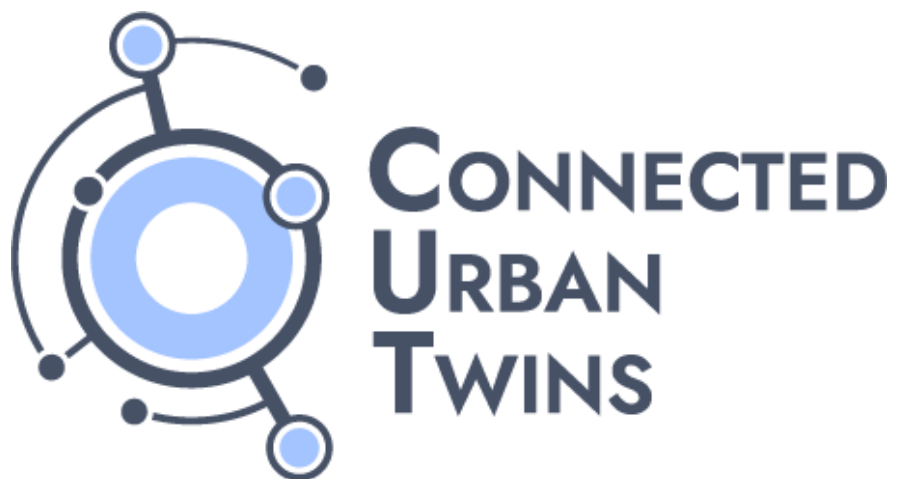


## Multiple roles of researchers

- Web developers
- UX Designers
- Storytellers
- Photographers & Videographers
- Media experts
- Observers
- ...

## Dealing with uncertainty

- COVID-pandemic
- Summer holiday ▪ extension of the second data collection phase



Partnerstädte:



Gefördert durch:



Thank you for listening!



**Rico Herzog**

M.Sc. Engineering and Policy  
Analysis

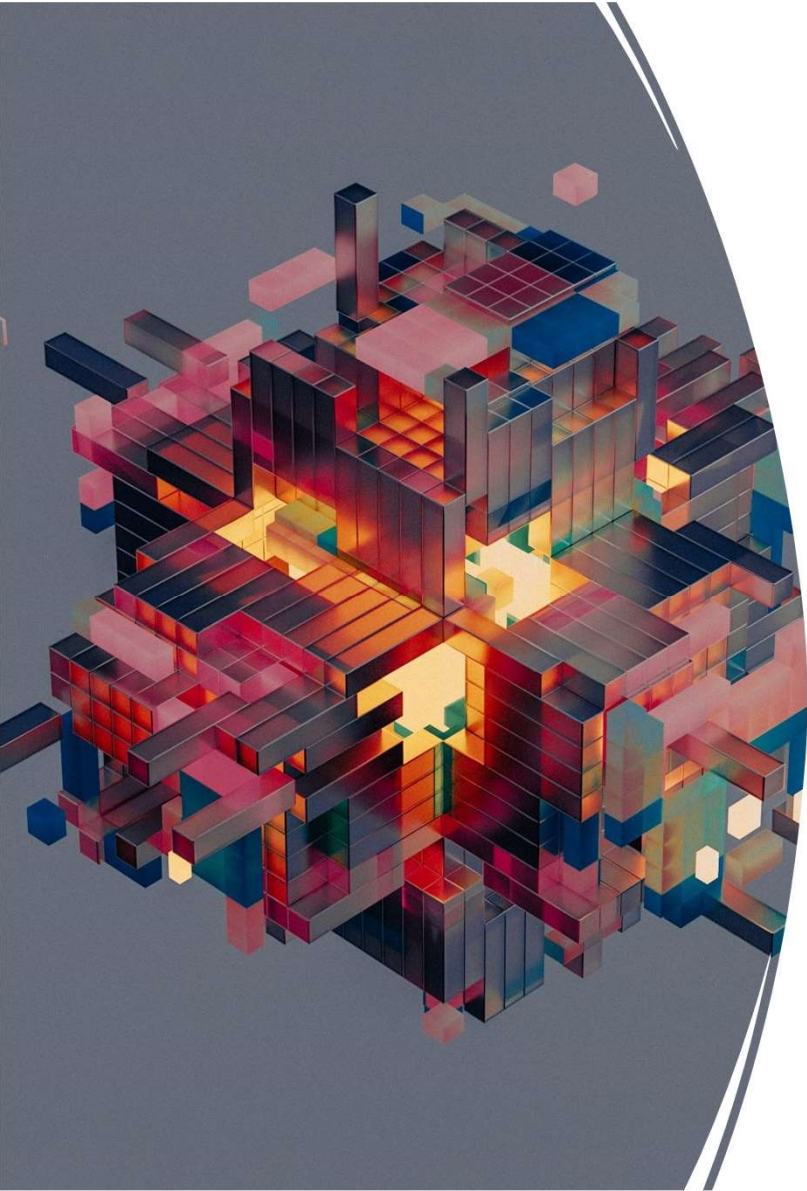
[rico.herzog@hcu-hamburg.de](mailto:rico.herzog@hcu-hamburg.de)

[www.citysciencelab.hamburg](http://www.citysciencelab.hamburg)  
[www.connectedurbantwins.de](http://www.connectedurbantwins.de)

Bundesministerium & für Familie, Senioren, Frauen und Jugend. (2021). *Kinder, Haushalt, Pflege – wer kümmert sich?*

Winker, G. (2021). *Solidarische Care-Ökonomie: Revolutionäre Realpolitik für Care und Klima*. Transcript.

Wuppertal Institute. (2022). Transformative Research. Retrieved from  
<https://wupperinst.org/en/research/transformative-research>



Transition Researcher



# *Transformative Research: Increased agency in times of increased complexity*

**Kristina Bogner**

Assistant Professor

Copernicus Institute for Sustainable Development

Workshop 'Transformative Research in Cities: Present and Future'

*Teamwork makes the dream work!*

# Transformative Research: Increased agency in times of increased complexity.

Barbara Kump, Julia Wittmayer, Mayte Beekman

Kristina Bogner

Assistant Professor

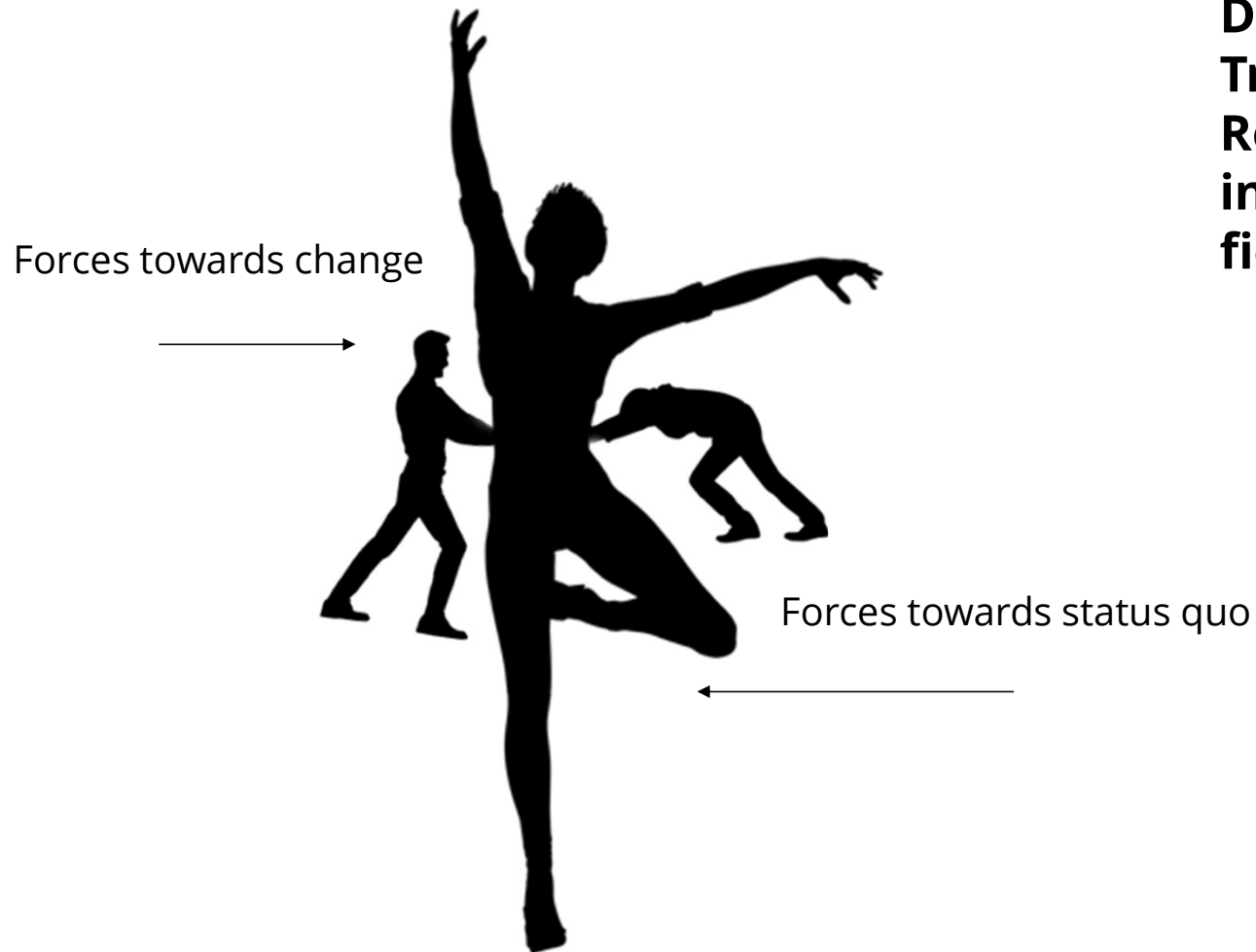
Copernicus Institute for Sustainable Development

Workshop 'Transformative Research in Cities: Present and Future'

## The Ideal-Type Researcher



## **Dancing with Forces: Transformative Research in an increasingly dynamic field**





# Forces

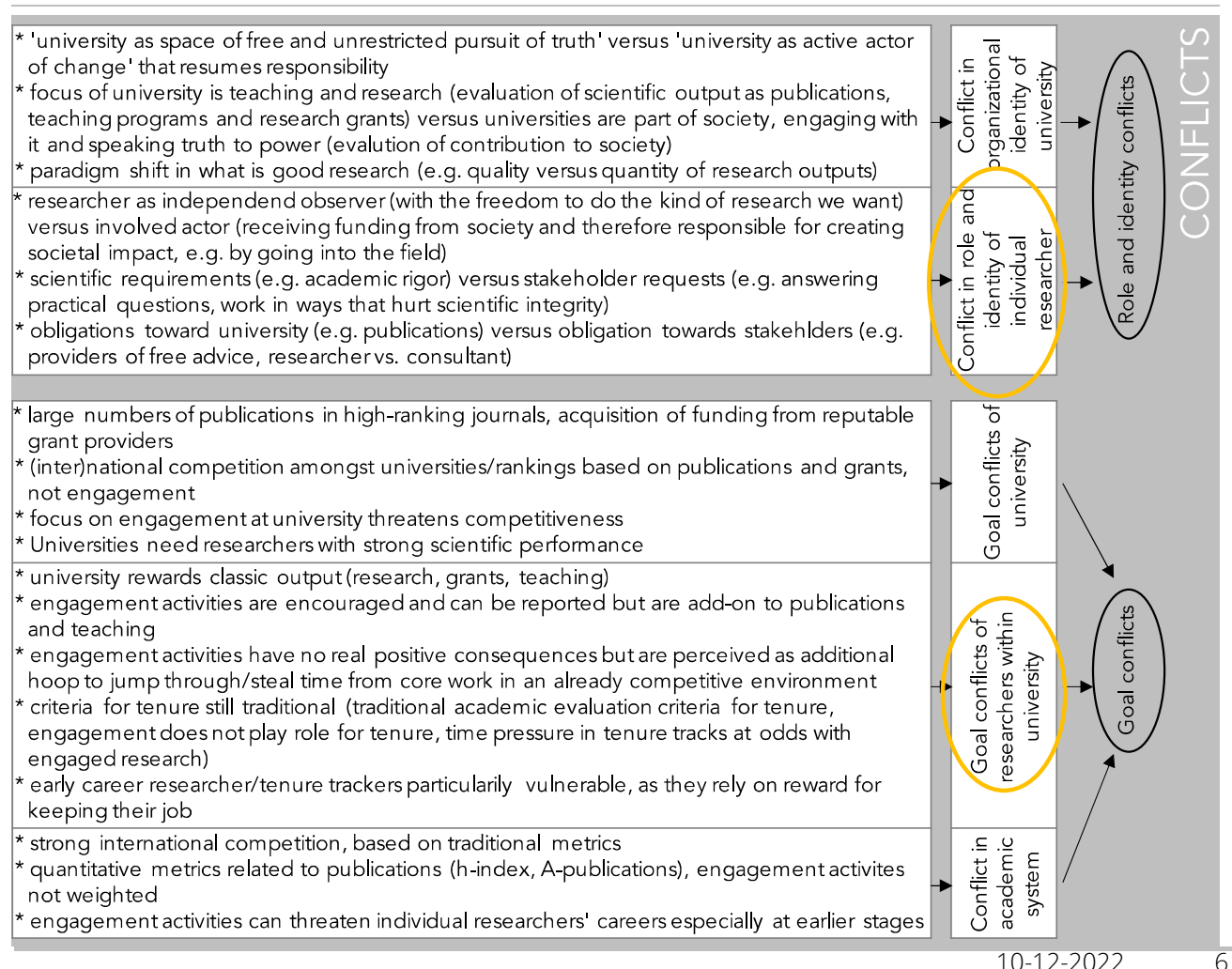


1 <sup>st</sup> order concepts	2 <sup>nd</sup> order concepts	Aggregate dimension
<ul style="list-style-type: none"> <li>* society reclaiming role of university for solving problems/grand challenges (Zeitgeist)</li> <li>* new national and international university-related policies to account for 'impact' and engagement</li> <li>* demands from students for teaching that prepares them to tackle grand challenges</li> <li>* impact competition among universities resulting from new evaluation criteria</li> <li>* increased interest of stakeholders</li> </ul>	Broader societal level forces for ER	<div>FORCES</div> <div>Field forces toward engaged research</div>
<ul style="list-style-type: none"> <li>* funding schemes demand for societal impact</li> <li>* topics in top journals are changing and journals with focus on societal problems have begun to put on ranking lists</li> <li>* impact awards at conferences</li> <li>* other niches within the academic system (e.g., slow science movement, open science movement) create landscape pressure</li> </ul>	Academic system forces for ER	
<ul style="list-style-type: none"> <li>* new impact strategy</li> <li>* diverse initiatives to foster engaged research within EUR (e.g. DIT, Impact at the Core; Erasmus initiatives such as Vital Citizens and Cities)</li> <li>* changes in evaluation criteria at EUR ("Recognition and Rewards")</li> <li>* individual frontrunners; e.g. younger generation of researchers, younger generation of deans</li> </ul>	University level forces for ER	
<ul style="list-style-type: none"> <li>* desire to have societal impact, to do meaningful and relevant work and to contribute to society</li> <li>* moral, ethical and political considerations</li> <li>* allows for more relevant and exciting research questions, unique settings, and interesting research methods</li> </ul>	Individual level forces for ER	

10-12-2022

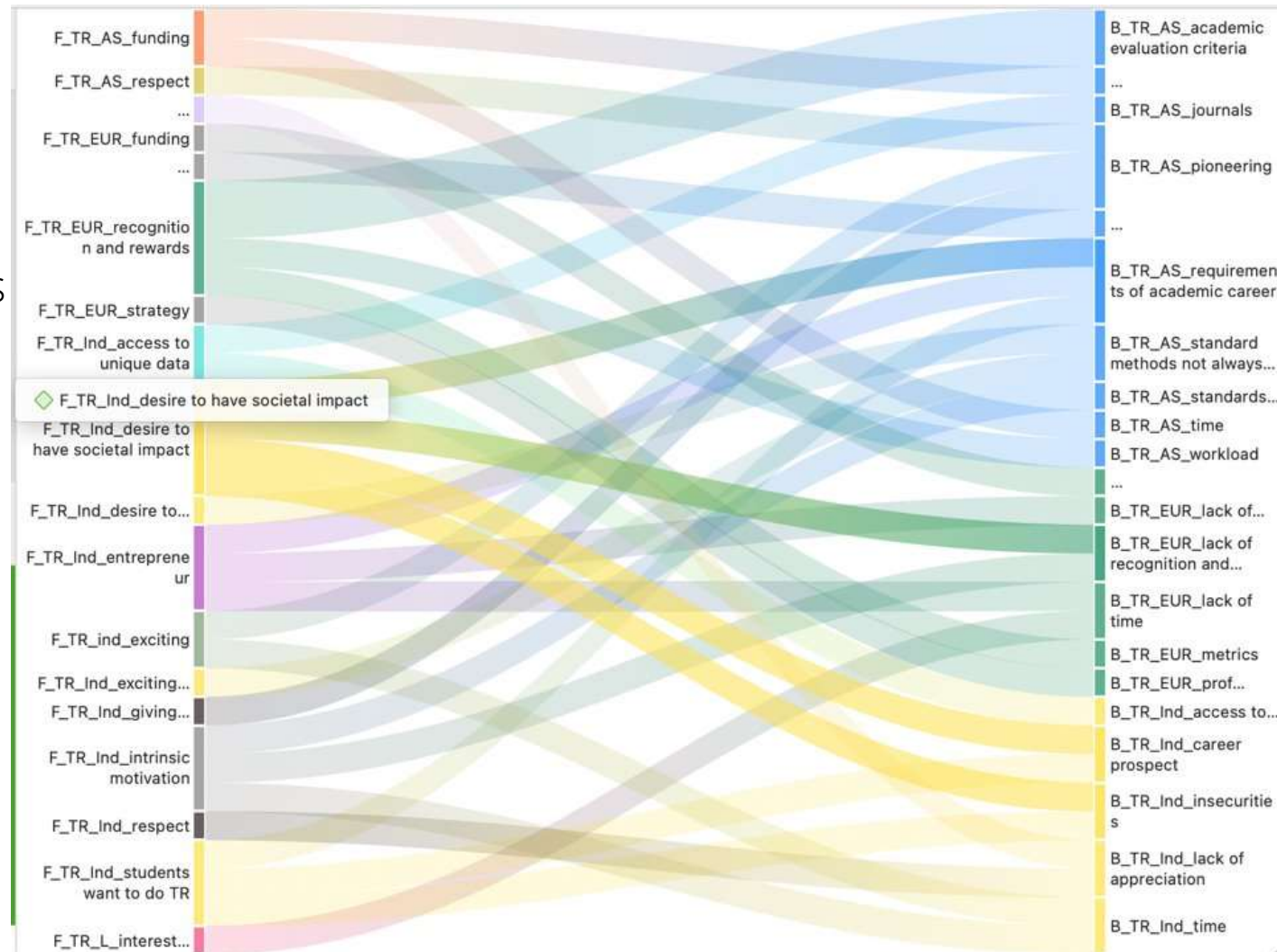
# Conflicts

- Goal conflicts
- Role and Identity conflicts



# Conflicts

- Goal conflicts
- Role and Identity conflicts



**Skillfully navigating an increasingly complex and dynamic system**





# *Outlook*





Utrecht  
University

Sharing science,  
*shaping tomorrow*

Erasmus  
University  
Rotterdam



DESIGN  
IMPACT  
TRANSITION  
PLATFORM

drift  
for transition

UNIVERSITY  
OF TWENTE.



UNIVERSITY OF  
HOHENHEIM



Online-Workshop

# Transformative Research in Cities: Present and Future

## First results

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UNIVERSITÄT  
DUISBURG  
ESSEN

*Offen im Denken*

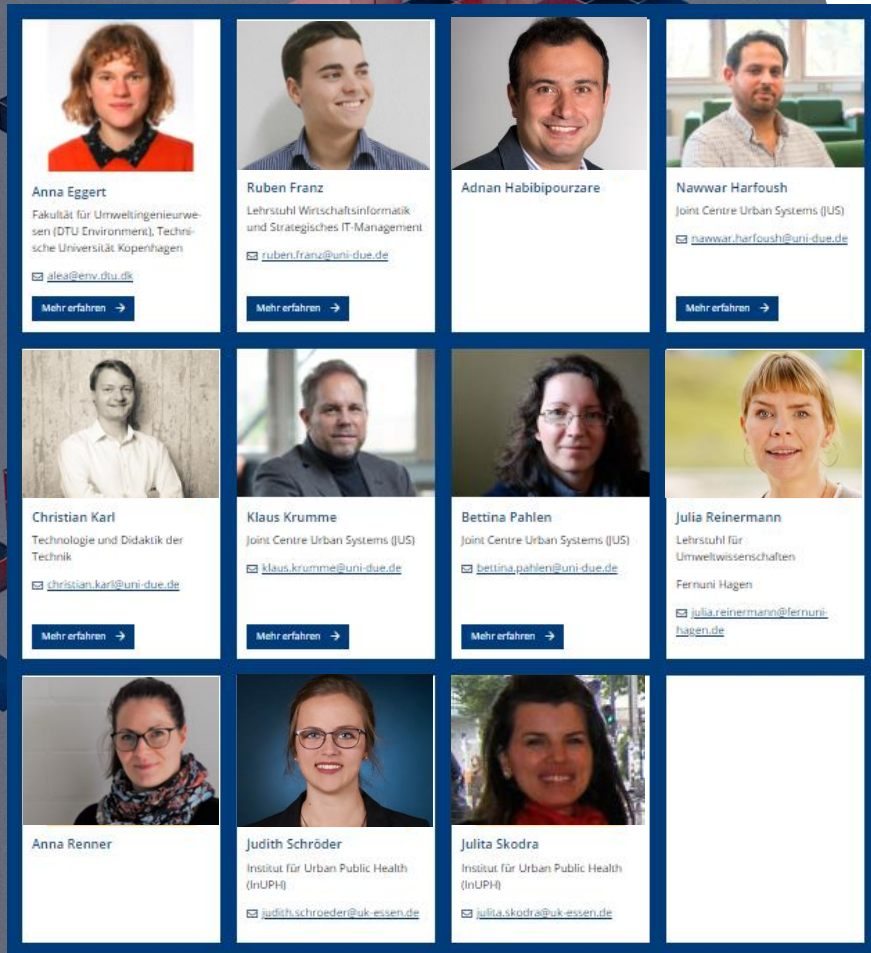
 Joint Centre  
Urban Systems

  
UA RUHR



Kompetenzfeld  
Metropolenforschung

# Urban Systems Group

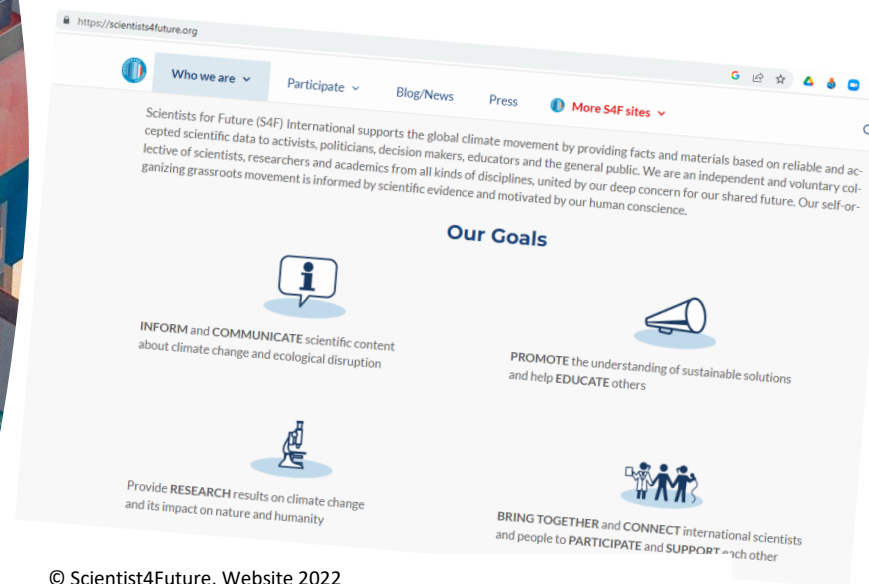


- **Founded in 2020**, Joint Centre Urban Systems (JUS), University of Duisburg-Essen
- **Open scientist platform**
- **Current network**  
PhD students, PostDocs, academic practitioners (from e.g., consultancies, intermediary organizations)
- **Interdisciplinary:** environmental engineering, ecology, geography, IT management, technology didactics, urban studies, spatial planning, cultural heritage, public health and communication and social sciences
- **Common interests** in transdisciplinary and transformative research



# Motive

- Increasing pressure on science to offer solutions & support transformation for sustainable societies
- growing group of scientists who engage against climate change



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scientist rebellion\_ about us the science



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# Motive



- **Transition research** enables structures to bring political action together with doing science for more sustainable modes of production and consumption
- **Often in the German Science System** the attitude towards a mix of political action and science is mainly critical or rejecting:
  - What happens to the reflective power of science when it is driven by solutionism to save the world?
  - Where is time & freedom of thought in a science market driven by the next sustainability trend?



An abstract 3D geometric artwork on the left side of the slide. It features a complex arrangement of translucent, multi-colored blocks (red, blue, yellow, and grey) stacked and interlocked. A bright, glowing yellow-orange light emanates from the center of the structure, creating a sense of depth and energy. The entire composition is set against a dark grey background with a subtle circular gradient.

# Workshop Agenda

Transition Perspectives North and South

Transition Methods

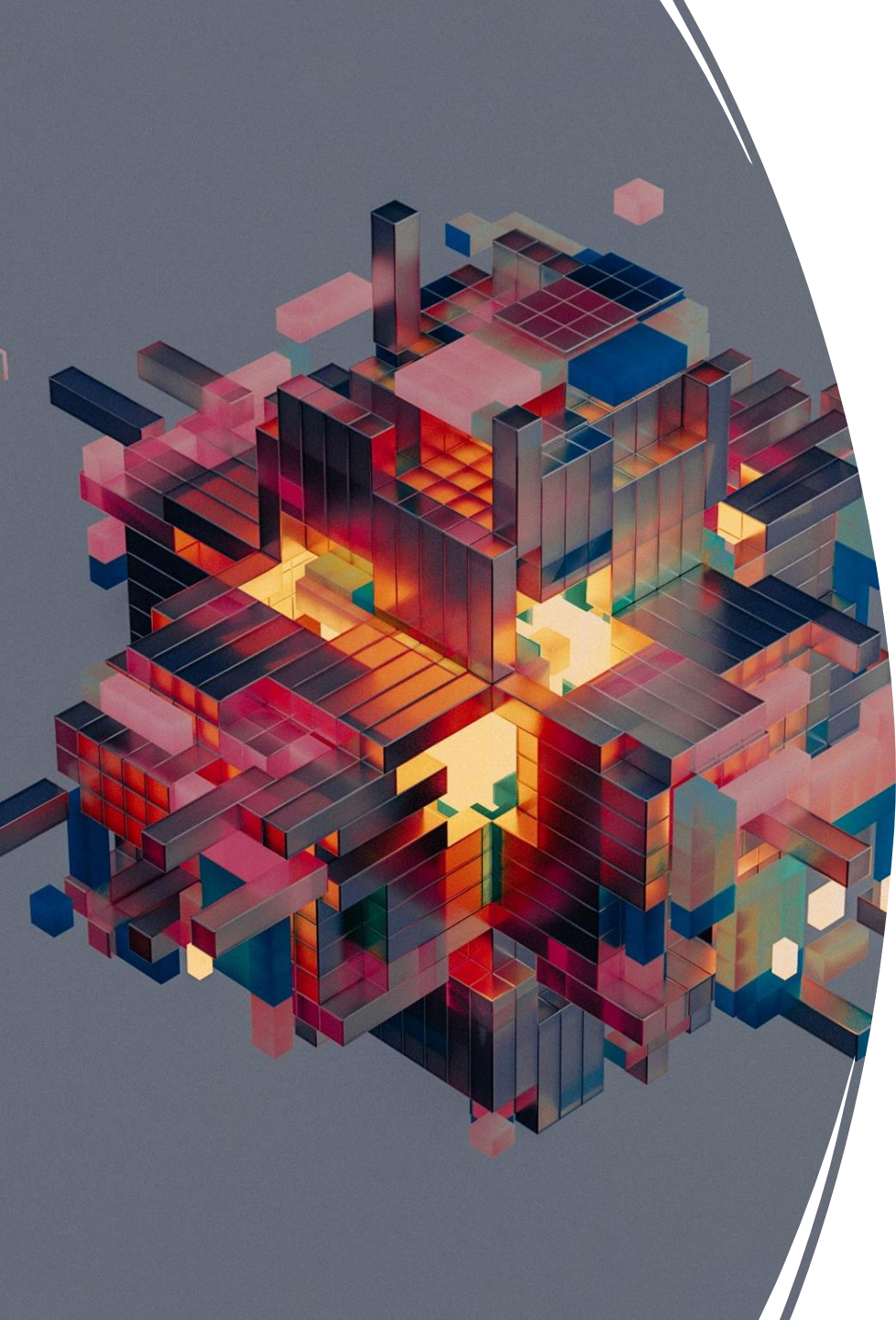
Transition Researcher

An abstract 3D geometric artwork on the left side of the slide. It features a complex arrangement of translucent, multi-colored blocks (red, blue, yellow, and grey) stacked and interlocked. A bright, glowing yellow and orange light emanates from the center of the structure, creating a sense of depth and energy. The entire composition is set against a dark grey background with a subtle circular gradient.

# Workshop Setting

- Call for Presentations
- 25 Participants (Doc's and Post Doc's) from Europe and abroad, affiliated with German Institutions including KIT, Fraunhofer ISI, FU Berlin, UDE, ...





# Workshop Results (preliminary)

## Transition Perspectives North and South

### Potentials

- Intercultural sensibility
- Understand local issues and acknowledge everyday challenges
- Create space for the critical reflection of western bias
- Challenge power structures, promote emancipatory processes
- Acknowledge informal organisational structures

### Challenges

- Transformative research practice currently cultivates unreflected westernized mindsets: in need of decolonisation
- Projects lack evidence of robust social engagement, esp. with social Justice (orchestrating, climate vulnerability stewarding)
- Globally heterogenous understanding of transformation and its challenges



# Workshop Results

## Transition Methods

### Potentials

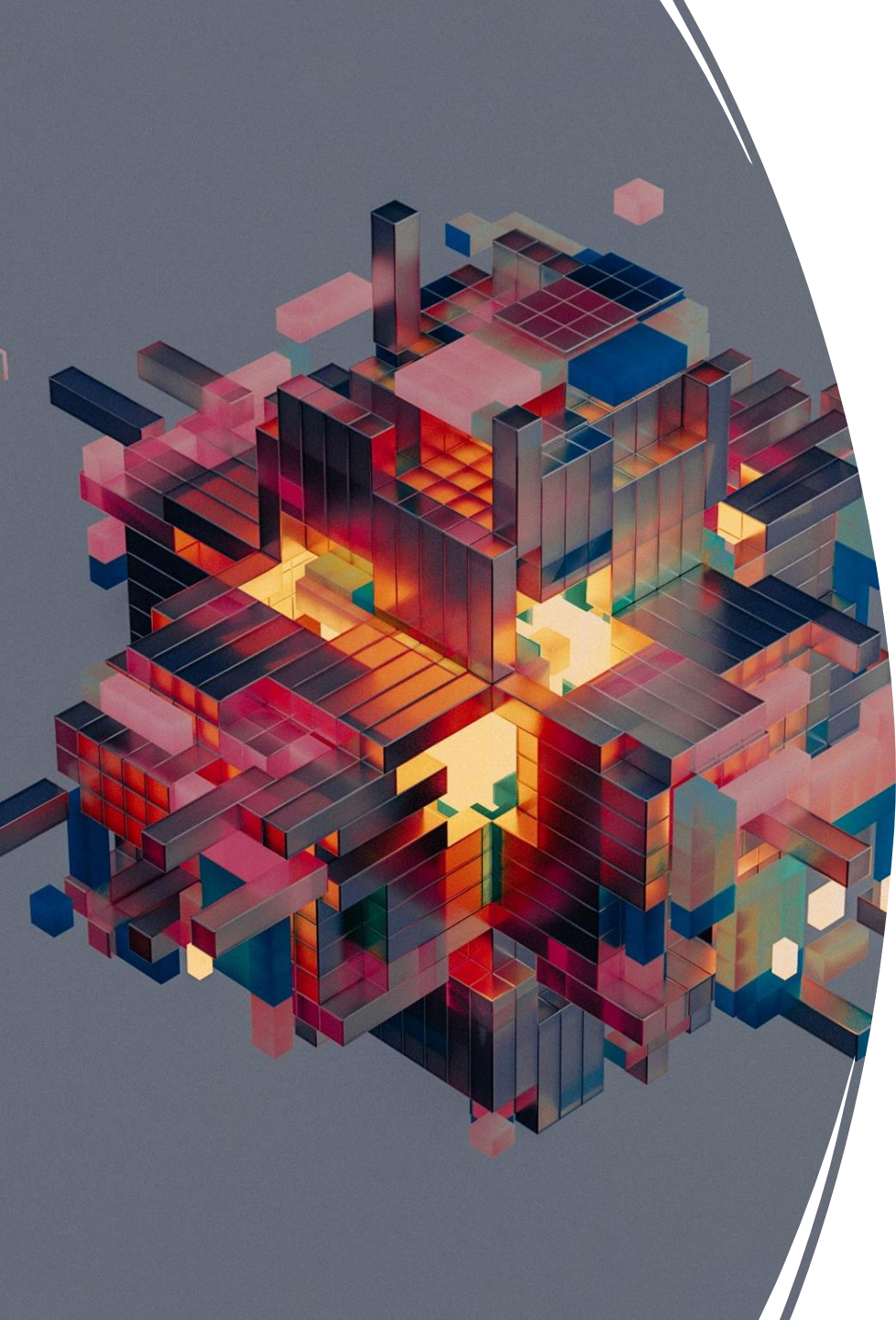
- Data Narration Tool: Modeling approaches make complexity easier to understand without implying loss of complexity
- Future scenarios can be painted: What? & if? sparks Reflection
- Transdisciplinary work is possible and co-production is fostered (different scientific disciplines , cross-sectoral)
- Flexibility of Decision Theatre (DT) methods
- High identification potential for Agent-based Modeling (ABM)
- Marginalized groups are given a face (caregivers in the Urban Twins project, needs and challenges)

### Challenges

- Lack of time and money
- Data sourcing, acquisition and processes (resource intensive)
- Interdisciplinary team and competencies needed (MINT + GeiWi, GesWi, ...)







# Workshop Results

## Transition Researchers

### Potentials

- Potential for capacity building within the system (e.g. workshops)
- "Better" research processes in complex and dynamic system
- Emotions are critical for making rational decisions
- There is hope! The system allows us to have agency over changing the system
- We should more focus on emotions in transformative research!

### Challenges

- Transformative research starts in doc and postdoc-phase: often frustrated and overwhelmed (end of the food chain)
- Lack of institutional support, how to do this (type of) research (e.g., no mentorship, no resources, no time)
- No or little ,safe' space to do this form of research (pressures and forces)
- Everything that is changing is not being rewarded by the system (e.g., the role and pressure of publishing)

An abstract 3D geometric structure composed of numerous colorful blocks and bars in shades of red, orange, yellow, blue, and grey. The structure is complex and multi-layered, resembling a digital or architectural model. It is set against a dark grey background with a white curved line on the right side.

# Perspectives

- Transdisciplinary, international
- Multi-method and multi-scalar
- Decolonising research (individual and institutional)
- Emotionally aware, truly engaged and power-critical research (with citizens, informal organisations, non-governmental organizations, economic sectors, politics, municipalities, ...)
- Data visualisation and modeling for reflexive and socially inclusive data narration tools
- Needs genuine institutional support, irrespective of career level and location (resources incl. funds, space, mentorship)
- Rewards needed for changing research and institutional frameworks.





# Thank you!

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