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DOI
10.21606/drs.2024.527

Publication date
2024

Document Version
Final published version

Published in
DRS2024: Boston

Jun 23rd, 9:00 AM - Jun 28th, 5:00 PM

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Citation

Slingerland, G., and Wang, G. (2024) Co-design for change: Propositions and dilemmas, in Gray, C., Hekkert, P., Forlano, L., Ciuccarelli, P. (eds.), *DRS2024: Boston*, 23–28 June, Boston, USA. https://doi.org/10.21606/drs.2024.527

DRS BOSTON 2024 JUNE 24 — 28

Co-design for change: Propositions and dilemmas

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doi.org/10.21606/drs.2024.527

Abstract: Co-design has been widely applied to develop interventions supporting behavior change. While numerous co-design propositions have been developed, applying these in practice often leads to difficulties and tensions. This study aims to review the co-design propositions and understand the dilemmas when applying them. A literature review was conducted, and twelve co-design propositions were identified after qualitative analysis. The study found that some co-design propositions conflict because they align with an idealistic versus a realistic perspective. By studying these conflicts in-depth, seven dilemmas were identified at the intersection of realist and idealist propositions. Implications of the findings on design for behavior change were discussed, and this paper serves as a starting point to help researchers and practitioners identify, articulate, and navigate these dilemmas to achieve successful co-design outcomes.

Keywords: Participatory design; Co-design; Guidelines; Dilemmas

1. Introduction

Contemporary societies are confronted with complex challenges, including climate change, conflicts, cybercrime, and the rising prevalence of chronic diseases. Coming up with adequate solutions requires the involvement of all stakeholders, as suggested by the 17th Sustainable Development Goal “Partnerships for the Goals.” In the past decades, co-design has emerged as a prominent approach for co-developing interventions aimed at fostering social change and solutions to societal problems (Blackwell et al., 2017; Eyles et al., 2016; Gooch et al., 2021; C. N. Harrington et al., 2018; Wang et al., 2022). Co-design is a collaborative approach that actively engages end-users and key stakeholders in the design process for change (Burkett, 2012) and holds promise to develop effective and contextually relevant solutions.

Over the years, propositions, guidelines, and heuristics have been proposed to ensure that this participatory approach successfully achieves its intended outcomes. They range from

the seminal book "Participatory Design: Propositions and Practices" (Schuler & Namioka, 1993) to recent studies investigating how to co-design with particular groups such as children (Thabrew et al., 2018; Yin et al., 2023), people with dementia (Hendriks et al., 2018; Wang et al., 2019), or vulnerable groups in general (Hodson et al., 2023). Key to co-design processes is that they are adjusted to the specific context and target group. Co-design facilitators continuously develop specific processes and corresponding tools appropriate to the situation, considering general propositions such as inclusivity or reciprocity. Since co-design is applied in various domains (e.g. healthcare, urban planning, design innovation, etc.), insights about best practices are scattered. Despite the application domain, co-design intentions are often similar: developing services, interventions, or solutions that support the envisioned (behavioral) change. Yet, a cross-disciplinary review and reflection on co-design propositions, guidelines and heuristics that support change is lacking.

Moreover, even with the good intentions of co-design facilitators, applying these propositions, guidelines and heuristics often presents complex challenges and tensions, which can complicate the co-design process. In 1998, Kensing and Blomberg highlighted the politics of design and the level of involvement as two major concerns during participatory design; and reviewed methods, tools and techniques developed for engaging participation (Kensing & Blomberg, 1998). Beck continued this debate, calling for a “stronger demand for analyses of societal/political/ethical consequences” in participatory design projects (Beck, 2002). Given that the scope of co-design has expanded from improving working conditions and productivity of workers by technology development to other sectors including healthcare (Donetto et al., 2014; The Lancet Digital Health, 2023), community (Cumbula et al., 2013; Wang, Kasraian Moghaddam, et al., 2022), public sector (Donetto et al., 2015; Evans & Terrey, 2016), and placemaking (Slingerland et al., 2020, 2022), the relevance of studying the challenges and corresponding power dimensions that arise in developing appropriate co-design techniques only increases.

A main cause of co-design challenges is that a wide range of philosophies drive the co-design processes (Zamenopoulos & Alexiou, 2018). The recent discussion of idealist and realist perspectives of co-design (von Busch & Palmas, 2023) inspired our thinking about conflicts and dilemmas in co-design processes. This study delves into the recent co-design literature in different fields, aiming to shed light on the intricacies of applying co-design propositions, guidelines and heuristics in practice and the dilemmas that arise. We do not posit to identify evidence of best practices but to generate a list of propositions and dilemmas to serve as a starting point for a future research agenda.

A research agenda is needed, because some dilemmas have been studied and discussed extensively while others remain implicit or hidden. Previous work already studied the difference between design-driven and research-driven co-design (Sanders & Stappers, 2008) and navigating abundant and limited resources in co-design (Meija et al. 2023). Our exploratory review of seminal literature on co-design practices generated twelve co-design propositions and seven dilemmas. Some of these dilemmas overlap with prior work as outlined above.

Yet, other dilemmas, to the best of our knowledge, have rarely been addressed in the literature so far while co-design facilitators need adequate strategies and tools to appropriately navigate the dilemma. The next section describes the way the literature search was conducted, which papers were selected for analysis and how they were analyzed to identify the propositions. Section 3 presents the twelve co-design propositions which were identified and the seven dilemmas that occur when facilitators want to apply multiple propositions at the same time. Finally, section 4 discusses existing strategies and tools to navigate the dilemmas and proposes future research directions for the dilemmas where strategies are currently lacking.

2. Methods

A literature search was conducted with the search string ((“Co-design” OR “Co-creation” OR “Participatory Design” OR “Participatory action research” OR “community-based participatory research”) AND (“propositions” OR “guidelines” OR “heuristics”)) on 11th August 2023 for any literature before the search date with Google Scholar. The inclusion criteria are that the article is peer-reviewed, with accessible full-text, and written in English.

With the help of Zotero, both authors screened through the titles and abstracts and selected articles relevant for full-text review together. Articles were deemed relevant when they would talk about general propositions, guidelines, or heuristics for co-design. The bibliography of these articles was reviewed to identify other relevant literature.

This led to a selection of 19 articles and books, with reasons for selection as outlined in the supplementary materials. In Zotero, all articles were first independently coded by both authors to segments of text that relate to co-design propositions, guidelines, or heuristics. The researchers discussed their initial codes during three biweekly meetings and resolved discrepancies through discussion.

Once consensus on initial coding was achieved, the researchers engaged in a collaborative process using Miro to cluster the codes into overarching themes during three bi-weekly meetings. The propositions were iterated multiple times using axial coding techniques during this process, which resulted in the twelve propositions for co-design. The axial coding also informed the development of the dilemmas, as the researchers started to see that some propositions could conflict with each other. Following the realistic and idealist perspectives of co-design defined previously (von Busch & Palmas, 2023), the researchers contrasted these propositions and developed themes of dilemmas during two bi-weekly meetings. The list of dilemmas was finalized when consensus was reached after discussion.

3. Results

The results describe the propositions from the literature and how these are divided into idealistic and realistic propositions. Contrasting these two perspectives leads to the identifica-

tion of dilemmas, when co-design facilitators aim to follow realistic as well as idealistic propositions at the same time. First, the propositions are described and then followed by the dilemmas.

3.1 Propositions

Twelve propositions were identified from the literature. As outlined before, these are categorized into propositions following an idealist perspective (in short: idealist propositions) and propositions following a realist perspective (in short: realist propositions). Idealist propositions are about improving the world and are strongly built on ideals such as harmony, inclusivity, democracy, and equality. The realist propositions contrast this ideal world by addressing limitations to the co-design process, illuminating the hidden agendas, power dynamics, and the political dimension of co-design.

3.1.1 Idealist propositions

Eight idealist propositions were found (see Table 1) and are further elaborated below.

Table 1 Eight idealist propositions on doing co-design.

Proposition	**Corresponding articles**
Promote inclusive events and language	Sendra, 2023; Çarçani & Stigberg; Hodson et al., 2023; Del Gaudio et al., 2017; Sanders & Stappers, 2008
Build connections and trust among stakeholders	Çarçani & Stigberg, 2023; Taylor et al., 2022; Israel et al., 2018; Sendra, 2023; Michalik, 2023; Zamenopoulos & Alexiou, 2018; Pettigrew, 1998; Simonsen & Robertson, 2013
Assure informed participation at one's own will	Kelly, 2019; Hodson et al., 2023; Racadio et al., 2014; Michalik, 2023
Ensure appropriate power distribution for fair involvement in decision-making	Schuler & Namioka, 1993; Hodson et al., 2023; Evans & Terrey, 2016; Sendra, 2023
Generate reciprocal exchanges and activities	Kelly, 2019; Zamenopoulos & Alexiou, 2018; Gregory, 2002; Schuler & Namioka, 1993; Israel et al., 2018; Racadio et al., 2014; Sabiescu et al., 2014; Simonsen & Robertson, 2013
Be transparent about all interests	Evans & Terrey, 2016; Salomao David Cumbula et al., 2013; Harrington et al., 2019; Iversen et al., 2012
Create lasting impact with codesign	Israel et al., 2018; Sabiescu et al., 2014; Harrington et al., 2019; Simonsen & Robertson, 2013; Racadio et al., 2014
Facilitate learning through doing activities	Sanders & Stappers, 2008, 2014; Iversen et al., 2012; Çarçani & Stigberg, 2023;Michalik, 2023; Evans & Terrey, 2016

Promote inclusive events and language

Being inclusive during co-design is recognized as a key proposition to ensure a truly representative and accessible process. Such inclusivity should be supported by the co-design events and language. According to Sendra (2023), co-design facilitators should proactively address the barriers that often exclude certain groups from participating. To do so, a range of strategies are suggested by scholars: offer diverse forms of participation (Çarçani & Stigberg, 2023), tail towards the unique comfort levels of diverse communities in participation (Hodson et al., 2023), schedule events at different times and days (Del Gaudio et al., 2017), target specific groups that may not typically participate in public events, and use of language that aligns with participants' everyday experiences (Sanders & Stappers, 2008).

Build connections and trust among stakeholders

The glue for collaboration in any co-design process is the connections and trust among stakeholders. Multiple scholars (Çarçani & Stigberg, 2023; Taylor et al., 2022) recognize facilitators of co-design sessions to be responsible for trust building. This can be achieved by bringing stakeholders together in the same space and time with an atmosphere of openness, mutual respect, and shared purpose (Michalik, 2023; Zamenopoulos & Alexiou, 2018) to diminish prejudice (Pettigrew, 1998). Trust needs to be established between all stakeholders, including the researchers or institutions who initiated the co-design (Israel et al., 2018; Sendra, 2023). Such relationships enable participants to voice their concerns, ideas, and aspirations more freely, leading to more informed, inclusive, and sustainable design solutions that truly reflect the needs and desires of the community (Simonsen & Robertson, 2013).

Assure informed participation at one's own will

True co-design is when participants join fully informed and at their own will. Such participation results in participants taking ownership (Kelly, 2019). Various pressures, whether from the project setup, other stakeholders, or the researchers themselves as authorities, can sometimes coerce individuals into participation (Hodson et al., 2023). Therefore, to ensure true voluntary participation, designers should create spaces where people can freely choose to be involved or not (Racadio et al., 2014). Moreover, informed participation necessitates clear communication about project details and potential implications, considering that design and co-design terminologies may be unfamiliar to those outside the field (Michalik, 2023). Designers should engage in dialogue with participants to ensure they fully comprehend the project and its potential consequences, including any unforeseen risks or implications that may arise.

Ensure appropriate power distribution for fair involvement in decision-making

Co-design necessitates a deliberate effort to balance power distribution among stakeholders, so that decisions reflect fair involvement. Some stakeholders usually have more power than others (i.e., possess greater resources, influence, or control over critical aspects of the

co-design process), which can significantly impact the collaborative effort (Schuler & Namioka, 1993). Given this, co-design facilitators may encourage powerful stakeholders to cede some of their power (Hodson et al., 2023), orchestrate situations and activities that redefine power relationships, or equip individuals with the skills needed to engage actively and co-lead in the decision-making process (Evans & Terrey, 2016; Sendra, 2023). In some instances, championing fair empowerment may even require designers to challenge individuals or institutions with greater authority, such as senior colleagues or funding bodies, to uphold a just and balanced distribution of influence and decision-making capabilities.

Generate reciprocal exchanges and activities

Co-design sessions should not be one-sided, with only the researchers and designers benefiting (Kelly, 2019; Zamenopoulos & Alexiou, 2018). Instead, this proposition underscores that participants should gain from the co-design process, either through their involvement in the process itself or through the outcomes that result from it (Gregory, 2002; Schuler & Namioka, 1993). Co-design facilitators should pay special attention to ensure reciprocity, creating opportunities for give-and-take among all stakeholders (Israel et al., 2018), for example empowering activities: sharing knowledge, or capacity building, and communication of results (Racadio et al., 2014; Sabiescu et al., 2014; Simonsen & Robertson, 2013). These reciprocal exchanges and activities foster a sense of shared ownership, trust, and collaboration among all involved, enhancing the overall effectiveness and impact of the co-design process.

Be transparent about all interests

Although stakeholders bring their interests to the co-design process (Evans & Terrey, 2016), these should be transparent to everyone involved. If interests remain hidden, they may negatively impact the co-design dynamics (Cumbula et al., 2013). Importantly, this proposition extends to the researcher or designer as well, who inevitably brings their interests, whether it be academic pursuits, the interests of the company they represent, or other motivations (C. Harrington et al., 2019; Iversen et al., 2012). This transparency fosters a climate of trust, clarity, and shared understanding among all participants.

Create lasting impact with co-design

Co-design processes are considered to be truly successful when they create a lasting impact. Stakeholders want impact and enduring results because they invest adequate resources in a resource-heavy co-design process (Israel et al., 2018; Sabiescu et al., 2014). The promise of co-design is that by actively involving end-users or citizens and enabling them to shape the co-design process, a sense of ownership regarding the outcomes is cultivated (C. Harrington et al., 2019; Simonsen & Robertson, 2013), and they feel a deeper commitment to sustaining the outcomes (Racadio et al., 2014). In essence, this proposition acknowledges that co-design should not only be a transient endeavor but a catalyst for enduring change, where participants take a central role in implementing and perpetuating the co-design outcomes.

Facilitate learning-through-doing activities

Central in co-design sessions is that participants learn through doing. What distinguishes co-design from focus groups is that participants engage in hands-on activities and collectively create artefacts (Sanders & Stappers, 2008, 2014). Consequently, "making" activities support participants to iteratively work on both comprehending the problem at hand and contributing to potential solutions (Çarçani & Stigberg, 2023; Iversen et al., 2012). This iterative approach, as highlighted by Michalik (2023), involves an ongoing cycle of problem-solving and problem-understanding, in short, learning-through-doing. Co-design facilitators play a crucial role in supporting this learning-through-doing process (Evans & Terrey, 2016). They are responsible for providing the necessary activities and tools that enable participants to engage in these iterations effectively, which may span multiple sessions.

3.1.2 Realist propositions

The realist propositions contrast with the idealistic ones because they make co-designer facilitators aware of the limitations and the difficulty of organizing a truly transparent, inclusive, and democratic process. Furthermore, they address the political dynamic that is often present in co-design. Table 2 shows the four realist propositions that were found in the literature.

Table 2 Four realist propositions on doing co-design.

Proposition	**Corresponding articles**
All interests cannot be treated equally	von Busch & Palmas, 2023; Simon, 1988; Harrington et al., 2019; Zamenopoulos & Alexiou, 2018
Fair and appropriate power distribution is subjective	Gregory, 2002; Hodson et al., 2023; Sabiescu et al., 2014; Kelly, 2019; Israel et al., 2018
Co-design work needs to be disseminated	Kelly, 2019; Harrington et al., 2019; Kensing & Blomberg, 1998; Sabiescu et al., 2014
Resources are limited	Harrington et al., 2019; Evans & Terrey, 2016; Taylor et al., 2022; Michalik, 2023

All interests cannot be treated equally

Stakeholders bring their, often conflicting, interests to the co-design session. This proposition states that these interests cannot be treated equally. What an ideal world is to one, is a dystopia to another: Creating ideal scenarios where all interests align is difficult (von Busch & Palmas, 2023). Quoting Simon (1988), "To design is to devise courses of action aimed at changing existing situations into preferred ones". Change inherently reshapes power dynamics, often favoring certain individuals or interests at the expense of others. Co-design facilitators should thus be aware that treating all interests equally is impossible and instead address whose interests are prioritized and whose interests are oppressed in the co-design process (C. Harrington et al., 2019; Zamenopoulos & Alexiou, 2018).

Fair and appropriate power distribution is subjective

In co-design, perceptions of what constitutes fair and appropriate power distribution can vary significantly among stakeholders (Gregory, 2002). Reaching consensus on the allocation of power in the co-design process is challenging (Hodson et al., 2023) and subjective (Sabiescu et al., 2014): what one group or individual considers fair and equitable might not align with the perspectives of others (Kelly, 2019). Co-design facilitators should be aware of this subjectivity and be prepared to navigate these differing interpretations (Israel et al., 2018).

Co-design work needs to be disseminated

Dissemination is a significant task of researchers to communicate results with peers and design professionals. When researchers facilitate co-design sessions, this means they need to juggle multiple tasks: taking care of participants, facilitating the process, and, driven by the academic reward system, documentation and dissemination. Kelly (2019) showed how dealing with all of this at the same time in a session is extremely demanding to researchers. Researchers may be inclined to then prioritize their own needs over what is best for all stakeholders (C. Harrington et al., 2019; Kensing & Blomberg, 1998; Sabiescu et al., 2014).

Resources are limited

Resources are always constrained. Co-design usually demands a substantial investment of time and effort from key stakeholders, which in turn raises the stakes (C. Harrington et al., 2019). In light of these high expectations and limited resources, researchers should critically assess the available resources to determine and communicate what is realistically achievable in terms of outcomes during the co-design process (Evans & Terrey, 2016). This requires a clear-eyed understanding of the practical constraints, which can encompass time, personnel, funding, and other necessary assets (Taylor et al., 2022). By aligning the goals and expectations of co-design with the available resources (Michalik, 2023), researchers can co-set more achievable and realistic milestones for the collaborative efforts with the participants.

3.2 Dilemmas

Further analysis of the propositions by contrasting the two perspectives exposes that trying to follow propositions from both perspectives may lead to dilemmas (see Figure 1). As a result, co-design facilitators need to comprise one proposition over the other. Following this line of thinking, seven dilemmas are elaborated below, each contrasting one realist with one or two idealist propositions. An overview of all seven dilemmas is provided in the supplementary materials.

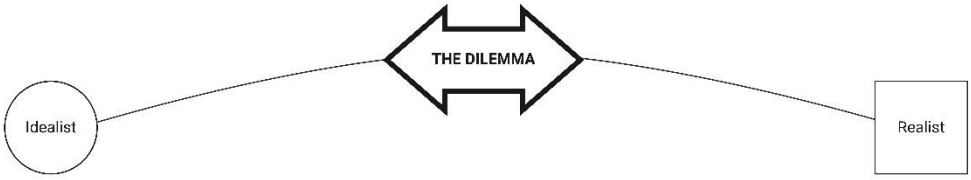

Figure 1 Overall framework where realist and idealist propositions are contrasted to reveal dilemmas that co-design facilitators need to deal with.

Following the plan vs Flexibility

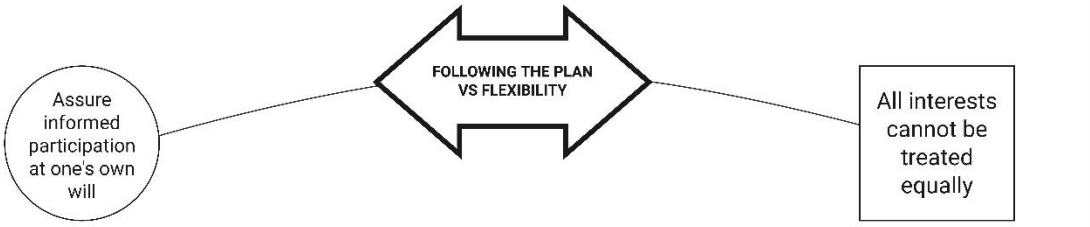

Figure 2 The dilemma Following the plan vs. Flexibility asks to compromise a realistic proposition over an idealistic proposition or the other way around.

Ideally, participants should be completely autonomous in deciding to participate and are fully informed about what participation entails. Consequently, co-design facilitators carefully schedule and plan their sessions and disseminate their plans during participant recruitment. Participants join the co-design process because they believe the process aligns with their interests and they can benefit from it. However, not all interests can be treated equally. How the interest dynamic will impact the co-design process and who will benefit is hard to predict. Instead, co-design facilitators need to navigate this during the session, potentially changing the initial plans. Given the explorative and iterative nature of design (Krogh et al., 2015), new insights will inherently emerge, adjusting the schedule and plans. As a result, it is a dilemma for co-design facilitators to follow the plan upon which informed participation was established and to be flexible in navigating diverging stakeholder interests.

Transparency vs Inclusivity

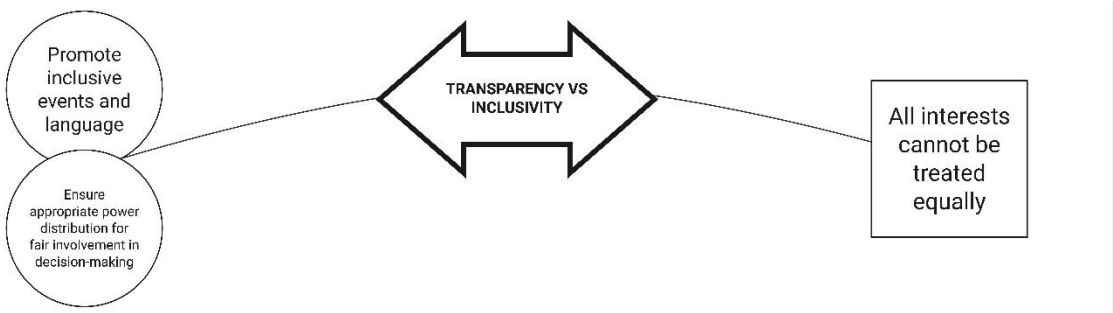

Figure 3 The dilemma Transparency vs Inclusivity asks to compromise a realistic proposition over two idealistic propositions or the other way around.

Co-design facilitators want to create an inclusive environment and involve all participants in shared decision-making. At the same time, they need to deal with the fact that not all stakeholder interests can be treated equally. Being honest about this may lead to participants dropping out of the sessions or not wanting to participate at all because their interests may not be prioritized. This harms the inclusivity of the co-design process. The dilemma for co-design facilitators is whether to be fully transparent when this compromises inclusivity. Being transparent about the intentions (e.g. whose interests may be considered more important) is crucial but may lead to some participants not wanting to contribute or feeling excluded because they disagree with the intentions.

Connect vs Categorize

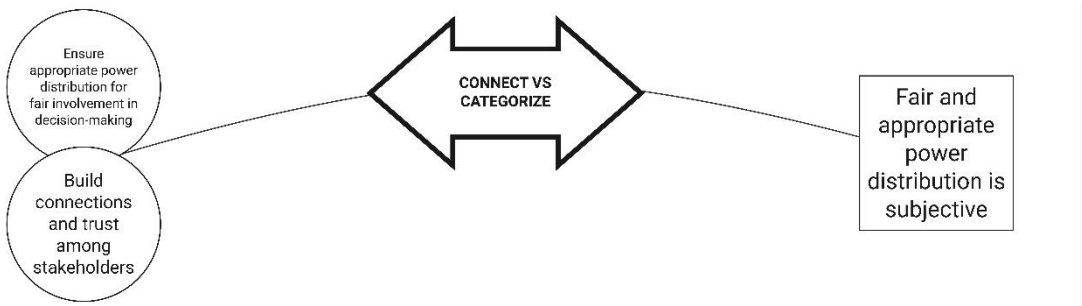

Figure 4 The dilemma Connect vs Categorize asks to compromise a realistic proposition over two idealistic propositions or the other way around.

Ideally, the co-design offers a fertile ground to help stakeholders build connections and trust by inviting them to work towards a shared goal and fair decision-making. To achieve this, co-design facilitators bring all stakeholders into one room to connect. Yet, facilitation may be difficult given the power dynamics between stakeholders. The dilemma for the facilitators is then whether to connect all stakeholders or whether to categorize them into groups to avoid one group exercising power over another. A disadvantage of categorization is that it challenges the stakeholders to collaborate on implementing the outcomes of the co-design process because they never worked together during the co-design itself.

Dissensus vs Consensus

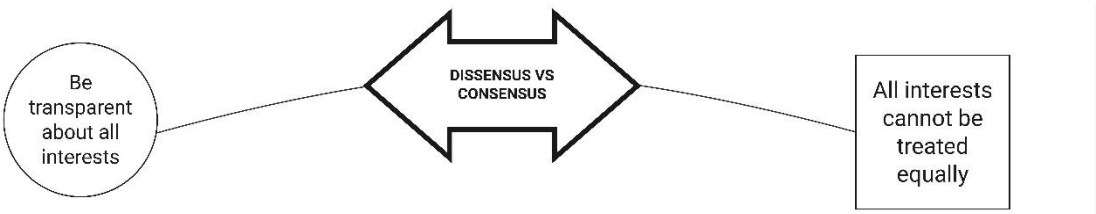

Figure 5 The dilemma Dissensus vs Consensus asks to compromise a realistic proposition over an idealistic proposition or the other way around.

While the co-design process should be truly transparent about the interests it serves and which interests are brought to the sessions, it is well-recognized that stakeholders have different and oftentimes conflicting interests, motivations, values, and perspectives. Actively acknowledging and proactively addressing tensions play a pivotal role in upholding the proposition of power balance and democratic design practices in co-design. Yet, from the realist perspective, sometimes a consensus can never be made, and the process of co-design is a process of conflict. Co-design facilitators face the dilemma of promoting dissensus (the tensions) or consensus (commonalities). The risk of focusing only on commonalities is that the conflicting interests implicitly continue to influence the dynamic. The risk of focusing on conflicts is escalation and an impossibility to reach any decisions.

Scaffolding vs Open ideation

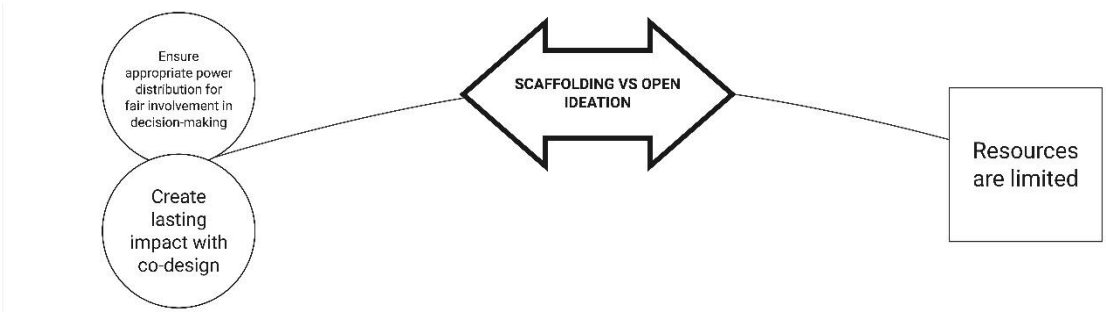

Figure 6 The dilemma Scaffolding vs Open ideation asks to compromise a realistic proposition over an idealistic proposition or the other way around.

Ideally, co-design facilitators ensure fair decision-making by providing participants with the necessary tools to actively engage and co-lead in the decision-making process, leading to outcomes with a lasting impact. Such a process is supported through open ideation, where participants determine the scope and direction of the process. Still, many co-design projects start from the designers' perspective open ideation is resource-heavy. Co-design facilitators thus scaffold activities for stakeholders to engage, often after fundamental decisions on scope and direction have been made. The dilemma that co-design facilitators face is whether to support open ideation, requiring many resources and with a less clear outcome from the start, or to scaffold activities based on their design expertise, yet compromising equal stakeholder involvement. This kind of scaffolding means that facilitators, potentially with other powerful stakeholders, are executing their power over the participants.

Participant benefit vs Researcher benefit

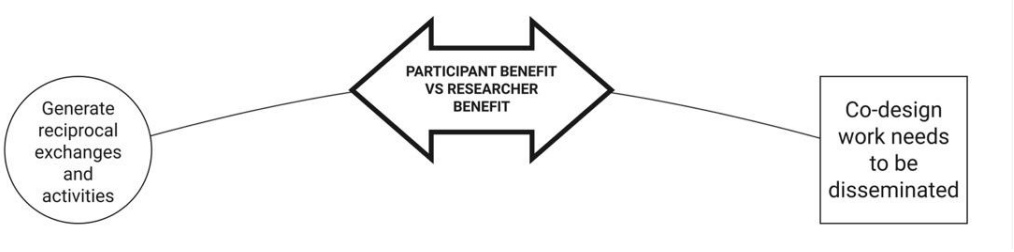

Figure 7 The dilemma Participant benefit vs Researcher benefit asks to compromise a realistic proposition over an idealistic proposition or the other way around.

Co-design practices place a strong emphasis on centralizing the needs and wellbeing of the participants, generating reciprocal exchanges with them. However, such efforts require extra time and effort of the co-design facilitator, who needs to juggle many tasks and are mostly rewarded for dissemination. Facilitators, who are often researchers, benefit automatically from the session when they can collect data, analyze the session, and publish a paper, while such activities bring no benefits to the participants. Furthermore, when researchers focus on establishing benefits for the participants, this may compromise the academic quality of the work. The dilemma faced thus is to achieve benefits for participants or for the researchers.

Solution-oriented vs problem-oriented

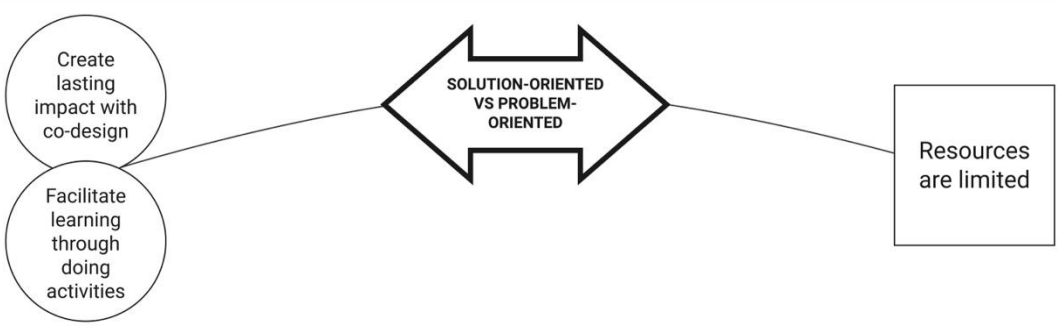

Figure 8 The dilemma Solution-oriented vs Problem-oriented to compromise a realistic proposition over two idealistic propositions or the other way around.

Ideally, co-design is an iterative activity between understanding the problem and finding solutions facilitated by learning-through-doing, and leading to lasting impact. This is often why stakeholders want to participate: they want to find practical solutions to issues they face. To be successful in this, many resources are required. Therefore, researchers, especially in academic settings, often prioritize gaining a deep understanding of the problem as well as the perspectives of problem owners through co-design and do not promise a final solution that can solve the problem participants face. This problem-oriented approach positions the design of solutions as a means to enhance comprehension of the problem itself. The tension

can arise between participants' desire for tangible, context-specific solutions and researchers' pursuit of knowledge generation and comprehensive problem understanding, and the limited resources available to support the co-design process.

4. Discussion and conclusion

The findings of this research reveal a fundamental tension between idealistic and realistic perspectives on co-design. The study elucidates that certain propositions advocate for an idealized, aspirational vision of co-design, while others necessitate a pragmatic, realist approach. This section discusses strategies for co-design facilitators to navigate such dilemmas. Based on previous research, two predominant strategies, infrastructuring and agonistic design, are identified and discussed as two starting points.

4.1 Infrastructuring strategies to navigate co-design dilemmas

First, infrastructuring in participatory design theories refers to the process of creating and developing the necessary infrastructure, tools, and resources to support collaborative and participatory design practices (Karasti, 2014). It emphasizes the role of design not just in creating end-products or solutions, but also in shaping the socio-technical systems within which these solutions exist and operate (Klerks et al., 2022). Infrastructuring recognizes that effective participation requires more than just inviting people to workshops or design sessions. It involves creating the conditions and structures that enable meaningful and sustained collaboration throughout the entire design process and ideally beyond (Dantec & DiSalvo, 2013).

The infrastructuring strategy is relevant to three co-design dilemmas: connect vs. categorize, scaffolding vs. open ideation, and solution-oriented vs. problem-oriented. Applicable infrastructuring concepts include creating collaborative spaces (scaffolding vs. open ideation), developing shared tools and methods (connect vs. categorize), establishing governance and decision-making processes (connect vs. categorize), building capacity and skills for the participants (solution-oriented vs. problem-oriented), and supporting long-term engagement (solution-oriented vs. problem-oriented). However, infrastructuring strategies remain described on a theoretical level. Future research should analyze practical case studies to understand how facilitators utilize infrastructuring techniques to navigate co-design dilemmas.

4.2 Agonistic design to manage conflicts in co-design

Second, agonistic design emphasizes the importance of acknowledging and embracing conflicts, tensions, and diverse perspectives within the design process (Björgvinsson et al., 2012). It recognizes that conflicts and disagreements are inherent in complex social and political contexts (Korn & Voida, 2015). Rather than trying to eliminate these tensions, agonistic design sees them as productive forces that can lead to more innovative, inclusive, and contextually relevant design outcomes (Björgvinsson et al., 2012).

Agonistic design can be helpful to three co-design dilemmas: following the plan vs. flexibility, transparency vs. inclusivity, dissensus vs. consensus. Agnostic design strategies include em-

bracing conflict, creating spaces for contestation, facilitating critical reflection, and promoting diversity. When co-design facilitators are equipped with more agonistic design skills, they can be more comfortable to facilitate conflicts (dissensus vs. consensus), know when all stakeholder groups felt heard to steer the conversation back to a constructive atmosphere (transparency vs. inclusivity), and effectively steer between the original plan and required adjustments based on agonistic discussions (following the plan vs. flexibility). Yet, similarly to infrastructuring, agonistic design strategies can remain abstract. Furthermore, design students should be better equipped with agonistic design skill.

4.3 Reframing dilemmas to trade-offs

Lastly, dilemma is defined as a situation in which a difficult choice has to be made between two or more alternatives, especially ones that are equally undesirable. One may argue the dilemmas we described above could be phrased as trade-offs, as sometimes one could create a third option that satisfies both the idealist and realist propositions to some extent. For example, achieving a balance between solution-oriented and problem-oriented perspectives is often essential for successful co-design processes (Sanders & Stappers, 2008), ensuring that the outcomes satisfy the needs and expectations of all stakeholders. While participants may be most interested in finding a solution, the researchers may want to support participants in understanding the problem first to solve the problem better. The dilemma of participant benefit vs researcher benefit also addresses this tension. The question is whether it is the one or the other, or if dilemmas can be reframed to find a middle ground. Future research will explore reframing of dilemmas further, by considering co-design cases from practice.

4.4 Limitations and conclusions

This article aims to stimulate a discourse surrounding the conflicting propositions in co-design. We hope this discussion will contribute to a deeper understanding of the complexities involved. Yet, this study primarily relies on theoretical knowledge, despite incorporating the practical experiences of both authors. The literature search performed was rather open and exploratory, therefore some relevant articles could have been missed. Next steps in this research, therefore, include a more systematic literature search and the inclusion of co-design case studies to translate these theoretical findings to practice. Future research endeavors should concentrate on the development and evaluation of methods and tools that can assist designers in navigating these dilemmas.

To conclude, the significance of these findings lies in their potential to provide a roadmap for researchers and practitioners engaged in the field of co-design. By acknowledging and understanding the dilemmas that can arise, one is better equipped to navigate the complex terrain of co-design, ultimately leading to more successful and effective outcomes. This study thus offers valuable insights into the challenges inherent in co-design, enabling the development of strategies to address them and achieve the full potential of this collaborative approach.

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Supplementary materials

Selected articles and books for literature review

Table 1 The articles and books selected to identify co-design propositions.

Author(s), year	Title	Reason to select
Burkett, 2012	An Introduction to Co-Design	Overview of the whole co-design process in business and social domain, describing five key features of co-design.
Çarçani et al, 2023	Reflecting on Collaboration in Participatory Design Facilitation	Reflection on facilitating practices and roles that are needed in participatory design approaches.
Del Gaudio et al., 2017	The challenge of time in community-based participatory design	Discussion of the temporal dimension of co-design practices, particularly with communities.
Evans & Terrey, 2016	Co-design with citizens and stakeholders	Integration of different disciplines to formulate the co-design process with three distinct phases and required conditions.
Gregory, 2003	Scandinavian Approaches to Participatory Design	Three propositions to identify the Scandinavian Participatory Design approach.
Hodson et al., 2023	Whom do we include and when? Participatory Design with vulnerable groups	Engagement map for working with vulnerable groups in Participatory Design practices.
Israel et al., 2018	Critical Issues in Developing and Following CBPR Propositions	Definition and key propositions of Community-based Participatory Research
Iversen et al., 2013	Values-led Participatory Design	Outline of the values that play a role in Participatory Design practices and how they emerge throughout.
Kelly, 2019	Towards ethical propositions for Participatory Design practice	Focus on ethical propositions of doing co-design and participatory design.
Kensing & Blomberg, 1998	Participatory Design: Issues and Concerns	Identification of challenges that participatory design practitioners may run into, driven by underlying values.
Michalik, 2023	The Basic Assumptions of Co-creation	Explanation of the underlying assumptions of co-creation in innovation settings.
Racadio et al., 2014	Research at the Margin, Participatory Design and Community Based Participatory Research	Integration of CBPR propositions into PD approaches.
Sabiescu et al., 2014	Emerging spaces in community-based participatory design: reflections from two case studies	Review of conflicting perspectives in participatory design approaches from the designer's and the community's point of view.

Sanders & Stappers, 2008	Co-creation and the new landscape of design	Describing shift in roles of the designer and the design landscape due to co-design practice.
Schuler & Namioka, 1993	Participatory Design: Propositions and Practices	Collection of seminal Participatory Design practices from the early development of the field
Sendra, 2023	The ethics of co-design	Definition of how to run co-design sessions in an ethical manner.
Simonsen & Robertsen, 2013	Routledge International Handbook of Participatory Design	Updated collection of Participatory Design state-of-the-art literature from the Scandinavian perspective.
Von Busch & Palmås, 2023	The Corruption of Co-design: Political and social conflicts in participatory design thinking	Provocation of the idealistic propositions that underlie co-design practices with a realist perspective.
Zamenopoulos & Alexiou, 2018	Co-design as collaborative research	Discussion various strands of co-design and its corresponding key dimensions.

Visual overview of seven dilemmas

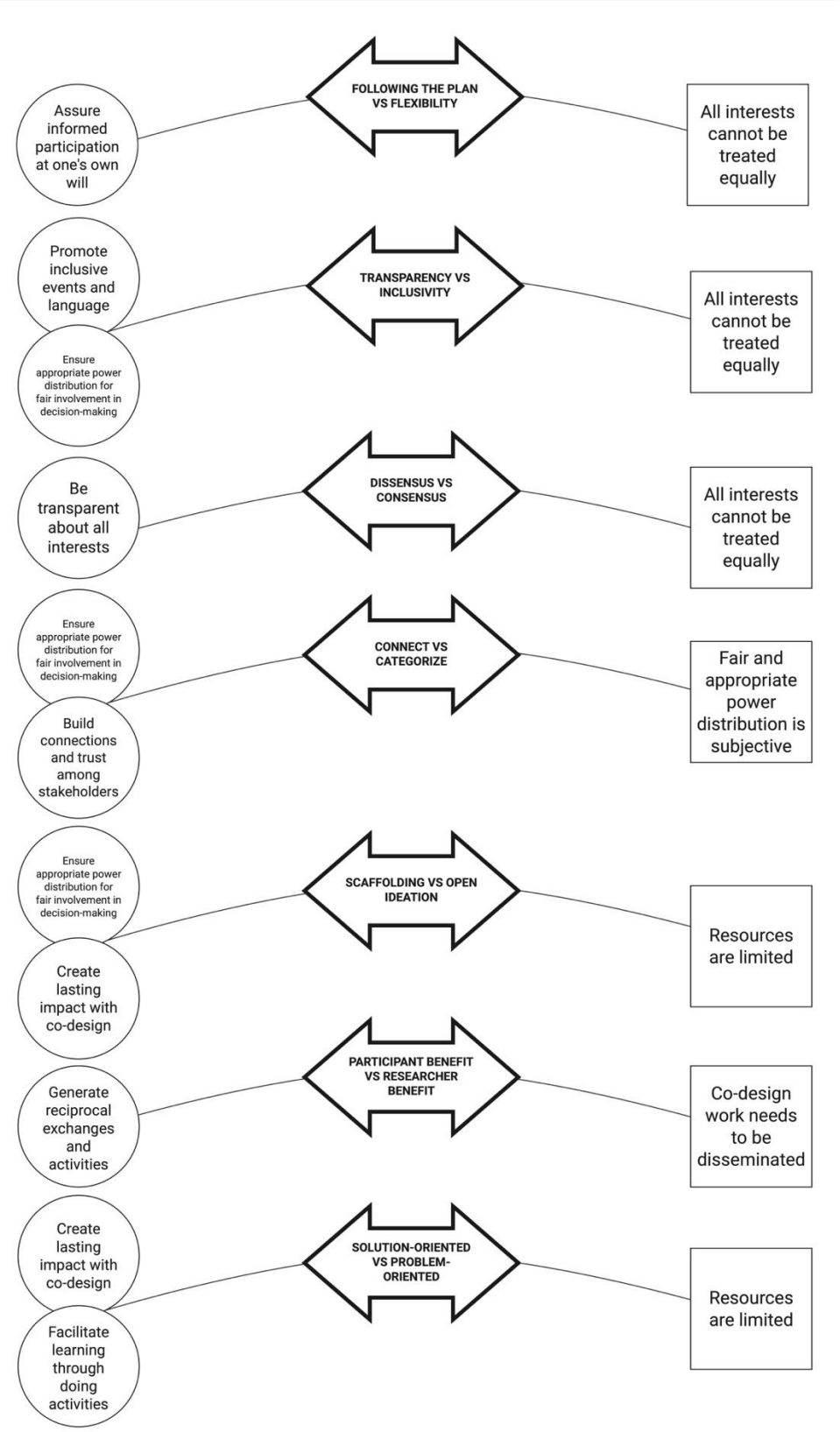

Figure 1 Overview of the seven dilemmas that were found by contrasting realist and idealist propositions. Note: different combinations of propositions are made to identify the dilemmas.