Gaining deep leverage? Reflecting and shaping real-world lab impacts through leverage points

Real-world laboratories (RwLs) are gaining further traction as a means to achieve systemic impacts towards sustainability transformation. To guide the analysis of intended impacts, we introduce the concept of leverage points, discerning where, how, and to what end RwLs intervene in systems. Building on conceptual reasoning, we further develop our argument by exploring two RwL cases. Examining RwLs through the lens of the leverage points opens the way for a balanced and comprehensive approach to systemic experimentation. We invite RwL researchers and practitioners to further advance RwLs' transformative capacity by targeting the design and emerging direction of a system, contributing to a culture of sustainability.

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A systemic perspective on real-world lab impacts

Real-world laboratories[1] (RwLs) and similar transdisciplinary research approaches have recently enjoyed a strong increase in scientific, political and broader societal interest (McCrory et al. 2020). They address problems in complex systems in future-oriented and participatory ways, aiming to catalyze learning and integration of multiple forms of knowledge (Caniglia et al. 2021). Since RwLs explicitly aim to contribute tangibly to societal transformations to sustainability, it is pivotal to understand their actual impacts. This is not least true as RwLs are applied in technological innovation areas of high risk and uncertainty (BMWi 2019, for an overview see Schäpke et al. 2024, in this issue).

Identifying the impacts of RwLs is notoriously difficult, as is the case with other transdisciplinary and transformative approaches (Belcher and Halliwell 2021). Planning impacts of RwLs is (at best) only partly possible, as multi-causal relations and iterative adaptation are the rule. The ex-post attribution of causalities remains equally limited. Different approaches have been proposed to understand the impacts of RwLs, such as logical models of evaluation (Luederitz et al. 2017), theories of change thinking (Schneider et al. 2019) or conceptualizing impacts via embedded agency (Augenstein et al. 2022). These approaches seek to disentangle factors contributing to systemic impacts of RwLs and to enable reflexive learning. The debate on suitable approaches continues and further empirical work is required (see, e. g., Christ et al. 2024, Wanner et al. 2024, Wiefek et al. 2024, all in this issue).

The core research method of RwLs are real-world experiments (RwEs) (Schäpke et al. 2018, Parodi et al. 2018). These are meant to create impact in the specific context as well as provide an empirical basis for transferable transformation knowledge. RwEs typically address a particular socio-ecological-technical system in a limited timeframe with defined core partners, following an adaptive and flexible transdisciplinary methodology. When designing an RwE, the core questions are why to intervene, where, and how. To support these decisions, as well as to guide, reflect and evaluate RwEs in the context of RwLs, we propose to use the concept of leverage points (LPs) (Meadows 1999) as a heuristic. We chose LPs as a prevalent framework, highlighted for its capacity to discern interventions on system elements regarding their effectiveness for change. To the best of our knowledge, this is the first systematic attempt to apply LPs as a heuristic in RwL research.

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Below, we first briefly introduce the LP heuristic and outline key analytical dimensions to understand interventions in their capacity to catalyze and understand systemic change. Second, we portray the RwL approach to RwEs, and reflect both building on an LP perspective. Third, we ground our considerations using four RwEs in two long-term RwLs as examples for the applicability of the LP heuristic. We end with a concluding discussion, outlining key learnings on RwLs and RwEs from an LP perspective.

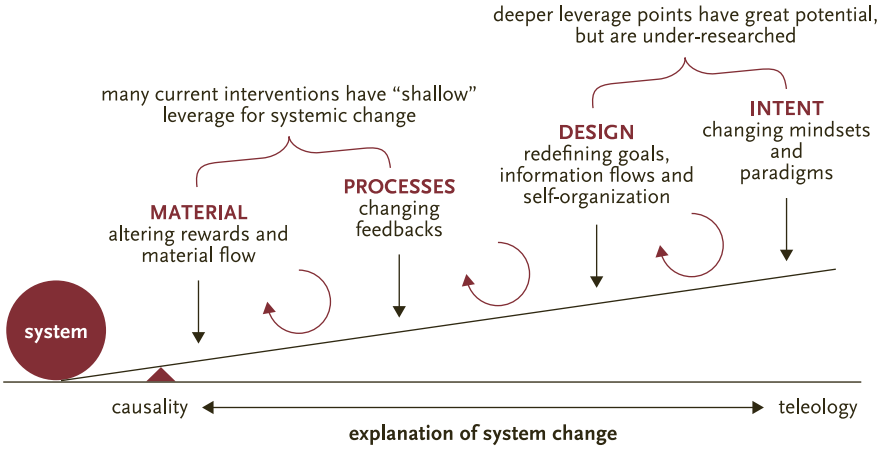

FIGURE 1: Schematic illustration of four types of leverage points showing a gradient from shallow to deep leverage points and their interrelatedness. Round arrows indicate stylized interaction that may occur between any combination of leverage points (Fischer and Riechers 2019, p. 117, based on Abson et al. 2017, p. 32).

Leverage points as a heuristic of system interventions

LPs are a conceptual framework from sustainability science to understand the effectiveness of interventions in systems. LPs "are places within a complex system [...] where a small shift in one thing can produce big changes in everything" (Meadows 1999, p. 1). It differentiates elements of complex systems ("leverage points") according to their potential to effect overall system change, and suggests associated intervention possibilities ("levers"). A system is understood as a group of interrelated elements that forms a complex and unified whole, organized around a specific purpose, and causing its own behavior in feedback loops. Systems typically include social, technological, natural, legal, and other elements of very different character.

Interventions, that is, levers, can target four types of LPs (based on Abson et al. 2017, see figure 1). An example is the public mobility system of a certain city:

- ***Material:*** tangible "characteristics such as taxes, incentives and standards, or physical elements of a system, such as sizes of stocks or rates of material flows" (Abson et al. 2017, p. 32); LPs in a mobility system include vehicles, employees, users, fares, emissions. Levers take various forms: technical and infrastructure installations, monetary incentives, or standards.
- ***Processes:*** interactions between elements that constitute the overall system dynamics, including dampening or reinforcing feedback loops, or providing "information regarding desired outcomes" (Abson et al. 2017, p. 32). Examples in mobility systems are maintenance frequency, rush hours, urban sprawl. Levers include communication and information tools or technical installations connecting system elements.
- ***Design:*** goals, social structures, institutions, information flows of a system, related (self-)organization and change capacities. Examples in a mobility system include business models, public planning or sustainability management. Levers include system- and design-thinking practices, envisioning and ideation practices or methods that foster deliberation and reflection (Woiwode et al. 2021).
- ***Intent:*** mindsets, paradigms, goals, and values, as well as the capacity to change them, shaping the emergent direction of the system transformation. Mobility system LPs include a guiding principle of, for instance, car-friendly cities, public opinion or pro-environmental values. Levers include processes relating to pro-environmental values, perceived human-nature connectedness, or reflexive awareness of the self and the collective (Woiwode et al. 2021).

Interventions often address materials and processes including environmental taxes, urban traffic regulations or end-of-pipe technologies (Dorninger et al. 2020). While this may create considerable effects, systemic impacts remain limited: materials and processes constitute tangible, but essentially shallow LPs. Design and intent represent deeper LPs guiding the overall set-up of systems. Here interventions may lead to potentially greater systemic transformation (Abson et al. 2017).

The framework further highlights the interrelation between deep and shallow system change (Fischer and Riechers 2019)[2], and combines causal and teleological explanations.[3] Causal log- >

1 RwLs are particularly prominent in the German-speaking context. They are part of a broader methodological frontier in transformation research (McCrory et al 2020).

2 Meadows "distinguished between leverage points at which interventions are easy but limited in their potential to bring about transformative change (here, termed 'shallow') and leverage points where interventions are difficult but have great potential to bring about transformative change (here, termed 'deep')" (Fischer and Riechers 2019, p. 117).

3 "A leverage points perspective can bridge causal and teleological explanations of system change – that is, change is seen to arise from variables influencing one another, but also from how human intent shapes the trajectory of a system" (Fischer and Riechers 2019, p. 115).

ics are grounded in relations of cause and effect which are most important in the dynamics among the material and process elements of systems. Teleology encompasses causality but focuses on the purpose for which changes are made – most important for the dynamics of design and intent elements in the system.

The understanding of interventions in the LP concept is marked by its origins in complex systems theory, with its underlying understanding of systems as intertwined and developing in non-linear, emergent, and unpredictable ways. Interventions can aim to change systems and their trajectories, depending on which leverage points they address. Yet, the metaphor of levers, where *interventions* can potentially lead to large system changes, may be misunderstood as calling for control based on simplistic linear cause-effect aims. Meadows herself warned of *interventionism,* such as seeing LPs as "silver bullets [...] secret passages, [or] magic passwords" (Meadows 2008, p. 146) which just need to be found and used to change the system as desired.

Meadows argued that LPs should be seen as an *invitation* to learn how to dance with systems, that is, to practice constant reflection of and adaptation to system states, elements, and dynamics (Meadows 2008). In this view, systems cannot be controlled, but have to be attentively listened to, in order to find out how system "properties and our values can work together" (Meadows 2008, p. 169). Working from the mindset of an invitation puts collaboration and co-creation, as well as iteration and learning, at the center. This corresponds to a process-relational perspective that shifts attention away from entities to ever-unfolding relations and processes composing the entities (West et al. 2020). Orienting attention to relations between entities allows us to go beyond dichotomies, like human-nature, actor-structure, mind-body. Such mindset shift can itself be considered a powerful deep LP (West et al. 2020).

In sum, the LP heuristic includes several analytical concepts to reflect RwLs and RwEs, including LPs of different depth and effectiveness, related levers, the interplay of various LPs, and interventions and invitations as the ends of a spectrum of experimental logics.

Reflecting real-world labs and experiments through leverage points

Real-world experiments between interventions and invitations

RwLs apply RwEs as a core research method. An underlying question in RwL research is what RwEs can and should aim for, when engaging with systems and their change. This is connected to the understanding of the very nature of RwEs.

RwEs serve the double aim of creating (societal) impact and understanding impact mechanisms. Regarding the former, RwEs directly influence societal change. Therefore, RwLs are developed as dedicated settings enabling RwEs on a limited scale. They are constructed as spatial, social, and institutional entities in cities or regions and are built through actor collaboration. Many RwLs test solutions in RwEs for possible transfer to similar cases, for scaling to higher system levels, or for adaptation to other systems. Evaluation can help produce transferable, evidence-based knowledge about where, when and how to intervene in systems. In line with pragmatist philosophy, knowledge is thus created in a transdisciplinary process linking action (creating impact), learning and reflection (understanding impact mechanisms), as well as capacity building (enhancing impact creation abilities) (Caniglia et al. 2021). RwLs apply different methodologies and draw on various schools of methods to shape RwEs.

McCrory (2022) applies LP thinking to discuss how RwLs and related RwEs can follow both an invitation and an intervention logic or combine them (see figure 2). On the one hand, following an invitation logic, scholars emphasize their co-created and co-produced character (Pregernig et al. 2018). This puts relations and processes at the heart of RwEs and RwLs (McCrory 2022). The aims and designs of RwEs emerge in co-creation, and outputs and impacts are evaluated in participatory ways. Knowledge created by experiments is itself often procedural and integrative in nature. This means, it includes understanding by which processes of collaboration and knowledge integration sustainability challenges can be solved (Caniglia et al. 2017). Accordingly, RwLs provide experimental arenas to include multiple ways of know-

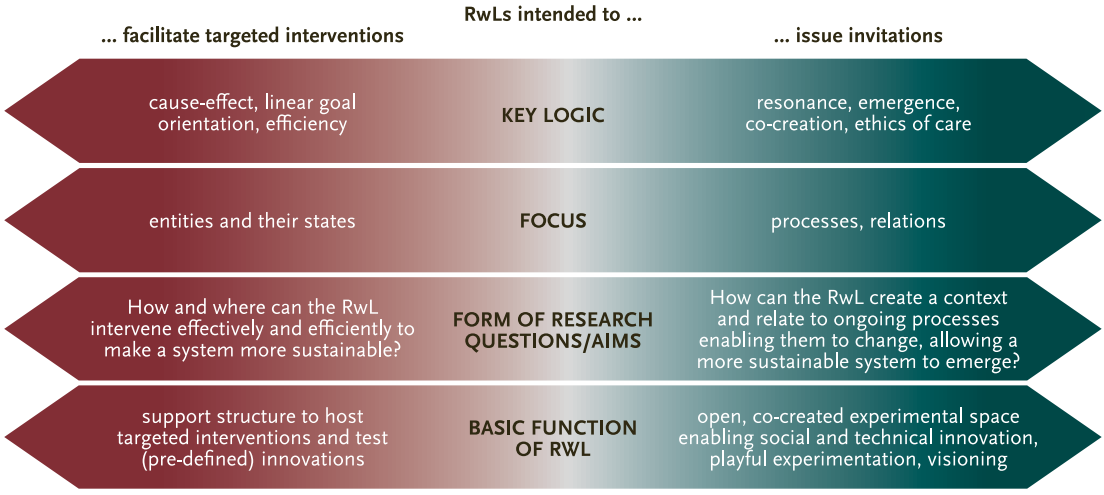

FIGURE 2: *Intervention* and *invitation* as ends of a spectrum of complementary logics in the design of real-world labs and real-world experiments (inspired by McCrory 2022, West et al. 2022).

ing, including cognitive, emotional, and embodied ways, which has been called for to substantiate relational approaches (West et al. 2020).

On the other hand, following an intervention logic, functional perspectives on RwLs planning and directing experiments are rather widespread. Authors emphasize RwLs as effective means to test innovative solutions to sustainability challenges, providing an empirical basis for mainstreaming policies (e.g., BMWK 2023; for a reflection on regulatory experiments see Bauknecht and Kubeczko 2024, in this issue). In a related view, RwLs can aim to develop generalizable insights on sustainability solutions (Caniglia et al. 2017), for example, through far-reaching control over the experimental setting. A simplistic, linear understanding of systemic change may lead to interventionism and solutionism in RwL practice (Wehling 2022). Yet, experiences, including from technology assessments, show that cause-effect thinking does not necessarily encompass simplistic views, and may include (self-)reflexive, critical thinking.

The presented perspectives open up a spectrum of possible designs and practices regarding RwEs in RwLs, which provide specific contributions and face specific related challenges. In both perspectives, RwLs give the respective system a (more open or more directed) impulse. RwL participants are called to reflexively engage with these foundational logics in conceptualization and practice. This includes the possibility for synergic combinations of RwEs that apply targeted problem-solving interventions *and* invitations for co-creation and learning. A lack of clarity about logics of RwEs can create tension or even conflicts, for example, if some members of the transdisciplinary project team, societal partners or funders expect effective interventions while others aim for a more open-ended dialogical process (on processes and conflicts see Klaever et al. 2024, in this issue). Here, the presented spectrum can support informed decision-making and practice.

The *where* and *how* of real-world experiments

A second underlying question concerns where in a system to intervene and how. There is no concise overview on places and forms of RwL experimentation. Existing reviews show that transdisciplinary labs (RwLs and other labs) target various LPs. Several labs focus on technological change, addressing *material* and *procedural* LPs (McCrory et al. 2020). Other labs develop new modes of governance or explore and shape system *designs*. Education-based labs focus learning, capacity building and empowerment of students, possibly influencing *intentional* LPs (McCrory et al. 2020). We assume that RwLs follow this general pattern by addressing a broad spectrum of LPs. RwLs with a focus on material and process LPs by, for instance, technological innovation in autonomous driving, drones, smart cities, and fabrication (BMWi 2019) are strongly present. RwLs targeting processes and designs use experimental performances and theater play, neighborhood support systems or local decision-making and participation. RwLs engaging with intents of systems as deep LPs do exist, including education settings, future visioning techniques, and deep reflections and dialogues (Singer-Brodowski et al. 2018). As these are mere conclusions about RwLs and RwEs drawn from studies about labs in general, we note a knowledge gap regarding the overall orientation and shape of RwLs and related RwEs.

Making leverage point thinking tangible: Cases of real-world labs and experiments

Broad empirics lacking, we underpin conceptual reasoning with tangible examples and present four cases of RwEs from two RwLs. We discuss the goals and understanding as well as the *where* and *how* of the experiments. The latter aspect is further deepened, including the question how addressed LPs and levers interact (figure 3, p. 120 and figure 4, p. 122).

Both RwLs are located at the level of urban neighborhoods of German mid-sized cities and aim at sustainable neighborhood development. We selected the cases for three reasons: First, both of them are typical cases of long-running RwLs and located in common RwL application areas. Second, both RwLs host(ed) multiple experiments of various kinds, allowing for a rich analysis of how interventions are shaped. Lastly, members of the team of authors were strongly involved in both RwLs, making data easy to access. The cases were reconstructed ex post in deliberation amongst the co-authors by interpreting existing data based on the LP heuristic. We select and portray two experiments of each RwL that together represent the style of each RwL respectively.

RwL *Mirke:* New dynamics for a deprived area

Mirke is a neighborhood of about 8,600 people in the German town of Wuppertal. It is a densely built-up area, located north of the city center. For long, the neighborhood was considered a deprived area, despite various redevelopment programs. Since about 2010, Mirke experiences a new dynamic: especially through diverse activities of bottom-up initiatives and other public interest actors, supported with public funding for urban development, both a changed self-confidence and a strong network of self-organized actors emerged. Scientific actors, particularly the Wuppertal Institute and the University of Wuppertal, have contributed to this development since 2014. Between 2014 and 2021, six transdisciplinary projects were carried out in cooperation with the collective actor *Utopiastadt,* constituting the Mirke as an RwL.

The overall objective of *Utopiastadt* and the engaged science-practice consortia was to make the (existing) goals and processes of neighborhood and urban development more sustainable, participatory, and common-good oriented. Adjusted goals were partly derived from analyses of the local situation and partly from a greater sustainability agenda. Each of the RwEs addressed individual elements of this grand vision. Each RwE started with its own intervention logic and – explicit or implicit – Theory of Change. There was no overarching coordination but intense communica- >

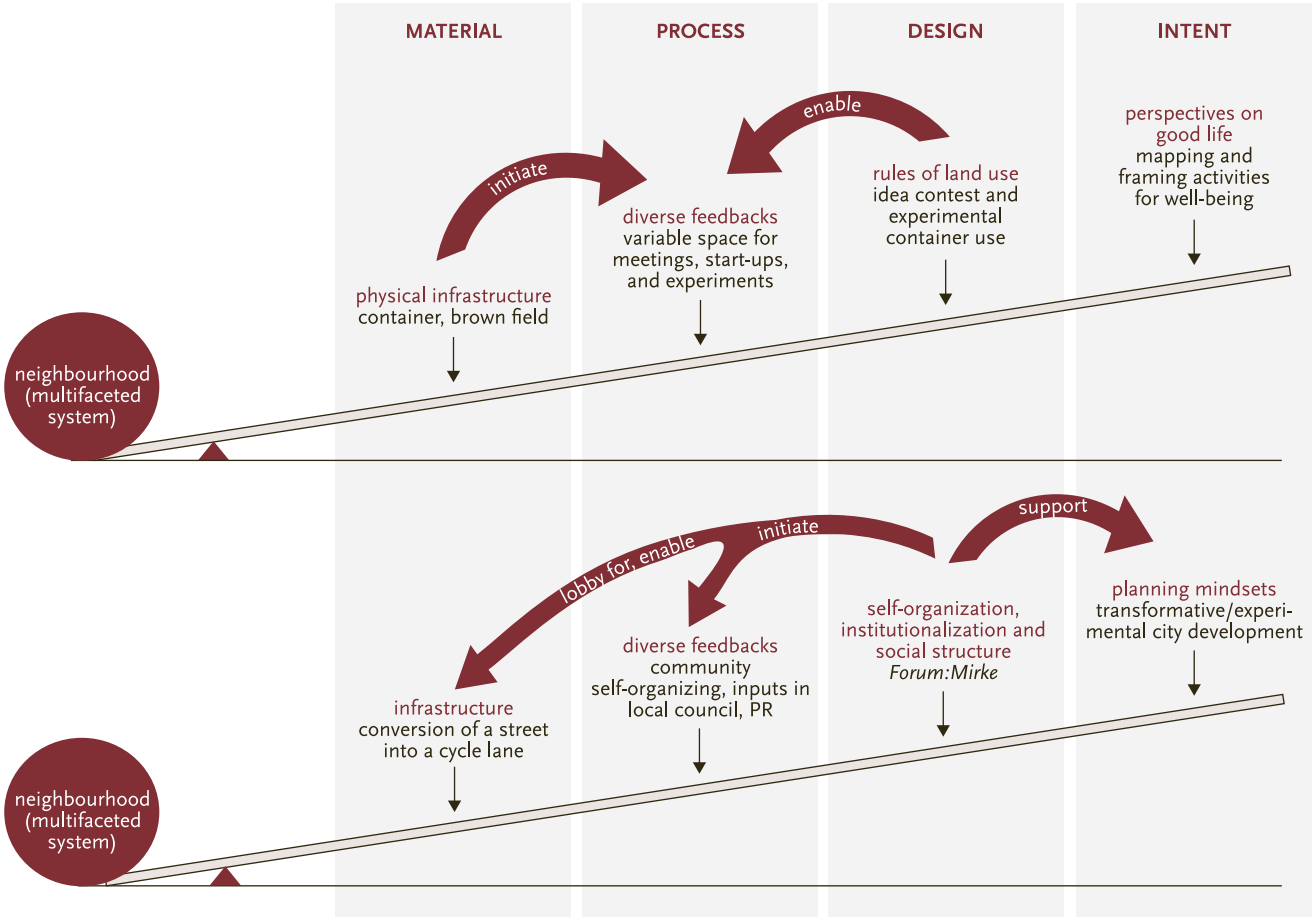

FIGURE 3: Schematic illustration depicting two real-world experiments (top: containers and idea contest; bottom: *Forum:Mirke*) and the leverage points addressed (red font) of the RwL *Mirke* (Wuppertal). Arrows indicate cascading effects, so-called "chains of leverage" (Fischer and Riechers 2019, p. 118), from the initial experiments with their addressed leverage points, to follow-up activities addressing other leverage points of the same system. The direction of these cascading effects can vary (see discussion of experiments 1 and 2). To ease overview of the two real-world experiments and their different effects, and given that they had different temporalities, we present them in the form of two (semi-separate) figures.

tion and mutual inspirations, facilitated by many years of (prior) collaboration, existing personal contacts, and trust. Additionally, actors continuously raised financial resources.[4]

Experiment 1: Containers and idea contest

Utopiastadt purchased about 36,000 m² of land where it located multifunctional containers. Land and containers provided a significant extension of spatial and physical resources available in Mirke, constituting an initial intervention at the material level (figure 3). This provided the basis for a consecutive experimental phase, an open call for ideas: individuals and groups from Mirke were invited to make suggestions on how to use the containers, with a broad focus on increasing sustainable liveability. We consider this experiment to focus on the design level. Winners were given temporary free access. For several months, children, start-ups, political parties, and local initiatives used the containers, bringing services, information, or simply joy to Mirke, shaping a new concept of how to appropriate the land. As a side effect, the regular exchange between different actors enabled various feedback loops such as growing mutual support and motivation, as well as the orientation towards the creation of synergies. A parallel activity aimed to map and frame local initiatives as contributions to sustainable, resource-light well-being. Although the project was not successful in establishing an online map, the initiatives, interviews, and public gatherings contributed to a change in perspective, understanding various local activities as contributing to sustainable well-being.

Experiment 2: Forum:Mirke

A second experiment was the establishment of *Forum:Mirke* as a regular, open, bottom-up platform. The *Forum* influenced the means and social structures of engagement in the neighborhood at the design level. From there, various secondary experiments

4 For an overview see *https://www.utopiastadt.eu*, *https://quartier-mirke.de*.

were initiated. On a material level, the *Forum* successfully lobbied for the conversion of a central street into a cycling lane to connect Mirke and the city center. On the feedback level, it enriched Mirke's information flows via extensive online media coverage, mailing lists, working groups and inputs for the local media, reinforcing upcoming dynamics. On the intent level, the activities contributed to a change in the public perception of the neighborhood. Now, the *Forum:Mirke* and related processes are seen as a lighthouse for citizen engagement. Sustainable, inclusive, and experimental ideas of how to develop the neighborhood have been coined.

Thus, *Utopiastadt* aimed to create a climate of experimentation and participation for sustainability in the neighborhood. Most RwEs had the character of invitations. This has resulted in strong and lively forums, numerous well-attended events and a creative spirit of optimism. Yet, it should also be noted that this has led to fewer "countable" results for sustainability, given that fewer RwEs addressed material LPs.

RwL *District Future – Urban Lab:* Inviting cultural transformation

This RwL has been established in 2011 in Karlsruhe, Germany, initially focusing on one district, the "Oststadt". Its overall goal is to facilitate a broad local sustainability transition in a fairly typical German city district. *District Future* has gained further reach and evolved to a hub for urban transitions towards a culture of sustainability in Karlsruhe and the wider region. It is run by Karlsruhe Transformation Center for Sustainability and Cultural Change, based at a larger technical university, the Karlsruhe Institute of Technology (KIT). Primary partners are civil society organizations, from various levels.

The guiding idea is that of systemic, multilevel interventions aiming to address transformation processes on individual and social levels and contributing to cultural change. To achieve this, *District Future* acts on two levels: in the form of transdisciplinary projects including various RwEs, and through the RwL as a whole. On RwL level, *District Future* provides a supporting, long-term environment for transformative experimentation. It offers both a physical space as an infrastructure, the *Future Space for Sustainability and Science,* and a social network of long-standing cooperation partners. This way, the lab creates an invitation, to scientists and other citizens, for interactions on a wide spectrum from information and dialogue to joint experimentation. The RwL aims at a shift of values, mindsets and paradigms and catalyzes self-organized activities. This follows the assumption that a network of RwEs in different topical fields and with different groups of actors can stimulate an urban culture of sustainability.[5]

The related RwEs cover a broad range of sustainability topics ranging from urban climate protection measures (e. g., adressing climate-friendly business travel, conflicts between heritage protection and energy efficiency, sustainable diet in canteens), via self-experimentation to capacity building for futuring skills. From the LP perspective, the RwEs typically link several LPs in different impact patterns illustrated by two examples in figure 4 (p. 122).

Experiment 3: Your balcony solar module network

This experiment invited citizens to actively take part in the research on the energy transition, which is typically an expert domain: 22 households received a balcony solar module and agreed to document both their energy production and the effects on their everyday life (LP: material, process). Experiences were shared in a network of participants and scientific partners, for instance, feeding back into the use (e. g., optimized positioning) of the solar modules (LP: process). Several of the participants positioned the modules to be easily visible from the street in order to initiate local communication (LP: design) about solar energy. Overall, the activities cultivated a mindset of democratizing the energy transition on the local level (LP: intent). Further impacts included energy production, snowball effects in the installation of solar modules, and the strengthening of local networks.

Experiment 4: Future fiction

This RwE reacted to disillusionment in civil society organizations, especially among younger participants, and a dominance of dystopian futures in the discourse, by searching for alternative narratives. It was a competition, with a broad social media campaign inviting teenagers and young adults to describe positive visions of (their) future life in relation to climate protection and energy production, as texts or videos. The contributions were reviewed by a jury, and shared in a ceremony, a booklet, an exhibition, a permanent online documentation, and supported by social media communication. The project started with a competition for positive visions that aimed at shifting mindsets (LP: intent). This created visible results (LP: material) and feedback on desirable energy futures (LP: process), thus supporting the impact on the societal discourse and mindsets of good energy futures.

Concluding discussion: Towards a balanced approach when dancing with systems

LP thinking contributes analytical categories that proved insightful to reflect RwLs and RwEs towards systemic impacts. This includes four areas of leverage points promising different systemic effects, a differentiation between leverage points (what in the system shall be changed?) and levers (by what measures?), and a spectrum from intervention to invitation as logics of experimentation.

Methodologically, informing RwLs with LPs addresses underlying tensions of RwLs. Systems thinking via LPs is oriented towards seeing the bigger picture, while RwLs draw on pragmatism to solve contextual real-world problems. What could be in- >

5 *https://www.quartierzukunft.de*; *https://www.transformationszentrum.org/english/index.php*

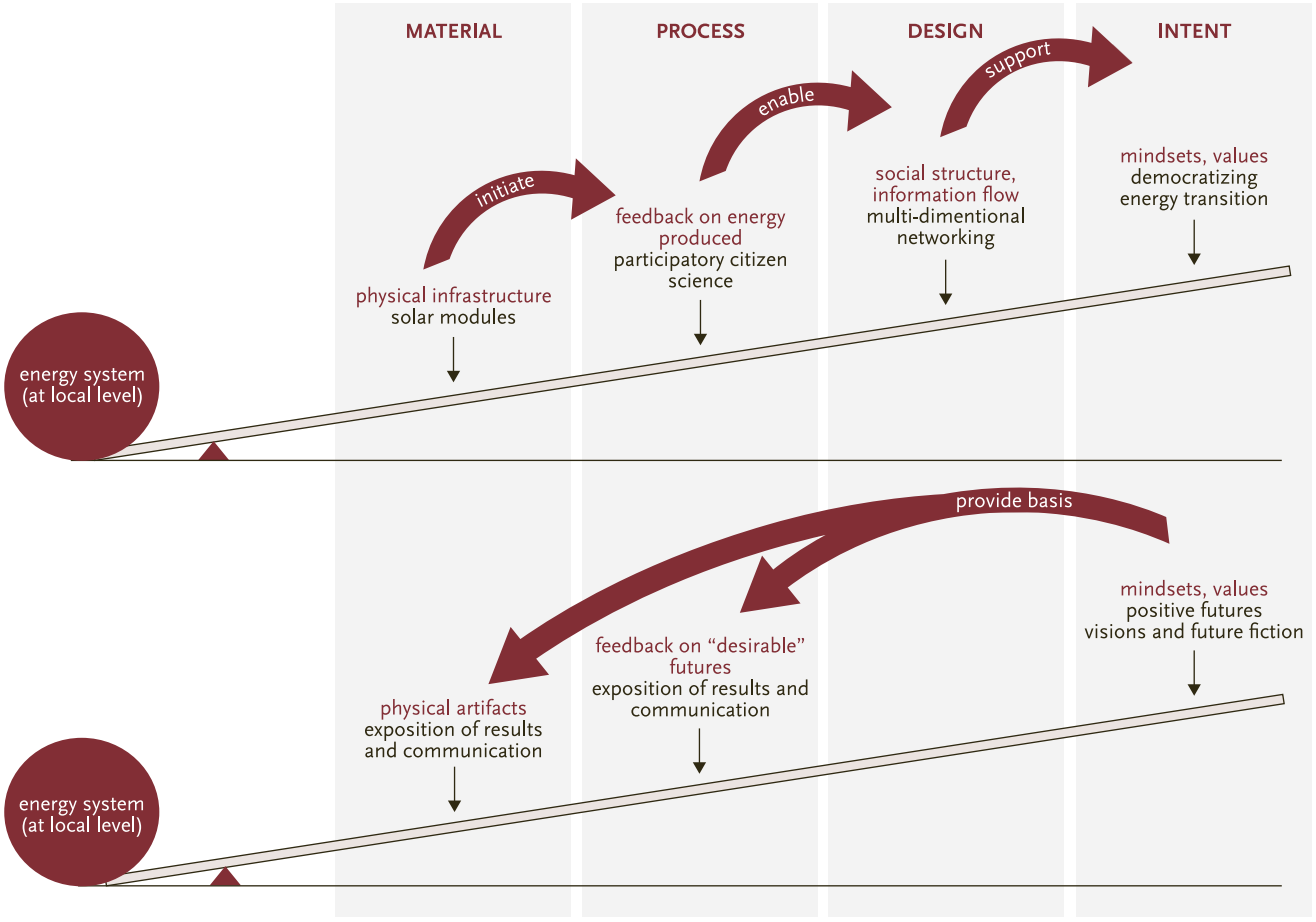

FIGURE 4: Schematic illustration depicting two real-world experiments (top: your balcony solar module network; bottom: future fiction) and addressed leverage points (red font) of RwL *District Future* (Karlsruhe) addressing the local energy system. Arrows indicate cascading effects, from the initial experiments with their addressed leverage points, to follow-up activities addressing other leverage points of the same system. The direction of these cascading effects can vary (see discussion of experiments 3 and 4). To ease overview of the two real-world experiments and their different effects, and given that they had different temporalities, we present them in form of two (semi-separate) figures.

terpreted as contradiction is a major, yet fruitful challenge to us: In RwLs, we can put systems thinking into action in RwEs using multiple methods. We can learn from experience, generating and continuously iterating knowledge on system dynamics and possibilities for change. RwLs ground abstract LPs in real-world contexts. The pragmatic nature of RwLs benefits systems understanding as "best-possible provisional knowledge" (Kueffer et al. 2019, p. 387) open for deliberation and refinement. Systems thinking in turn calls for and provides orientation to make informed choices on how to frame the (local) system and on how to address it in RwEs. It thus guides RwLs' pragmatist knowledge generation by informing action, reflection, learning, and capacity building.

Reflecting RwLs through LPs underlines the importance of a comprehensive approach including various layers of system change. The underlying teleological dimension, including the goals and paradigms we want to base a newly developing system on, and the procedural and material dimension to manifest the new system need to be combined (cf. Fischer and Riechers 2019). A focus on the material would possibly leave the transformative aim out of sight, while a focus on the teleological dimension would miss out on manifestation. We call to develop a comprehensive, multi-directional, and balanced RwL approach that systemically links all levels of leverage in experimentation for transformation. This can be informed by the LP framework.

The RwE cases show that the interplay between shallower and deeper LPs follows different patterns. Observations suggest that levering changes at material or process level may contribute to consecutive change of deeper LPs. The changing infrastructures of RwEs further enabled community building and learning, which may include mindset changes on sustainable life in the neighborhood. Other experiments directly engage with values and paradigms as deep LPs, enabling consecutive changes at material and process levels. In most cases, interplays, that is changes of one LP sparking changes of other LPs, benefitted from continuous support by the respective RwL. By tendency,

RwEs addressing shallower LPs followed an intervention logic, RwEs addressing deeper LPs an invitation logic. Both logics appear complementary allowing an RwL to flexibly engage with the system in question. Observations caution against a linear understanding of where to start experimenting, and invite further analysis of how to bring about systemic change.

The cases provided evidence on how open-ended, creative initiatives can change the underlying mindsets and dynamics of public life and collaboration: LPs that are often considered hard to change (e.g., Abson et al 2017). The described RwLs aimed to catalyze changes of deep LPs via learning and empowerment. While these emergent processes escape planning and measurement, they can still be nurtured. RwLs should less aim to spread the "right" values and mindsets, inviting backlash, reaction and ethical concern, but more to provide environments for relation building, resonance and self-directed engagement (Rosa 2019, Ives et al. 2023). RwLs can take inspiration from neighboring approaches such as transition management (Loorbach and Rotmans 2010). The approach links deliberation processes including teleology (visions), design and feedbacks (pathways), and material manifestation (experiments). Balancing openness and directionality, the process combines practical consideration with reflection on underlying assumptions and values, to open up a transitioning mindset.

Options to integrate the LP concept into RwL practice exist, for instance, in the co-design phase, enriching a possible actor and context analysis with concrete questions, for example: What does a shallow and a deep LP mean in our specific thematic area? Which are preferred by the actors involved? How to balance between intervention and invitation? A similar set of questions could be used during reflection periods. This may support RwL practitioners to explicate a strategy to link different LPs through joint actions, or to identify a suitable framing of the system. It also offers a theoretical language to address the question which synergies and interrelations are to be tested in the lab. As RwLs are confronted with numerous requirements, from research, practice and funders, a focused LP operationalization in key aspects or questions is recommended.

Practicing RwLs as a *dance with the system* (Meadows 2008) constantly challenges us to open up for the unexpected and new, to allow new connections to be made, to listen attentively, and to co-create responses fitting to the actual state of the system (Mc Crory 2022). In return, this practice benefits the resonance capacity of the engaged actors as a central catalyst for societal change to sustainability (Rosa 2019). This is the capacity to become aware, acknowledge, and be moved by other beings, to establish productive relations, and to be able to take appropriate action. Here, RwLs and similar transdisciplinary labs can connect two larger trends in sustainability studies, the experimental and the relational turn, for understanding and advancing systemic transformation. They can contribute to an overall paradigm-to-practice shift towards more resonant, "response-able" and sustainable societies.

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