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A double-eyed and sociotechnical approach

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Perspective

Towards effective and just energy transitions in underprivileged neighbourhoods: A double-eyed and sociotechnical approach☆

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ABSTRACT

Especially in underprivileged neighbourhoods (UNs), with high renovation urgency and thus opportunities to kick-start the energy transition (ET), residents tend to resist retrofit measures. This is due to general lack of trust in government, housing corporations, and other key players. We contend that a negative spiral of ET effectiveness and justice is rooted in two mismatches, between (i) UN resident needs and everyday practices and customary ET solutions and between (ii) UN residents and the key players running the ET. This may produce a downward spiral of ineffective solutions, declining trust and inequalities. We argue that fundamentally addressing these mismatches may reverse this downward spiral into an upward one, and then present our Just PREPARE approach to that challenge. At the core of this approach are (i) 'double-eyed' methods to help articulate residents' needs and practices in their own context, which then inform the design of the technological and governance aspects of solutions and (ii) participatory settings and processes for planning the ET. We elaborate this approach and present some illustrative preliminary experiences from a transdisciplinary research project in which we implemented it in four UNs in the Netherlands. We end with some recommendations for future research.

1. Introduction

Over the past 10 years, in debates on energy transition strategies, energy justice has attained more attention [1–10]. In strategies for housing energy renovations, the focus of this article, this is highly needed, for intrinsic, normative reasons, as energy renovation projects may involve connecting existing houses to new energy systems and adaptations inside homes such as insulation. Also, lack of attention to justice in all three tenets – distributive, procedural and recognition justice – appears to often undermine the effectiveness of energy renovation projects, and may undermine its societal acceptance or, even worse, may feed increasingly widespread popular discontent.

This has special urgency in so-called underprivileged neighbourhoods (UNs), i.e. neighbourhoods with several of the following features: low quality housing and public space, low social-economic status, and residents who generally experience little agency, have a great diversity of (ethnic) backgrounds and little trust in institutions [11–13]. While UNs typically have high renovation urgency and, consequently, opportunities to kick-start the energy renovation, residents tend to resist retrofit measures, due to general lack of trust in government, public

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housing providers, and other key players [14] and due to their precarious situations. Households with lower incomes and unemployment, more than others, tend to reject or under-utilize energy technologies, reducing retrofit effectiveness [13]; and retrofit measures in UNs may reinforce already existing inequalities and energy poverty [15]. In UNs, such missed opportunities for higher effectiveness, like energy saving strategies, are exacerbated by diversity of residents, and thus of needs, practices, and understandings of energy systems (e.g. levels of (digital) literacy) [16].

In sum, we observe a downward spiral, exacerbating the already high distress in UNs: technologies are ineffective, actors are not trusted, and impacts reinforce existing inequalities, which may affect the use of technologies, foster distrust, and further increase inequalities. Thus, lack of effectiveness and unjust impacts reinforce each other. This Perspective article aims to present an approach to doing energy renovation projects in UNs that may create an upward rather than a downward spiral. We first argue that effectiveness and justice may reinforce each other in an upward spiral (Section 2). We then translate this contention into an approach to promote a more productive interaction between justice and effectiveness. To illustrate its use, we present some preliminary experiences from a transdisciplinary research project in which we implemented this approach in four UNs in the Netherlands.

2. The potential for mutual reinforcement between effectiveness and justice in energy renovation projects

Essentially, the downward spiral is rooted in two mismatches: 1) between retrofit technologies and residents' energy practices, and 2) between residents and those actors planning and implementing solutions. Regarding the first, technologies are typically designed for average residents in well-maintained dwellings, rather than for the context of UNs, with a great variety of (ethnic) backgrounds and lower socioeconomic status amongst residents [17]. This may yield user rejection and under-utilization of energy technologies. Discrepancies between technical innovations and residents' actual expectations, needs and practices may also yield rebound effects (increased energy efficiency yields increased energy consumption). Similarly, prebound effects (energy savings from retrofitting are lower than expected for energy-efficient households) may result [18].

The second mismatch is caused by a technology driven approach, primarily defined by state actors, housing corporations and other actors and experts [19,20]. While these actors increasingly seek to involve residents in the energy renovation projects [21] and welcome bottom-up initiatives [22,23], solutions are often still shaped amongst the major stakeholders - a common reflex in major infrastructural projects, fuelled by the felt urgency to achieve climate objectives [24]. Especially in UNs, given low trust in institutions and experienced lack of agency, such top-down approaches risk getting stuck [25], as residents may reject or underutilize solutions that do not properly match their daily practices. Simultaneously, the lack of trust and experienced lack of agency lead to low involvement in current forms of participation [26].

The mirror side of the downward spiral outlined above is that, through properly addressing these mismatches, justice and effectiveness in the project may also come to mutually reinforce each other over time. Addressing the first mismatch by explicitly designing solutions, with effective residents' engagement (procedural justice) to mitigate rather than exacerbate existing inequalities (distributive justice) and recognize residents' identities and practices (recognition justice) will increase acceptability and the likelihood of effective use of solutions. Crucially, what these needs and practices are should be neither assumed by researchers, nor understood in generic terms, as this is likely to reproduce both mismatches. Rather than such an 'etic' approach (an outsider's perspective), an 'emic' approach is needed, i.e. one that relies on residents' own accounts of their needs and practices, reflecting their perspectives and interpretations. [27] We need 'two-eyed seeing' [28,29], using an emic approach to help articulate residents' expectations, needs and practices in their own context, which are then integrated with the 'etic', outsiders' perspective of professionals into the design of the technological, economic and governance aspects of solutions.

Including an emic, hence contextual and relational, understanding, implies using energy justice not as a normative (i.e. outsider defined) concept but as an analytical and decision-making concept [9]. Especially when used through an interpretivist epistemology and ethnographic methodology, such understanding of energy justice may help make justice a transformative force in 'two-eyed' designing of energy renovation plans [30].

As part of the transformative effect, a strong orientation on the expressed needs and lifestyles of residents helps address also the second mismatch by making the design process less technology driven. As a second-order effect, more participation and recognition justice in planning processes may also help turn 'vicious cycles of mistrust' into 'virtuous cycles of trust' [31]. This reflects that interaction and reflection between people are a key source of increasing trust especially if they lead to better and more clearly articulated alignment between transition proposals and involved actors' needs [32]. Conversely, more trust may lead to more eagerness to participate, and thus procedural justice; and solutions must be accepted and practically used in order to actually yield more distributive justice (e.g. enabling more health and wellbeing without more costs).

3. The Just PREPARE approach for a just and effective energy renovation in underprivileged neighbourhoods

The above analysis informed the transdisciplinary Just PREPARE (JP) project. In JP we—as researchers from social science and design departments of four universities and two universities of applied sciences in the Netherlands—collaborate with residents, public professionals, housing corporations, energy companies and other local stakeholders in UNs in four Dutch municipalities.

We have translated the above approach into several concrete elements. First, to enable an emic, contextual understanding, this collaboration is embedded in 'living labs' (LiLabs), one in each of the four neighbourhoods, run by the universities of applied science. They serve as spaces where needs of residents and other local actors can be articulated, and where both residential and neighbourhood practices and energy renovation governance processes can be observed, discussed and experimented with. Also, LiLabs are the places to test and improve in collaboration with local actors, initial knowledge outputs (analyses of the problem and solutions, developed by PhD students and senior researchers at the universities on the basis of data obtained earlier from interviews, observations, and discussions in the LiLabs).

Second, a specific method of co-design was used to enable 'two-eyed' design in UNs, empowering residents. To avoid reproducing the mismatches, analyses are deliberately contextual and the project does not seek to generalize them into one-size-fits-all insights and solutions for all UNs. The aim is to understand how insights and solutions pertain to a specific context, as a basis for a repertoire: a collection of knowledge and insights plus an understanding in what kinds of contexts they may be relevant, enabling residents and practitioners in other neighbourhoods to see what lessons and solutions can pertain to their context. Over time, the repertoire developed in Just PREPARE can thus be elaborated, helping to routinize a just and effective energy renovation in UNs. To develop this initial repertoire, we set up a 'Learning Lab' (LeLab) in which we shared and discussed our findings with a wide variety of governmental, business, civil society and specialized knowledge utilization actors [33]. The LeLab will advise on insights in residents and neighbourhoods' needs and practices; energy solutions that may meet these; effective planning and governance approaches; methods for identifying residents' and neighbourhoods' needs and practices and translating these into energy renovation designs; and on collaborative and fair governance arrangements for the future energy system. LeLab participants are invited to enable learning across the four cases and to

bring the outcomes to a wider audience.

Third, to understand and remedy the lack of experience on the side of both residents and practitioners to productively talk to, listen to and understand each other, we mapped and intervened in existing processes of energy renovation planning and governance.

Below, we outline each of these three elements. Our aim is to further outline the JP approach, without presenting an empirical analysis. While we will, to make things more concrete, provide some quick examples, we do not seek to draw definite lessons here on the approach and even less so on the energy renovation in UNs.

4. The living labs

4.1. Setting up living labs

The JP Living Labs are located in the Netherlands' two largest cities, a medium sized city and a rural municipality. They are designed to provide a playing field for collaborative and transdisciplinary learning and development [34] to overcome the two mismatches in planning the energy renovation there. The labs essentially form a configuration of and bring together perspectives from parties engaged in the local energy renovation to conduct collaborative action research [35], to facilitate design processes with partners and local stakeholders; and to set up support structures for local networks of stakeholders as partners in the project on the one hand, and platforms for reflection and learning on the other.

The type of neighbourhoods targeted already 'host' many different local stakeholders, like welfare organizations, housing corporations and civil society organizations, seeking to work with residents to enhance public value and social equality. To prepare rather than damage the ground for more productive interactions, we actively recognize these pre-existing platforms and initiatives, shaping Living Labs as complementary to existing partnerships, such that residents see added value. Hence, we must balance requirements implied in the functions of the LiLabs, their embedding in the local context, their stages of development and action research approaches practiced in them. To enable a transdisciplinary approach, we ensure diversity of participants and perspectives through including housing corporation(s); owner-occupiers; tenants; public professionals; neighbourhood initiatives; experts and researchers; and students (in limited numbers, not disturbing Lilab dynamics).

At the start, we built productive relations with practice partners in the consortium, engaging them in carefully exploring and dealing with issues that might provoke complications in the collaboration with residents that might reproduce mismatches– especially sensitivities rooted in earlier local events, and anticipated disinterest amongst residents in active involvement in tasks they might regard as the responsibility of government or organizations. Meanwhile, JP consortium partners were consulted to determine substantive and geographical focus, and an appropriate locus for the LiLab home base. These preparations shaped the case studies for scientific research and changed our perception of LiLabs as a physical location, to promote visibility, towards LiLabs as manifestations of local networks that would meet in various locations in the neighbourhood.

4.2. Exemplary experiences in living labs

While this careful staging of the LiLabs was important to make them work well, proper functioning requires equally careful maintenance throughout the LiLabs' iterative cycles of activities [36]. In the 'exploration phase', our LiLab team met with selected consortium partners to discuss the meaning(s) of energy justice in neighbourhoods exchanged in LiLab meetings.

After this exploration, the labs organically developed into a platform for deliberation and research which could contribute to local change. Especially regular evaluation and adaptation appear important, to add value under emerging tensions and changing local circumstances. For instance, because the living labs pinch in as much as possible with already ongoing developments, aligning with and navigating the local practices shapes our work more than agenda-setting and steering. This sometimes yields issues in activity planning, such as when local housing corporations seek to shield off respondents for research because of political tensions concerning the local heat network (Nijmegen), or external conflicts between stakeholders 'imported' into the living lab (Amsterdam).

Other experiences pertain to actually achieving the intended transdisciplinary learning through deliberative, contextual interactions between stakeholders through so-called Key Enabling Methodologies (KEMs) [37] for promoting learning to develop innovations and interventions for wicked problems. They are tailored to the state and evolving needs of the process. An example is community development methods [38] for approaching, involving and working with citizens. Another example is the so-called (learning) agenda, to foster collaborative learning to realize a just and efficient energy renovation, by local partners in the LiLab. Thus, the subsequent learning process with researchers and partners can be adequately navigated to ensure that it remains collaborative, reciprocal and relevant for all involved. This helps to keep a shared horizon and prevent 'superficial' ad-hoc issues to dominate by continuously tracking back to the jointly set overarching learning issues.

Following the local (learning) agenda, researchers discuss with local partners concrete topics for the analysis and development phase of the living labs. Initially, some small study projects are undertaken, to answer questions from neighbourhood partners. Based on the local agenda and learning calendar, priorities are set for other studies. Regular feedback on their progress is invited and obtained through other KEMs, chosen to fit purpose and context. For instance, after asking the Rotterdam Living Lab to think of ways to better highlight what promoted collaboration in the local energy renovation yielded a suggestion to work on a collaborative impact analysis and storytelling (KEM category 'vision and imagination') to support effectiveness and collaborative recalibration of the programme. Altogether, KEMs offer useful methodological handles, and their selection, actual use and impact are affected by differences in perspectives and interests, especially where broader local political and relational tensions interfere with energy renovation projects.

In these and similar ways, the KEMs help properly perform collaborative action research to devise and test concrete solutions for a locally effective and just energy renovation, navigating local issues, aligning with discourses and collaborating with local stakeholders. Maintaining an emic, contextual approach when it appears necessary to adapt to emerging, non-anticipated local issues demands that the project team delicately balances perspectives, including the research perspective.

5. Translating residents' needs and practices into technical design

Within the LiLabs, we take a bottom-up approach to explore 'what energy is for' [39] together with residents so as to address the two mismatches discussed above and work towards a reinforcement between justice and effectiveness. The first mismatch plays out at the interfaces between energy systems and residents' practices. The second mismatch points to differences between residents and professionals, regarding their visions of future energy practices and how these could be shaped in just ways. Effectively shaping domestic energy demand in a just manner therefore requires in-depth knowledge of energy-consuming everyday practices such as cooking, laundering, getting around, and keeping warm and cool. However, due to a higher likelihood of language barriers, cultural differences, personal problems, and lower literacy, we expected conventional co-design methods to be inadequate.

To address these gaps, we adopt a four-fold approach. First, it maps energy-relevant domestic practices and their anticipated future

trajectories using tailored methods for close collaboration with UN residents in our LiLabs. These tailored methods are developed through a collaboration between the design and social science partners. Second, through collaboration with the project's building physics experts, results are linked to decision making tools for designing renovation strategies on building and neighbourhood level [40]. Third and in parallel, we co-develop designs for novel energy interfaces (e.g., indoor climate control systems, smart meters, but also doors, windows, showers and cookers) that are inspired by existing resident practices. Fourth, we map how residents' practices are shaped by their context to inform processes of implementing and managing retrofit on a household level.

By residents' energy practices we mean implicit and explicit routinized sayings and doings embedded in space, time, and materiality that require energy in and around the home. More specifically, we focus on thermal comfort practices. Currently, nearly two thirds of Dutch household energy is used for heating and hot water provision [41], while cooling is one of the fastest growing areas of domestic energy demand, wrought with inequality issues [42]. We consider thermal comfort in a broad sense, acknowledging that even temporary moments of discomfort can contribute to achieving comfort [43].

Research shows that pre-bound effects [18] are particularly prevalent in UN households [13]. This may highlight possible injustices, where indoor climate conditions are kept below decent living standards to save money. Alternatively, it may indicate situations in which residents have found creative, unexpected low-energy solutions to make themselves comfortable. Studies by Dillahunt et al. [44,45] show that people in low-income households often have great practical know-how and skills to adopt a variety of resourceful, creative and low-tech ways to save energy. These creative, bottom-up solutions are viewed in JP as valuable sources of knowledge, both locally in context, but potentially also more generally as part of more effective retrofit strategies.

In terms of **mismatch 1**, between residents' practices and renovation technologies, this focus on working with residents' existing knowledge, expectations and know-how of their own dwellings and lives in making their own comfort is a response to the trend towards 'smart' energy saving technologies that might create a form of smart paternalism: shifting agency over everyday decisions from residents to algorithms, based on averages and standards [46]. We therefore develop methodologies to collect this situated, marginalized knowledge and know-how.

As quantitative energy data misses important information to understand what energy is (anticipated to be) used for [39], while ethnographic approaches tend to brush over relevant technological details, we developed a sensory auto-ethnography approach grounded in the work of Pink et al. [47] that links sensorial and situated accounts of what energy is (not) for to smart meter data. This approach helps enable residents' situated understanding of how their current and future everyday practices relate to their actual consumption [43].

In the second iteration we organize productive interactions between residents and designers and other professionals through so-called cultural probes [48]: creative techniques widely used in design research to provide open and participant led insights into everyday contexts and practices. Probes are packages of creative activities, which we complement with in-depth interviews conducted in the participant's homes. The different probes are not meant to offer a 'holistic' overview of everyday practices, but complement each other as partial, situated, and subjective snapshots of residents' idiosyncratic know-how and the kinds of ways in which they make themselves comfortable. As such, they provide a playful way to address an ambiguous topic like energy, giving a glimpse of how residents' expectations relate to wider social and technical contexts [43]. Fig. 1 shows an example of the probe kits [43,49], containing Postcards, a Camera, a Floorplan and a Speculative Newspaper, each with specific but open instructions to the residents (see the example in Box 1).

In a third iteration of this resident-led approach to retrofit, the aim is to work towards bespoke, alternative energy interface designs firmly grounded in residents' existing know-how and knowledge of their homes and (anticipated) practices, but enhanced with a number of low-tech exploration tools (such as a heat camera) and professional design expertise (e.g. working out a make-do solution into a high-fidelity bespoke artefact using techniques like 3D modelling and printing). From these resident practices we zoom out to relevant professional practices, e.g., government agencies, housing associations, network operators, landlords and installers.

Fig. 1. The probe kit [42].

To address **mismatch 2**, between residents' and professional practices around energy renovation, we use creative methods such as tailored probe kits to discuss difficult topics such as energy, anticipated future energy practices and justice. These methods help to get better and richer information than through an interview alone. We prioritize listening to residents and sharing their voice.

The first probe kit focused on practices of keeping cool in summer, the second version on a renovation project. In the Living Labs, together with residents we discuss how they currently use energy to stay warm or cool, and what they expect to change after a renovation. We consider what residents want to share and are interested in, and how we can address their questions as the renovation process advances. After the renovation process, residents can participate in a focus group with other residents and/or professionals. As during the first probe kit some residents voiced interest in exchanging with others, the second probe kit is more open-ended and participatory. In addition, we use methods of ethnographic interviews with residents, semi-structured interviews with professionals, focus groups with professionals, and document analysis to answer the research questions.

Drawing on these results on mapped residents' energy practices and complemented by data from a national database on occupant behaviour, we are developing a wide range of occupant profiles to capture the individuality and variability of these energy practices. Selected 'unconventional' retrofit measures for the winter season (e.g. localized insulation, infrared panels, and personal comfort devices) are being assessed considering the variability of occupant profiles. By taking this approach, we seek to uncover hidden opportunities for advancing energy renovation. Although 'unconventional' retrofits may be overlooked by stakeholders and considered less effective when evaluated by standard thermal comfort methods and average energy use, they can be more effective and avoid prebound and rebound effects when considering the diversity of residents' routines and energy practices.

Box 1
Some exemplary open questions to write and draw on the postcards.

1. Write instructions for the next inhabitants of your house: What should they know? What are the secrets, insider tips and golden advice?
2. A love letter to your favourite appliance.
3. Describe an appliance that you would always leave on if it would not use energy.
4. Describe an appliance that is important for other dwellers in your home but that you would have no problem getting rid of.

6. Mapping and intervening in current processes of planning energy renovation

Both negative and positive reinforcement between effectiveness and justice in UNs are produced by the interaction between domestic practices, technical designs and energy renovation governance. An upward spiral requires mitigating the mismatches through a high level of coordination between all actors involved. However, effective coordination is often difficult, as shown in public policy literature [50], particularly in an urban retrofit setting [51], where residents do not see nor prioritize the merit of adopting sustainable energy options, and distrust implementing organizations such as local government [51].

Because it is so challenging, there is a need for knowledge on best practices. Here we present an illustrative case of the timely and successful renovation of apartments in the Gijsinglaan multi-storey residential buildings (flats) in the Rotterdam Bospolder-Tussendijken district (BoTu, a typical UN), that can serve as an example of how a downward spiral between effectiveness and justice can be broken and take a positive turn. These flats (consisting of 360 residential units) were to be connected to a district heating (DH) system with better thermal insulation to warrant a higher degree of efficient energy use and user comfort. In this case, two factors were critical in creating a solution in which effectiveness and justice could mutually reinforce each other: 1) the establishment of two multilateral agreements (summarized as Table Table in Supplementary material) between three main actors – i.e., the municipality of Rotterdam, housing association Havensteder, and heat supplying company Eneco Inc.; and 2) the involvement of social entrepreneur 'De Verbindingskamer' that managed to create and maintain meaningful connections between the three main actors and the residents.

Between 2019 and 2021 the three main actors frequently met, developed trust relationships, and worked with open books to develop the business case for the renovation project. In a multilateral so-called 'Area Agreement', they established legally binding and economically sound norms for their collaboration in the neighbourhood. This agreement clearly defined ownership, construction, connection, implementation and operation, including the division of powers and responsibilities of each actor. This proved to be a strong basis that allowed the municipality to take a coordinating role and deal with conflicts and other issues during the implementation process.

Adjacently, already in 2019, the municipality had started a social program for the neighbourhood called 'Resilient BoTu', working towards more residents helping each other and working together to cope with adversity. Building on the awareness for social problems in this program, the three main actors explicitly formulated shared public values, promised coupling opportunities to provide work for young people, ensured affordability and pre-empted a debt-trap for all, and indicated that they wanted to collaborate with residents during implementation. This was deliberately laid down in a so-called 'Collaboration agreement.'

Crucially, the organization and implementation of the process appeared as effective, legitimate and timely – which is important to generate a positive dynamic between trust and effectiveness. The two multilateral agreements provided a strong legal and economic basis for collaboration between the three main actors and based on their trust relationship the municipality was able to coordinate and keep the whole process on track. Another positive feat of the case was the deliberate integration of social and technical issues, particularly in the Collaboration Agreement. The three actors did not just argue that they aimed for socio-technical change, they managed to accomplish such change. This can also be seen in the way they collaborated with 'De Verbindingskamer', a social entrepreneur, specialized in creating connections between distrustful residents and public institutions.

'De Verbindingskamer' tried to bridge the distance between residents and public institutions by actively listening to residents at their doorsteps and in the hallways of their building. In their conversations with residents, all kinds of problems were mentioned, for example about discomfort or unhealthy situations in the apartment due to drafts or humidity, or broken things in the housing complex. 'De Verbindingskamer' communicated these problems with the three main actors, ensuring that something was done to resolve them. Moreover, residents were informed about the follow-up of the reported problems. In the end, 'De Verbindingskamer' managed to reach almost all residents in the project. Only after this succeeded, residents were engaged to take an active role in the implementation of the retrofit processes. In the end, more than 40 residents were persuaded and became actively involved.

What is remarkable about the approach by 'De Verbindingskamer', is that close attention was paid to the who, where and what of listening [52]. The 'who' is about them listening indiscriminately to everyone. The 'where' refers to their places for listening, at the front door or in the hall, rather than at an orchestrated residents' event. And the 'what' is about residents reporting all sorts of problems. Through this inclusive way of listening and by getting results on reported problems, even residents who typically remained out of sight of public institutions felt seen and heard, indicating that the activities of 'De Verbindingskamer' succeeded in paying serious attention to recognition justice [8,53].

In sum, the 'BoTu' case shows how effectiveness and justice can both be 'governed' and achieved in UN-based retrofit processes. The two agreements and the coordinating role of the municipality allowed for timely realization of sustainable renovation, while ensuring that the three main actors also worked towards achieving distributive justice by securing coupling opportunities and by keeping costs for residents at bay. In addition, the approach taken by 'De Verbindingskamer' clearly contributed to achieving recognition justice, by including all residents and by ensuring that residents' reported problems were addressed.

7. Concluding remarks: remaining issues and some guidance

This Perspectives article has pointed out that, while two mismatches that prevail in the energy renovation in UNs may well create a downward spiral between energy renovation effectiveness and justice, an upward spiral might be possible as well if we adopt an emic, contextual and relational approach. Our discussion of some early experiences with turning this into practice indeed shows the potential - but it also points

to some key issues that appear to arise in practice and require further scrutiny in our project and more widely.

First, experiences with the LiLabs show that their main merit is to bring together and facilitate deliberative interaction between the perspectives of residents, through an emic approach, and the perspectives of professionals and experts. By its nature, deliberation requires that all participants may scrutinize each other's arguments and ask for justification of proposals [54]. Experiences show that this is far from a smooth, easy-going process, especially not in a context – like in our LiLabs – with tensions and contestation. Simultaneously, we have seen that properly dealing with such friction may contribute to important successes [55]. We have seen that researchers may facilitate this process by (i) generating, from an emic perspective, insight into residents' needs and practices; (ii) supporting deliberation using appropriate methods, and creating contextually appropriate arrangements; (iii) undertaking or commissioning studies and design processes to address expressed questions and needs as well as scrutinize claims; and (iv) responding to others questioning their claims. To better understand these multiple roles of researchers, future (interpretive) research is needed, preferably comparing how they play out in various material and institutional contexts [28,56].

Second, this reciprocity is important as it not only implies that official and expert knowledge may be critically scrutinized, but also the needs and practices of residents cannot always be considered as just given when designing solutions. Practices (and their related needs/wants) may change with changing material arrangements. This is an important cause of rebound effects; e.g. with better insulation, indoor temperatures increase, as a response to which people change their ways of dressing and use thicker blankets, and thus come to 'need' higher indoor temperatures [39,57,58]. This is even more pressing if we take into account that 'needs' for comfort in most Global North countries arguably lie above the standards that can be sustainably provided to all (e.g. [59]). Needless to say, this is an intricate issue that requires subtle navigation given the mental and social distance between professionals and residents. More exploration, through action research, is needed. We believe that ethics of care notions [60] - like the principle caring for others *and* self and the understanding of needs as socially constructed in a wider material and institutional setting – offer a helpful normative guidance in the implied deliberative processes.

Finally, we have seen that practices like that of the 'Verbindingskamer', which are firmly embedded in the neighbourhood context, may indeed enable such deliberation. While we plan comparative analysis of our LiLabs (which share this embedding but differ in their features) to yield more insight on this and are looking for other research on the topic, the analysis of governance arrangements also raises another pertinent question for further research: how may professionals deal with the tension between sharing authority while retaining professional responsibility? [61].

CRediT authorship contribution statement

John Grin: Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization. **Joep Frens:** Writing – review & editing, Investigation, Funding acquisition, Conceptualization. **Thomas Hoppe:** Writing – original draft, Investigation, Funding acquisition, Conceptualization. **Erik Jansen:** Writing – original draft, Funding acquisition, Conceptualization. **Thaleia Konstantinou:** Investigation, Funding acquisition, Conceptualization. **Lenneke Kuijer:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Conceptualization. **Roel Loonen:** Investigation, Funding acquisition, Conceptualization. **Stan Majoor:** Funding acquisition, Conceptualization. **Sietske Veenman:** Investigation, Funding acquisition, Conceptualization. **Floris Vermeulen:** Investigation, Funding acquisition, Conceptualization. **Mark Wiering:** Investigation, Funding acquisition, Conceptualization. **Anna de Zeeuw:** Writing – original draft, Methodology. **Imrat Verhoeven:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.erss.2026.104748.

Data availability

Data will be made available on request.

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