Real World Labs versus Solutions – Exploring Possibilities in Digital Laboratories

Workshop
Helmholtz Centre for Environmental Research, Leipzig, Germany, 08.-09.10.2025
Organised by Danny Otto and Matthias Gross

Research frontier

The recent upsurge in so-called real world, reality, urban or living Labs has helped to establish many transdisciplinary platforms designed to foster knowledge exchange and transfer not only among researchers, but especially in cooperation with policymakers, industry representatives and civil society more generally. The concept of "Solution labs" as well as the call for planetary solutions at UFZ can be understood as part of this trend. However, to build such labs to test and install pre-set solutions (less cars in an urban neighbourhood, for instance), seems to go against the idea of experiments happening in laboratories. After all, a laboratory is deliberately arranged to generate unexpected events so that the surprising effects derived out of the set up serve as driving force for new knowledge. Surprises and perhaps even failures often help scientists to become aware of what they formerly did not know as a basis to produce new knowledge. Failure or surprises, however, are not something that is normally allowed or even striven for in reality labs of recent years since a solution (e.g., more sustainability) is normally closely coupled with a clear goal that should be reached.

To ease the tension between solution and lab/experiment this workshop will explore the possibilities of digital environments for experimentation and their potential to allow for unexpected results without bringing the process to a halt. After all, serious games are interactive digital applications that use game mechanics and storytelling to engage users in solving real-world problems, learning new concepts, or practicing specific skills in a simulated environment. They are often used in fields such as education, healthcare, corporate training, and, most generally, processes of social change. As such, serious games enable different user-groups to explore actions, decisions and consequences in safe digital environments that are forgiving to failures and experimentation. Beyond that, digital labs – in contrast to real-world laboratories – can travel to different locations. Tasks, contexts and game experiences can be designed to simulate planetary problem constellations in specific regional or local settings. Thus, they allow relevant actors to engage with a digital representation of surroundings and circumstances they are acquainted with and explore effects of changes without the pressure to make right decisions but with the actual possibility to experiment. This can be done alone or in groups. Data can be generated and provided to scientists for further development of the digital setting and to assist the search for possible pathways towards ways to address real world problems. In this sense, digital laboratories can be a great transdisciplinary tool to support experimental solutions.

This workshop brings together theoretical and empirical social scientists as well as practitioners experienced in designing and conducting real world laboratories as well as serious games as laboratories to discuss and study a) the tension between real-world labs and solutions, b) the possibilities of digital laboratories for experimentation, and c) ways to effectively engage in transdisciplinary research to define problems and exploring solutions.

Agenda

08.10.2025

13:00	Welcome address
13:10	Introduction (Danny Otto)
13:20	Matthias Gross (UFZ) From real world experiments to solutions and back again?
13:45	Katharina Gugerell (BOKU University, Vienna) Keynote: Gameful Futures: Creating Spaces for Imagination, Empathy, and Learning
14:30-15:30	Coffee Break and UFZ Serious Games Fair 1 *Malin Gütschow (UFZ) - crop cultivation planning* *Samuel Fischer (UFZ) – forest development and growth* *Stephan Pietsch (Universität Tübingen) - Digital Location-Based Gaming*
15:30	Tadeusz Rudek (University Kraków) Reflexive Public Reason. Transitions and Labs: between Scripted Futures and Surprise.
16:15	Nafimane Hamukoshi (University of Namibia) Gamifying Sustainability: Youth Engagement with the SDGs
17:00	Mathilde Boissier (Centre Inria de l'Université Grenoble Alpes) Playing with flows in transition territories
17:45-18:45	UFZ Serious Games Fair 2 *Room for games of participants*

09.10.2025

9:30	Coffee and Tea
10:00	Phedeas Stephanides, Jason Chilvers (University of East Anglia, UK Energy Research Centre, UK) Mapping experiments in participation: Implications for opening-up real world and digital labs
10:45	Christiane Schürkmann (Mainz University, Germany) Exposing research to “natural reality”: rock laboratories between experimentation and exploration
11:30	Jianyu Chen (James Hutton Institute, UK) Socio-cognitive Representations of the Environment: A Lever Between the Real and the In-Silico Worlds
12:15-13:00	Lunch
13:00	Philipp Bernert (Research Institute for Sustainability, RIFFS, Germany) Impacts of Real-World Labs and Experiments – Between Intentionality and Emergence
13:45	Nils Matzner (Technical University Munich), Danny Otto (UFZ) Carbon Cascadia - A Carbon Dioxide Removal Game
14:30-15:15	Coffee Break and Serious Games Fair 3 *Nils Matzner/Danny Otto/Annika Weinberger/Ricarda Mock (UFZ) – Carbon Cascadia* *Greta Rose/Manon Cavagna: ‘A breath of fresh air for Ahlswalde’*
15:15	Close of workshop

Summary

Danny Otto opened the workshop by questioning whether real-world labs can truly be experimental and introduced digital solutions as potential bridges between controlled experimentation and goal-oriented approaches. He framed digital laboratories and serious games as spaces that allow for failure, iteration, and co-creation across disciplines. His introduction set the stage for exploring how digital experimentation might restore openness and surprise to sustainability research.

Matthias Gross traced the historical development of laboratories as spaces for controlled experimentation and discussed how their boundaries with society have shifted over time. Using examples such as the Chernobyl disaster, he explored how experimental knowledge escapes the lab into the real world, often with unforeseen consequences, albeit with great potential for social and scientific learning from failure. He questioned that at this point real-world labs are able to successfully accommodate failure and uncertainty, suggesting that genuine experimentation requires openness to surprise, and thus novel forms of real world learning.

Katharina Gugerell highlighted the power of playful futures and serious games as boundary objects that foster emotional engagement and collaboration in sustainability transitions. She emphasized the importance of emotions, storytelling, and embodied experiences in transdisciplinary work, while warning of the challenges posed by funding cycles, bias, and scalability, that not only hinder learning from surprise and failure, but simply ignore it. Her reflections stressed that balancing fun, learning, and scientific neutrality is key to developing meaningful and ethical serious games.

Tadeusz Rudek presented a comparative study of energy technology imaginaries in China and Taiwan, illustrating how differing sociopolitical contexts shape risk perceptions and innovation pathways. He introduced the cube model of reflexivity and projects like FAMOS and PANTHEON to show how stakeholder engagement and virtual tools can reveal underlying assumptions in transition planning. His talk raised questions about modelling limits, reflexivity, and how openness to surprise can coexist with structured experimentation.

Nafimane Hamukoshi demonstrated how games can foster youth engagement with the Sustainable Development Goals (SDGs) by transforming abstract global issues into relatable, emotional experiences. Through privilege-based role-play, she illustrated how empathy and awareness emerge when participants confront social inequalities and climate challenges. Her work emphasized that experimental learning through play can connect communities, challenge stereotypes, and stimulate civic responsibility, and also make aware of unexpected forms of felt injustice.

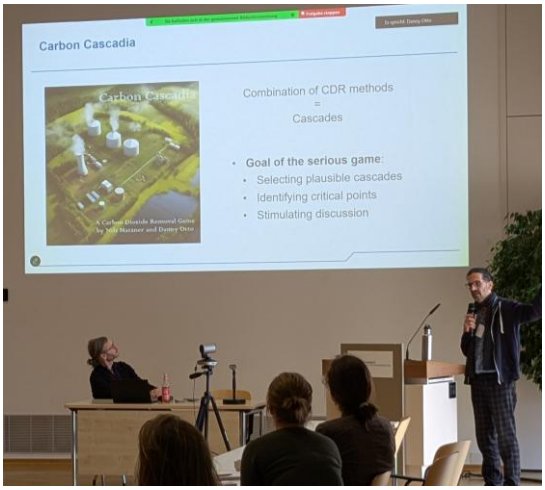
Mathilde Boissier discussed the use of games to explore resource and energy flows in transition territories, drawing on her STEEP project. She described how analogue and digital game designs can help participants understand system interdependencies and negotiate trade-offs and unexpected side effects within circular economies. Boissier stressed the tension between accurate modelling and creative play, arguing that imperfection and storytelling are essential to capturing real-world complexity. By so doing the opened the debate on the possibility to incorporate solution orientation in a playful manner to become part of experiment based real world labs.

Phedeas Stephanides & Jason Chilvers joined the workshop online and mapped different modes of participation in experimentation, distinguishing between institutional and citizen-led approaches. Their framework illuminated how real-world and digital labs intersect, emphasizing reflexivity, inclusion, and responsibility in participatory design. They argued that all forms of participation can be experimental if they remain open to failure, ethical reflection, and the co-production of knowledge.

Christiane Schürkmann examined rock laboratories for radioactive waste disposal as real-world experiments, showing how scientific control intersects with public accountability. Her case of the Mont Terri lab revealed how geological materials are treated as active participants with self-healing capacities, blurring the boundary between human and non-human agency. She highlighted tensions between controlled laboratory environments and exposed, socially embedded experimentation.

Jianyu Chen presented research on socio-cognitive representations of the environment, proposing the “cognitive collage” as a richer concept than traditional spatial mapping. Through comparative studies of workers and students using digital and physical mapping tools, he explored how emotional, cultural, and symbolic factors shape spatial understanding. Her work raised key questions about whether digital replicas can truly capture real-world behaviour and meaning, thus critically pointing to the workshops core tension between solution labs and real work experimentation via serious games and similar methods.

Philipp Bernert addressed the impacts and infrastructures of real-world labs, noting the difficulty of measuring their long-term societal relevance. Drawing on examples like Lüneburg's local initiatives, he emphasized that most useful outcomes, quite paradoxically, often emerge unpredictably from outside influences such as networks, materials, and social processes rather than planned actions or pre-set goals. He argued that transdisciplinary labs balance on a "high wire," navigating between research integrity, funding pressures, and the need to produce actionable results.



Nils Matzner & Danny Otto showcased Carbon Cascadia, a serious game designed to explore carbon dioxide removal (CDR) pathways and stakeholder interactions. They discussed the challenge of translating complex scientific data into an engaging, playable format without oversimplification or bias. Their presentation sparked discussions on game design ethics, justice considerations, and the role of playfulness in communicating sustainability science. It further let to a failure driven exchange on the translation of social scientific findings into modelling, something that many participants perceived as an important and persistent future challenge.

The workshop was accompanied by the first **UFZ Serious Games Fair**. Five games were presented to participants and guests, covering topics ranging from tree growth and carbon dioxide removal to agricultural planning and regional development. Below are some impressions from this inspiring event, which offered a great opportunity for interaction and exchange.