Aarhus School of Architecture // Design School Kolding // Royal Danish Academy

Foregrounding Learning in Infrastructuring

Eriksen, Mette Agger; Hillgren, Per-Anders; Seravalli, Anna

Published in:

Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1

DOI:

[10.1145/3385010.3385013](https://doi.org/10.1145/3385010.3385013)

Publication date:

2020

Document Version:

Version created as part of publication process; publisher's layout; not normally made publicly available

Document License:

Unspecified

[Link to publication](#)

Citation for published version (APA):

Eriksen, M. A., Hillgren, P-A., & Seravalli, A. (2020). Foregrounding Learning in Infrastructuring: to Change Worldviews and Practices in the Public Sector. In C. Del Gaudio, L. Parra-Agudelo, R. Clarke, J. Saad-Sulonen, A. Botero, F. César Londono, & P. Escandón (Eds.), *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1: Participation(s) Otherwise - Volume 1* (PDC '20 ed., Vol. 1, pp. 182–192). Association for Computing Machinery. Proceedings of the Participatory Design Conference Vol. Volume 1 <https://doi.org/10.1145/3385010.3385013>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Foregrounding Learning in Infrastructuring—to Change Worldviews and Practices in the Public Sector

Mette Agger Eriksen
KADK, School of Design
Copenhagen, Denmark
meri@kadk.dk

Per-Anders Hillgren
Malmö University, K3
Malmö, Sweden
per-anders.hillgren@mau.se

Anna Seravalli
Malmö University, K3
Malmö, Sweden
anna.seravalli@mau.se

ABSTRACT

Mutual learning and infrastructuring are two core concepts in Participatory Design (PD), but the relation between them has yet to be explored. In this article, we foreground learning in infrastructuring processes aimed at change in the public sector. Star and Ruhleder's (1996) framework for first, second, and third level issues is applied as a fruitful way to stage and analyze learning in such processes. The argument is developed through the insights that arose from a 4-year-long infrastructuring process about future library practices. Framed as Co-Labs this process was organized by researchers and officers from the local regional office. This led to adjusted roles for both PD researchers and civil servants working with materials at the operational and strategic levels. The case shows how learning led to profound changes in the regional public sector in the form of less bureaucratic and more participatory experimental and learning-focused worldviews and practices.

Author Keywords

Infrastructuring; learning; mutual learning; public sector; new worldviews and practices; future library practices case.

INTRODUCTION

Over the past decade, Participatory Design (PD) researchers have increasingly engaged in exploring and addressing complex societal challenges in collaboration with civil servants [22]. These engagements focus on various issues such as neighborhood development, social innovation initiatives, public service development, sustainable behavioral changes, and public innovation practices [i.e. 4, 18, 22, 22]. Moreover, rather than placing a strong focus on developing new (technical and IT) solutions (i.e., products or services), these explorations have mainly focused on how to introduce and appropriate participatory, experimental, and designerly practices [19, 23, 26]. In some engagements, infrastructuring has been applied as an approach for interweaving actors and resources [20, 24, 25, 37].

Engaging the public sector through PD highlights how organizational context and policy frames are central in

supporting or hindering the diffusion of new practices [22, 23, 37]. Huybrechts et al. [23] recognize how PD needs to move beyond the politics of practices by engaging with meta-cultural frames, institutional action frames, and policy frames. Likewise, Lenskjold et al. [28] argue for the need to combine local, situated experiences and insights with long-term collaborations involving people working at more strategic and decision-making levels in public organizations. These findings echo the concerns of public sector innovation studies that highlight the need for learning and knowledge production alongside design-oriented experimentation to support the emergence of more co-creative ways of working [i.e., 1].

A focus on learning—or what is often phrased “mutual learning”—has always been considered at the core of a PD approach [i.e. 13, 38]. Many publications and accounts of prior PDC proceedings mention mutual learning but often without further empirical or theoretical elaborations of the concept. However, a renewed interest has sprung up around this concept in PD. Bossen et al. [5] have fairly suggested a more systematic evaluation of mutual learning in PD processes, and we too support Robertson et al.'s [34] proposal to foreground mutual learning in the research design of PD processes. Furthermore, in *Participatory Design for Learning*, DiSalvo et al. [12] fairly critique that it is not enough for PD researchers to briefly reference Lave and Wenger [27]; they must also encourage a much deeper focus on understanding learning in PD and a focus on “the diverse and changing needs of learners (as opposed to sophisticated users)” [12 p. 4], or what they call a “learner-centered approach to design” [12 p. 3]. Overall, we align with these views; however, in this article, we do not relate to theories from learning sciences, as the book proposes, but rather turn to infrastructuring. It is interesting to note that Star and Ruhleder [39] stress the importance of learning for the creation and maintenance of infrastructures. However, within PD literature, the focus on learning in infrastructuring is not yet as prominent [6]. Therefore, we argue for foregrounding learning in infrastructuring processes. This is based on years of experience collaborating with civil servants, where we observed the importance of learning in changing worldviews and practices in the public sector. Finally, we ask many questions in our research, but this article aims to explore particular questions such as, *How does learning intertwine in infrastructuring processes aimed at changes in practice? How to design and stage infrastructuring processes aimed at learning for change? And How to identify changes in practice?*

(MUTUAL) LEARNING AND INFRASTRUCTURING IN PD

In this section, we outline our understandings of the PD concepts of (mutual) learning and infrastructuring.

Mutual learning in PD

‘Mutual learning’ has always been considered a core concept of the PD approach. Mutual learning as a phrase or concept is also used in other research fields [i.e. 29, 31], but here, we focus on core descriptions within PD literature.

The concept of mutual learning—or what in Swedish was initially called ‘gemensamt lärande’—developed in early Scandinavian PD projects like UTOPIA (1981–84). The intention was to capture the respectful relationship and collaborative work between the involved researchers/designers (of information systems) and workers/users (i.e. typographers) [13]. Mutual learning is mentioned in the classic PD book, *Design at Work* [17], which reflects on the UTOPIA project. When presenting the core of a participatory or cooperative design approach, and in line with Bjerknes et al. [3], the editors emphasize the idea of “mutual learning between users and designers about their respective fields” [17, p. 5]. Further, the book argues that PD entails situated design by doing, experience-based cooperative action, attention toward democratic issues and the equalization of power relations, respecting mutual competences in opposition to ‘expert rules’ and so on. [17].

In the more recent publication, *Routledge International Handbook of Participatory Design* [38], Simonsen and Robertson repeat and further recognize mutual learning as a core aspect of PD processes. They describe PD as “social interaction as users and designers learn together to create, develop, express and evaluate their ideas and visions. Shared experimentation and reflection are essential parts of the design process” [38, p. 8]. Additionally, mutual learning is in the book’s list of five guiding principles of a PD approach (along with equalizing power relations, democratic practices, situation-based actions, and tools and techniques). Here, it is described as “Mutual learning—encouraging and enhancing the understanding of different actors by finding common ground and ways of working. (...)” [38, p. 33]. In other words, “The mutual learning process typically includes ideas and visions for change as they evolve through a design project” [38, p. 6]. And lastly, they stress that “commitment to mutual learning and guidance on how to set up mutual learning processes are conditions that distinguish Participatory Design. (...)” [38, p. 6, p. 132].

In the book, *Participatory Design for Learning*, one of the fathers of the Scandinavian PD approach, Pelle Ehn [14], reflects on how different theories (some explicitly on learning) influenced his trajectory as a member of the PD community for almost fifty years. He emphasizes that, throughout all his PD engagements (e.g., the UTOPIA project), “collaborative learning has been a central theme” [14, p. 8]. Additionally, he mentions concepts and ideas that have influenced him and other PD researchers in their understanding of learning, for example, Wittgenstein’s idea of tacit knowledge and language games [13];

Winograd and Flores’ views on skills and computer artifacts as tools [44]; Suchman’s distinction between ‘plans and situated actions’ [41]; and the work on organizational learning and ‘communities-of-practice’ by Lave and Wenger [27]. Finally, Ehn emphasizes Dewey’s pragmatist arguments for learning-by-doing [10, 11], particularly Schön’s understanding of reflective (design) practice understood as situated reflection-in-action and reflection-on-action [36]. All these references have broadly informed the basic core views of learning in PD.

To summarize, in PD, the concept of mutual learning is framed as a matter of establishing a respectful relationship between designers/researchers and users, including learning about each other’s fields or domains. However, as Bossen et al. note [5], this understanding of mutual learning does not provide a sufficient framework for the analysis of the different kinds of learning in PD processes. This article contributes by advancing the understanding of learning in PD processes, with a focus on infrastructuring.

Infrastructuring and learning on multiple levels in PD (in the public sector)

As summarized by Karasti [24], the concept of *infrastructuring* has been richly elaborated in PD over the last decade. The concept builds upon Star and Ruhleder’s work on infrastructure, which focuses on the development and (lack of) implementation of large-scale technical systems [39]. They found that infrastructures are entangled and embedded in socio-material structures, where artifacts are typically taken for granted. Moreover, they found that infrastructures and practices are largely learned by being a member of a community of practice [27]. This implies that an outsider of that community encounters the infrastructure as something to learn about, and she needs to become a member of the community to fully understand the conventions and work cycles of the practice in which it is entangled [39]. Later, Karasti and Syrjäne argue for a more process-oriented, ongoing and long-term perspective on the creation of infrastructures and reframed it as infrastructuring [24, 25]. Further, the notion of infrastructuring has been proposed as a co-designerly approach that entails an open-ended and long-term process of aligning diverse actors and perspectives for the emergence of new practices. Infrastructuring is characterized by a flexible allotment of resources to respond to emerging opportunities and by distributed agency between the designer/researcher, participants, and resources [4].

As mentioned, PD efforts for infrastructuring participatory practices in the public sector revealed that issues and breakdowns in the organizational context and policy might emerge, which resonates well with the framework proposed by Star and Ruhleder [39]. With inspiration from communication theorist Gregory Bateson [2], Star and Ruhleder [39] describe three levels of communication issues that might lead to infrastructural challenges. They view these levels as intertwined and also stress how these levels of communication are essentially levels of learning.

The First Level is about facts and practical issues, and from a learning perspective, entails what has been described “as

learning something”. It encompasses concrete aspects which often can be handled by increasing resources and finding concrete solutions. First level issues emerge when work patterns and resource constraints shift, often as a consequence of changes on the second and third levels. The Second Level is about context and cultural aspects, and from a learning perspective, entails “learning about learning something.” It “broadens the context of choice” for understanding first level issues, where second level issues can emerge from the interaction between two or more first order issues, including issues such as who owns a problem, barriers for implementation and so on, which can often be solved with increased coordination and cooperation. The Third Level is about values and worldviews, and from a learning perspective, entails “learning about theories and paradigms of learning.” Issues on this level are highly political, as they raise broader questions and can consist of disputes between worldviews. Within a community, third order issues may not be immediately recognized because worldviews are often taken for granted. Solutions to these issues (if solvable) go beyond the local realm, requiring the involvement of the wider community. They may include new requirements, new criteria for evaluation, and new reward structures, among others. [39].

This framework highlights the importance of learning within infrastructuring. In the current body of PD literature on infrastructuring, learning is recognized, but not much has been elaborated [6]. Star and Ruhleder claim that “what are missing are institutional mechanisms (...) to understand and address second and third level issues, especially as they unfold over time” [39, p. 130]. We claim that such approaches and formats can be useful to address challenges related to organizational context and policies that emerge when infrastructuring toward participatory practices in the public sector [22, 23, 28, 37].

In the following case, we provide insights on how to set up processes to support learning about these three levels of issues and how a focus on learning can lead to change in worldviews and practices in the public sector.

METHODOLOGICAL STAND AND CASE INTRODUCTION

In line with the aforementioned descriptions, we apply an infrastructuring approach to our work [20, 24, 37] which, since 2014, has increasingly focused on foregrounding learning [6, 12, 27, 36, 38, 39]. It is based on core PD values, including the aims of mutual learning and equalizing power relations, while simultaneously recognizing our own stand [38] of pushing for participatory, experimental, design-oriented and self-critical approaches to foster changes across operational, strategic and policy-making levels. In line with Storni’s suggestion that design (researchers) should act as an “agnostic Prometheus” [40], we have increasingly adjusted our role from initiating and driving local experimental development processes to supporting collaborators in driving these themselves instead.

To help our partners understand how these infrastructuring and learning processes differ from practical development

processes, we framed them in a particular format—the Co-Lab [21]. This format is based on the aforementioned PD values and is inspired by classic academic study circles and Schön’s idea of reflection-on-action [36]. A co-lab process typically lasts 3–7 months and is usually composed of 5–7 half-day monthly events [7, 15] lasting between 3–6 hours. The events are initially staged by PD researchers in collaboration with members of the community in focus but are later increasingly organized by the latter. These processes can sometimes entail “homework” or experiments for the participants to do between events to share at the events. As PD researchers, we bring in different theoretical perspectives, questions, and ways of collaborating. So far, seven co-lab processes have been carried out (e.g., about urban living labs, elderly care, and the circular economy) [21]. Not all may be deemed successful in terms of learning leading to clear changes in practice—because sometimes managers with a mandate to change did not (want to) take part or give others such a mandate. In this article, we focus on a 4-year co-lab process around the future of libraries—a case where concrete changes at all levels are traceable.

In 2014, we were contacted by officers from the library team at the Culture Department of Region Skåne because, in their work with regional library development, they identified an interest in user-centered methods and approaches. At the time, the regional library team had a “strategic” practice that was mainly focused on serving library managers who managed funding procedures for development projects, and established competence development and training courses for librarians in the region.

On such premises, an infrastructuring process was initiated in the form of two related Co-Labs (Figure 1). The process involved people from the local and regional (library) communities of practice who work on both operational and strategic policy-making levels. The process supported learning among the participants and eventually led to changes in practice in terms of practical issues (Level 1), contexts and cultural aspects (Level 2) and worldviews (Level 3).

In the process, the following data was collected and used for the storytelling and analysis of the case: 1) materials from co-lab sessions (e.g., co-produced visuals and annotations on whiteboards and paper, personal notes, session agendas, images, video recordings of summarizing discussions and prior and post email correspondence); 2) written reports and web-posts by a journalist partially following Co-Lab I, including interview quotations by some of the participants; 3) sound recordings of semi-structured interviews with involved regional officers conducted by us, the involved researchers, during Co-Lab I in September 2015 and after Co-Lab II in January 2019 (see the black squares in Figure 1); and 4) various internal and external national and regional library steering documents and publicly accessible website descriptions and visuals by the library team at the Cultural Department at Region Skåne.

Figure 1. Timeline of the 4-year-long infrastructuring process on future library practices.

In our analysis, the data was interrelated, and the aforementioned three-level learning framework was used as the main analytic lens. Here emphasis was placed on the second- and third-order issues in particular. As a way to assess learning for change, the focus was on discovering new worldviews and practices through tracing changes in vocabulary in policy documents and templates as well as noting any changes in the activities and roles of civil servants (mainly the regional library officers).

CASE CONTEXT: SWEDISH FUTURE LIBRARY PRACTICES

Other PD researchers have also engaged with the long-term development of public libraries practices [i.e., 30, 43]. However, we do not focus on this specific domain in this article, but rather the case is intended to serve as an example of how the foregrounding of learning can be staged in infrastructuring processes and how such a learning process may lead to changes in the public sector.

Nevertheless, it is important to contextualize the case by providing some background about public libraries in Sweden. The national Swedish library law [42] stipulates that there should be local public libraries in all the municipalities, in all larger cities, and in many smaller towns. They are adjusted to the local conditions, but the Swedish library law sets the overall goal for libraries, namely, that they should support democratization and equal access to knowledge for all citizens. The law also states that all municipalities should provide and be responsible for the local public libraries and that all regional offices are responsible for supporting the development of and foster collaboration between local libraries. In addition, both the regions and local municipalities are obliged to develop policy documents that guide library activities and development, which often is done within the regional cultural departments [32, 33]. Finally, each library in Sweden is financed by the local municipality and led by one or more local managers. The employed staff are mostly educated as librarians, but those from other professions are increasingly being employed. In terms of space, some libraries have their own facilities, while others, for example, are merged with citizens' service desks or cultural houses.

CO-LAB I: FOCUS ON LOCAL LIBRARIES' PRACTICES

The Co-Lab I process (Jan.–Nov. 2015) was set up by two officers from the regional library team (one was the team leader) and us, three PD researchers from Malmö University. The other participants were eleven librarians from five different libraries within Region Skåne, who all had applied to take part in the process through an open call. As a part of their applications, the librarians were asked to join in pairs and specify a concern that they would like to explore during the process at their local library. Their managers also participated during Session 5 (see Figure 2).

The aim was three-fold: to introduce and get hands-on experience with some user-centered and co-designerly theories and ways of working to explore new relations between libraries and local communities/citizens; to share experiences between libraries and the regional office; and to learn together about the role of libraries and librarians in today's Swedish society.

The process included six half-day sessions touring between our different workplaces. The sessions were organized by us, the PD researchers, in a continuous dialogue with the two involved regional officers. Additionally, the process included some readings and some experimental, design-oriented "homework" for the involved librarians to do in between the sessions (see details in Figures 1 and 2).

As shown in Figure 2, a variety of design-based formats of staging for participation and dialogue were used in the sessions [i.e., 15, 17, 21, 38]. One of the shared process concepts that particularly stuck with many of the librarians was the fuzzy front-end squiggle process-model because they felt it gave them the freedom to experiment and reflect in new ways [35].

During the sessions, the two involved regional officers mostly listened and took part in the discussions that arose. However, while the co-lab process was running, they were, in parallel, highly involved in writing a new Regional Culture Plan for Skåne 2016–19(+20) [32]—a strategic steering document in which plans for library development was one area. They explained on several occasions how insights from the Co-Lab were intertwined in this work, for

example, by integrating words such as ‘experimental’ in the document. During a later interview, the head of the regional library team expressed that, by following the process, she learned to work more iteratively and be more flexible and sensitive about opportunities that emerged along the way. She also found the mutual learning across libraries and the opportunity to reflect on basic values and their role in society to be crucial.

Figure 2. Snapshots from Co-Lab I, Session 2: Making local visions concrete with doll scenarios. Session 3: Planning proposals for local user-centered experiments. Session 5: Library managers join to discuss challenges of locally integrating more iterative and co-designerly practices. Session 6: Speed-dating organized by librarians to illustrate how to integrate a co-designerly mindset in everyday practices.

During the last session, the librarians in groups of four or five staged half-hour reflective discussions about what they found to be the main issues. Two of the groups raised the concern of how to keep the creative mindset and enthusiasm alive and how to spread the idea of continual development processes among their colleagues and in their everyday working environments. This was repeated in a later interview with two of the librarians and one of the library managers, who stated that they appreciated the iterative aspects of design, but they were also worried that it could be difficult for higher management and colleagues to accept this way of working. Another group initiated a performance where one person acted as an extremely creative change maker of libraries and the other opposed him and took the stance of a defender of the continued core role of literature in libraries. The performance humorously problematized the strong innovation paradigm that is present in the library world today and highlighted the wide diversity of worldviews that had surfaced during Co-Lab I.

Levels of learning during Co-Lab I

Initially, according to a mutual learning perspective, we gained an understanding of and learned about some of the core activities and core structures as well as core documents composing much of the practices of the local librarians and the regional officers (for example, through stories of everyday experiences and local experiments, etc.). Likewise, through the ways we organized the co-lab sessions and spoke about our co-designerly perspectives,

the librarians and regional library officers increasingly gained an understanding of our co-designerly worldviews and practices. This included ways and theories of understanding situated participation and learning as well as more flexible, iterative and experimental and (self)critical processes of development. Likewise, as expressed in interviews with some of the Co-Lab I participants, valuable mutual learning also happened between the librarians from the five different libraries (and partially between the managers) as well as between the librarians and the regional officers (by simply meeting and talking to one another on a monthly basis, which otherwise was not encouraged by official structures). So, in classic PD terms, we surely learned about each other's fields.

Yet, in aiming to further articulate what kind of learning actually happened, we could observe learning about concrete practices across libraries (i.e., how they did things differently) but also about the contexts they and we as researchers were operating within. We could thus see the emergence of first and second level issues, for example, when one of the libraries suddenly was requested by management to lend out tools (hammers, screwdrivers, etc.). The participating librarians expressed frustration that the management did not understand the local cultural context, interests within their profession, their competences and limited skills in handling that kind of equipment.

Issues like this led to even more profound level three questions, such as *What is a library?* This influenced views on second level issues, as several librarians expressed frustration because libraries are nationally evaluated in relations to how many books people borrow and how many visitors they get. To cope with this practically, they worked with solutions to increase the number of visitors, for example, through late open hours with self-service systems. However, these visitors/citizens have often failed to get support from other established public institutions. As reflected during Co-Lab I, the core value of Swedish libraries is rather to meet the needs of citizens in terms of lifelong learning and empowerment. Regarding how to understand processes of change to enhance these core values, one of the librarians commented that she had learned that “everything doesn't need to be planned. It's okay to test and work step by step.” Another librarian stressed that development work can be done through much more co-designerly and open-ended approaches without specifying goals and methods in advance. The manager responsible for the regional library team expressed that the Co-Lab helped her “to reflect on how libraries produce value”. As described, learning happened on different levels, which became the basis for the coming changes in library practices.

CO-LAB II: FOCUS ON REGIONAL OFFICERS' PRACTICES

The Co-Lab II process (May 2016–Jan. 2017) was established because “we needed to develop our funding procedures and change our strategic work. It seemed natural to continue the collaboration (...) since they knew our operation” (retrospective quotation by the regional officer who took part in both Co-Labs).

Co-Lab II was kick-started at Session 1 in a meeting room at the regional office. Collaboratively, we mapped the ‘yearly wheel’ of the current core activities of the regional officers. Next, they marked with yellow sticky dots the activities they found most oriented toward future development. During this first session, the co-lab process was decided to have a focus on the “regional role in relation to development work.” This corresponds with the remark at the left of the whiteboard in Figure 3, which reads, “Strategically we should get more operational again.”

This work around ‘development projects’ included certain tasks: making the strategic thematic call for applications in relation to various regional visions, judging applications, supporting the accepted projects, checking budgets and documentations, among others. It was revealed that the judgment involved looking for specific characteristics: the quality and clarity of the content and underlying principles of equal access and distribution across the region as well as documentation plans to ensure that public tax-money was correctly used. However, according to the many local library managers, those in the regional offices found the current required procedure of documenting the projects dull, bureaucratic, difficult, and of little relevance to the local libraries. It actually kept some libraries from even applying for the funding. This prompted the regional officers to reflect on what they could do differently.

The collage consists of six photographs of book pages with handwritten notes and diagrams. The pages are from a book titled 'Biodiversität' (Biodiversity) and 'Biodiversitäts + Habitatverlust' (Biodiversity + Habitat Loss). The notes are written in German and include terms like 'Biodiversität', 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', and 'Artenvielfalt'. There are also diagrams of a tree and a flowchart.

Page 1 (Top Left): Title 'Biodiversität' and 'Biodiversitäts + Habitatverlust'. Handwritten notes: 'Biodiversität', 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Page 2 (Top Right): Title 'Artenvielfalt'. Handwritten notes: 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Page 3 (Middle Left): Title 'Artenvielfalt'. Handwritten notes: 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Page 4 (Middle Right): Title 'Artenvielfalt'. Handwritten notes: 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Page 5 (Bottom Left): Title 'Artenvielfalt'. Handwritten notes: 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Page 6 (Bottom Right): Title 'Artenvielfalt'. Handwritten notes: 'Artenvielfalt', 'Habitatverlust', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt', 'Artenvielfalt'. Diagram: A tree with 'Artenvielfalt' at the top and 'Habitatverlust' at the bottom.

Figure 4. Collaborative re-opening and questioning of the funding application call and template (Session 2, June 2016).

During Session 3, first the new regional manager briefly participated to show her support and remind the others of her vision to focus on knowledge development and share insights. Next, possible future experiments by the regional officers were mapped with red dots (i.e., the current procedures for documentation were selected to further unfold) (Figure 5).

6

Figure 5. Mapping of possible regional experiments (lower left) and detailing of current and possible future documentation and learning structures around projects (Session 3, August 2016).

and conclusions of the projects were shared and celebrated. A practical plan was also outlined for testing the film format with three of the ongoing projects given that the officers could reallocate a budget post and already had procurement deals with professional filmmakers.

The Co-Lab II process continued. We, the PD researchers, continually encouraged the officers to open up and take responsibility for making their own experiments aimed at challenging and reflecting on their current and possible future regional practices, which set the frames for library development in the region. They increasingly did; for example, one of the regional officers largely ran Session 4 (Oct. 2016) because she wanted the rest of us to engage in developing an idea she had—to redirect a chunk of money previously allocated for “media development” into new funding called “experimental track”. Partially inspired by similar ideas of a “bag of money” within the regional Culture Department, this should include smaller budgets, simpler applications, running deadlines and various formats of possible documentation. This eventually became one of three core ways of working with (the funding of) library development, as shown in Figure 6.

Towards changes in policies and practices

Co-Lab II came to an end in early 2017. Nevertheless, we kept in contact with the regional officers to follow how the new ideas and visions that emerged during Co-Lab II became integrated or implemented into new practices (see the right side of Figure 1).

During their quarterly event with library managers and others in their community (in 2017), the team of regional officers launched their new application calls and procedures as described in the new Regional Library Plan 2017–20 [33]. In parallel with Co-Lab II, the plan had been created by the regional officers who were increasingly in close dialogue with the local library managers in the region. The officers explained that the managers received it very positively. This steering policy document, among others, included a visual ‘model’ which presented a new view on how to support library development work (Figure 6).

As shown, building on the national Swedish library law [42], core aims in the model are “To promote collaboration, organizational development and quality.” The plan specifies that this should be largely realized through the three partially new practices and procedures

for the library team within Region Skåne: ‘Experiment track’, ‘Project funding for library development’ and ‘Knowledge sharing’ (see red circles in Figure 6). The ‘Experiment track’ emerged as a promising idea for libraries during Co-Lab II and was something novel for the library team at Region Skåne. The central emphasis on promoting ‘collaboration’ and ‘knowledge sharing’ was also practically a change in focus. ‘Mutual learning’ is also described and emphasized on a later page as a core part of the new regional development strategy.

Figure 6. The Regional Library Plan 2017–20. The ‘model’ (on p. 17 of the plan) shows the new regional worldview on how they would focus and work. It steers their new core practice (content translated into English by the authors).

In March 2018, one of us joined the first knowledge sharing “party”, or “Development Day” [8]. The regional organizers explicitly framed the day and further process as an opportunity for learning between libraries, and libraries and the more strategic (regional) policy levels.

Figure 7. Participants at the first “Development Day” around (future) library practices (March 2018). Copyright 2018 by Region Skåne. Photographer: Nils Bergendahl. Reprinted with permission.

The Development Day included parallel activities such as lectures by various researchers, coaching by the regional officers on different funding options, and perhaps most importantly, presentations made by librarians of outputs from the most recent development projects. Many of the day’s discussions addressed views of how libraries currently addressed different societal challenges and how it could be done in the future. The regional officers

reported that the event was highly appreciated [8, 9]. It was decided that the event would be annual, with the next events happening in March 2019 and 2020.

Levels of learning during/after Co-Lab II

In February 2019, we met for an informal follow-up interview to reflect on our collaborative process and the organizational changes that emerged afterwards at the regional office and in the broader library community. A series of comments are included in the following to show the learning and levels of reflection among the regional officers.

To refresh, Co-Lab II started with the self-critical (third level worldview) insight among the regional officers, namely, that their current, mostly strategic role had increased the gap between them and those involved at operational levels (at local libraries)—and that they “strategically, should get more operational again.” Yet, in the regional context, such an insight would not necessarily result in changes in practice, as one of the regional officers described the value of the co-lab process: “In a sense, it (the process) was more for real than if we had done it through department meetings because then you know that it will not settle. We have always questioned our bureaucratic processes, but here, we suddenly got a frame and legitimacy for doing something about it. (...) Here, we created a whole new ‘frame’ together (...). Well, okay, if we assume that it does not exist, how do we do then? (...) The frame was challenging, but (...) not so big that we, through this, we cannot change. It was just right, so we got some kind of empowerment and thought that it actually was possible to change. I think that was very valuable.”

Another officer supplemented this view: “There was both safety and freedom in the frame, and you also pushed us a bit (...) in relation to our own processes in our organization. With your mindset and since you did not know all our rules, you could ask other kind of questions—that made us think, ‘Here, we can slip through’ (...). Without getting too big, it just happened quite easy. (...) then I thought, ‘Oh, now we think like this.’”

The first officer responded, “We did not use the rhetoric we have at the department. We looked at it with new glasses, and with new words also.”

During the follow-up interview and to clearer understand what we, the researchers, had done to support a push for such change, one of us asked, “If we should get really concrete—what was it that set that frame? Do you remember what it was we did or said—very concretely?” The third officer responded, “Among one of the first things you did, you had brought our application template (Figure 4). We looked through it, *but what is it actually saying here?* That grounded it quite clearly—we had some kind of new understanding of what it is that we are asking for and how odd this actually is. When we met again after the summer, (...) it became a dialogue from point zero. Okay, we can remake it, we can do it in another way (...). Okay, we have been working like this, but we do not want to do that anymore.”

The reflections around the concrete funding application template also opened up for changes in worldviews among the regional officers. They shifted the understanding of their role from having to be bureaucrats evaluating development projects mainly through economic and goal-oriented measures to being responsible for establishing new practices, for example, by hosting events aimed at sharing experiences and knowledge, and supporting networks and mutual learning among librarians.

During Co-Lab II, first level issues also emerged in relation to concrete, factual issues. The need to document the projects and to account for the use of tax money clashed with the critique that the documenting process was dull and of little value to the local libraries. This clash prompted the emergence of a second level issue, with the focus shifting from the (taken-for-granted) written report as the only possible way of documenting to broadening the context of choices through the question, *How can other formats for documenting and sharing knowledge be developed?*

During the interview, to elaborate on Level 3 worldviews, one of us researchers further asked the question, *Have you changed your view of what it means to work strategically?* The second officer responded, “I clearly sense we have taken a step backwards, that we dare to let others do certain tasks. Previously, we kept control over all parts, both because we sensed that we were good at them (...) but maybe also because we were scared about what would happen if we let go of the control over them. (...) Maybe that is what we have done. We actually dared to let go and step back. (...) We moved forward, but in another way.”

The first officer continued, “I see, that the strategic role is continually to re-formulate the different frames. (...) I continually consider, *What is the frame for this library?* so they can play freely (...) for their own development. But I think it is needed to get assistance in setting frames, and that you can also do together. (...) Now, I spend a lot of my time on this in dialogue with the local libraries.”

This was also reflected in the framing of the event that we took part in, the Development Day, which contained several examples of Level Three learning issues that had occurred in the joint infrastructuring process. It was demonstrated both through the clear framing on learning and how libraries were discussed in ways that recognized their societal and political role.

Lastly, during the interview, the officers shared reflections and comments about their current position: “A lot has happened”; “We have reformed the funding system. (...) We have made a huge step in reforming and packaging it, and we got very good feedback on this. (...) and our status within the department has become higher”; “Our manager is defending us within the department”; “Our model has made us able to adapt to changes, for example, when a large national funding program was launched”; “Everyone wants to work with us”; and “It is clearer to the public libraries what they can do with us. They are now very happy with us, [and] it shows in the latest national evaluation.”

Finally, the officer involved in both Co-Labs summarized her experiences of the whole process: “The meetings and dialogues in our Co-Labs created a free space for us. Here, we have been able to let go of the everyday, reflect on our working practices, and test and develop new thoughts”.

DISCUSSION

The analysis of Co-Labs I and II highlight how all three communication and learning level issues are at play in infrastructuring. In the following, we further elaborate the argument for foregrounding learning—for change—in infrastructuring processes, and lastly, we summarize cores of how we practically designed and staged such a process.

Learning for change in infrastructuring processes

In several places throughout this article, we have deliberately placed (mutual) learning in parentheses. We also find this core PD concept extremely valuable, as it characterizes some of the learning at play in the case. Yet, the PD descriptions of mutual learning cannot fully describe the levels of learning which had emerged in the case. In other words, the learning in infrastructuring processes can go far beyond researchers/designers and users/stakeholders respectfully learning about each other’s fields and domains. Again, as framed by Star and Ruhleder, it is also a matter of supporting participants in learning about practical concrete issues (Level 1), learning about contextual issues (Level 2), and learning about different worldviews (Level 3) [39].

In Co-Lab I, participants learned, for example, about the different practical issues in everyday routines at the different local libraries (Level 1). They also learned that introducing and using co-designerly practices requires shifts in contexts and cultural aspects (Level 2) and worldviews (Level 3). In Co-Lab II, the regional officers learned about the limits of current project application and documentation procedures (Level 1) and how they are informed by specific bureaucratic worldviews (Level 3). They also understood the importance of fostering knowledge exchange across libraries and between libraries and the regional office and how this particular kind of learning requires specific formats and activities (Level 2). Overall, it shows how the participants engaged in learning and how their worldviews shifted through the processes. In addition, we have seen the shifts become concrete changes in practice, particularly from Co-Lab II. In this perspective, learning was the first step toward strategic organizational changes.

If we return to Star and Ruhleder’s description about how to tackle Third Level issues, they mention new requirements as well as new criteria for evaluation and reward systems. This is exactly what happened here, with the development of new formats of sharing experiences and with new requirements and evaluation systems focused on experimentation and learning between different actors. Further, Star and Ruhleder suggest that solutions include going beyond the local realm to deal with issues in the wider community. This can also be seen here, where the regional office developed a reformed library funding system with a new practice and culture which has resulted

in positive evaluations and a higher status within Region Skåne and nationally.

Quite hands-on, in terms of assessing learning for change over time, we have looked for evidence of manifesting changes in practices. Main examples are shown in Table 1:

Table 1. Overview of evidence examples of learning leading to a change in worldviews and practices in the library case.

Evidence for learning manifested through changes in practice, as seen in the following:
New policy documents The Regional Culture Plan for Skåne 2016–19(+20) and The Regional Library Plan 2017–20. Both incorporate new phrases emphasizing participation and design-oriented approaches such as “mutual learning”, “experimental”, and “knowledge sharing”.
New templates/formats Re-design of the funding application template; new documentation formats (i.e., exhibitions to showcase insights from development projects during the Development Day, etc.)
New activities New year-round possibility for easy application for the newly invented ‘Experiment track’; the new annual Development Day; new competence development courses for librarians in the region (i.e., about creating video and poetry-inspired documentation, etc.)
New roles of the regional officers Clear mandate to initiate changes and rethink what strategy work entails; organizers of the concept of Development Days; communication of strategies (i.e., in new visual forms, as seen in Figure 6); new forms of dialogue with local libraries about development ‘frames’, among others.

In Table 1, the Development Day and the design-oriented phrases in the policy documents can be seen as manifestations of how new worldviews (Level 3) have influenced what strategy work can entail. The re-designed application template and the new “Experiment track” can likewise be seen as signs of an increased understanding of addressing contextual issues (Level 2). However, we note that, in practice, we should always be aware that the different levels of learning are intertwined in complex ways.

How to design and stage for foregrounding learning in infrastructuring

Finally, we come to the *how?* of foregrounding learning in infrastructuring processes. The previous methodology section outlines our overall stand and approach with Co-Labs. In the following, we list a few more takeaways in relation to foregrounding a focus on learning for change:

- The description and event-based structure of the co-lab format emphasizes how this process is essentially reflective and about learning, and not about focusing so much on designing new detailed solutions.

- In terms of participants, in Co-Lab I, we emphasized that two people from each organization (Region Skåne and local libraries) should engage to be able to support each other. Further, we also favored the encounter between people across organizational contexts (librarians, managers and regional officers). We found it is key to involve people in decision-making positions and/or who have the possibility to drive change processes (like the regional strategic library team from Co-Lab II).
- As the case highlights and as it is commonly recognized within PD, we confirmed the importance of trust and mandate for infrastructuring processes to be able to lead to change. In terms of trust, two officers described this as collaboratively setting a “just right” “frame” of “safety and freedom”. In terms of mandate, especially in Co-Lab II, the participants sensed they had full management support, legitimacy, and empowerment, and thus, a mandate to change their own practices.
- To challenge participants’ taken-for-granted worldviews of process design, we read and talked about PD theories and methods.
- Inspired by our PD ethnographic roots, the process focused on details and stories from the participants’ local everyday practices and eventually their own experiments. Yet, when we met, the emphasis was on collaboratively relating and reflecting on them in relation to all three levels of learning (practical issues, contexts and cultural aspects and worldviews).
- We also focused on exposing some of the worldviews behind their current everyday practices by challenging their taken-for-granted, hands-on working materials and associated bureaucratic procedures. The focus was on practical issues such as the actual formatting of documents and the wording they contained (i.e., the application template).
- As researchers, we continually asked a variety of provoking questions aimed at gently pushing the participants to see their current practices in a ‘strangely familiar’ perspective [18], for example, “What do you actually consider (library) development to be?” (Level 3) and “What is your role in the gap between the strategic and operational levels?” (Level 2).
- When practically staging the co-lab events, initially, we, the PD researchers, mainly initiated the activities. Yet, in line with previous findings about infrastructuring [i.e., 20, 24, 37], we increasingly encouraged the participants to take the lead, both in terms of deciding on the focus and formats of collaboration [15], so it aligned with the challenges and openings for change evident in their everyday work practices.
- Lastly, more than a year after the co-lab events ended, we took part in some of their activities and organized a follow-up semi-structured interview/dialogue to collaboratively articulate traceable changes in their worldviews and practices.

In summary, to foreground learning, infrastructuring processes should be staged to collectively open and

articulate issues and action on all three levels—facts and practical issues, contexts and cultural aspects, and values and worldviews—and learn about how they are interconnected. In particular, attention should be on the key role of worldviews (Level 3) in processes of learning for change in practice.

Finally, when taking a stand and pushing for changing worldviews and practices (in the public sector), it is also crucial, as PD researchers, to engage in a process of deep self-reflection—a process where we challenge our own worldviews and taken-for-granted assumptions (i.e., understandings of mutual learning) and allow multiple worldviews to become articulated side by side.

CONCLUSIONS

With a review of current understandings of mutual learning and infrastructuring in PD as our starting point, we propose to foreground learning in PD infrastructuring processes. Also, to advance understandings, we use and suggest Star and Ruhleder’s (1996) framework of three levels of communication and learning issues in infrastructure development. This helps reveal and elaborate learning in infrastructuring processes aimed at fostering change in worldviews and practices (in the public sector). In short, we claim that foregrounding learning in infrastructuring process is needed to change worldviews and practices. These claims are based on findings from an infrastructuring process about future library practices that involve people and working materials intertwining in operational, strategic and policy-making work in the (regional) public sector in Sweden. A focus on learning allows one to articulate the relationship between practical issues, context and cultural aspects, and worldviews and to favour strategic change toward more participatory, co-designerly, experimental and learning-centred worldviews and practices.

ACKNOWLEDGMENTS

We greatly thank Annelie Krell, Ann Lundborg, Annelien Van Der Tang-Eliasson, Karin Ohrt, Kristina Elding and other involved regional officers, local librarians and managers for our fruitful collaborations. Likewise, for funding and enabling the process, we thank Region Skåne, the European JPI Urban Europe project *URB@Exp* (2014–17) <https://jpi-urbaneurope.eu/project/urbexp/> and Forum Social Innovation Sweden and the European Regional Development Fund project *Social Innovation Skåne* (2015–18), www.socialinnovationskane.se

REFERENCES

- [1] Bason, C. 2010. *Leading Public Sector Innovation: Co-creating for a Better Society*. Bristol: Policy Press.
- [2] Bateson, G., 1978. *Steps Towards an Ecology of Mind*. New York: Ballantine Books.
- [3] Bjerknes, G., Ehn, P and Kyng, M. 1987. *Computers and Democracy*. Aldershot: Gower Publishing Company Limited.

- [4] Björgvinsson, E., Ehn, P. and Hillgren, P-A. 2012. Agonistic participatory design: working with marginalised social movements. *CoDesign*, 8(2-3), 127-144.
- [5] Bossen, C., Dindler, C. and Iversen, O.S. 2016. Evaluation in participatory design: a literature survey. In *Proceedings of the 14th Participatory Design Conference*, Volume 1, 151-160. ACM.
- [6] Botero, A., Karasti, H., Saad-Sulonen, J., Geirbo, H. C., Baker, K. S., Parmiggiani, E., Marttila, S. 2019. Drawing together, Infrastructuring and politics for participatory design. Workshop eZine at the *Participatory Design Conference* August 20-24, 2018, Belgium. University of Oulu, Finland. ISSN 2490-130X. Available at: <http://hdl.handle.net/2142/103012>.
- [7] Brandt, E. 2001. *Event-driven product development: collaboration and learning*. Doctoral dissertation, Technical University of Denmark, Lyngby, Denmark.
- [8] Development Day 2018. Retrieved 10 March 2020 from: <https://socialinnovation.se/folkbibliotek-viktig-arena-for-samhallsutmaningar/> (Region Skåne link to 2018 event no longer accessible)
- [9] Development Day 2020 / Den stora Utvecklingsdagen. Retrieved 12 March 2020 from Region Skåne: <https://utveckling.skane.se/om-regional-utveckling/kalender/kultur/2020/stora-utvecklingsdagen-2020---inspiration-for-skanska-bibliotek/?highlight=utvecklingsdag>
- [10] Dewey J. 1927. *The Public and Its Problems*. New York: Henry Holt.
- [11] Dewey J. 1934. *Art as Experience*. New York: Berkley Publishing Group.
- [12] DiSalvo, B., J. Yip, E. Bonsignore, and C. DiSalvo, C. (eds.) 2017. *Participatory Design for Learning: Perspectives from Research and Practice*. Routledge.
- [13] Ehn, P. 1988. *Work-oriented design of computer artifacts*. Doctoral dissertation. Arbetslivscentrum.
- [14] Ehn, P. 2017. Learning in Participatory Design as I found it (1970-2015). In DiSalvo, B., J. Yip, E. Bonsignore, and C. DiSalvo, (eds.) 2017. *Participatory Design for Learning: Perspectives from Research and Practice*. Routledge. 7-21.
- [15] Eriksen, M. Agger, 2012. *Material Matters in Co-designing – Formatting & Staging with Participating Materials in Co-design Projects, Events & Situations*. PhD dissertation. Malmö University, Sweden.
- [16] Experiment track / Bidrag till biblioteksutveckling – experimentspåret. Retrieved 28. June 2019 from: <https://utveckling.skane.se/utvecklingsomraden/kulturutveckling/kulturbidrag/bidrag-till-biblioteksutveckling---experimentsparet/>
- [17] Greenbaum, J.M. and Kyng, M., 1991. *Design at work: Cooperative design of computer systems*. L. Erlbaum Associates Inc.
- [18] Halse, J.; Brandt, E.; Clark, B. and Binder, T. 2010. *Rehearsing the Future*. The Danish Design Scholl Press.
- [19] Hillgren, P-A., Seravalli, A. and Eriksen, M. Agger, 2016. Counter-hegemonic practices; dynamic interplay between agonism, commoning and strategic design. *Strategic Design Research Journal*, 9(2), p. 89-99.
- [20] Hillgren, P-A., Seravalli, A. and Emilson, A., 2011. Prototyping and Infrastructuring in Design for Social Innovation, *CoDesign* 7(3-4), p. 169-183.
- [21] Hillgren, P-A., Augustinsson, E., Seravalli, A. and Stenqvist, B. 2017. *En Skrift om Co-labs*. Publisher: Social Innovation Skåne, Sweden. Retrieved 21 February 2020 from: <https://socialinnovation.se/publications/skrift-om-co-labs/>
- [22] Huybrechts, L., Benesch, H. and Geib, J. (eds). 2017. Co-Design and the public realm. *CoDesign, Special Issue*, 13(3).
- [23] Huybrechts, L., Benesch, H., & Geib, J. 2017. Institutioning: Participatory Design, Co-Design and the public realm. *CoDesign*, 13(3), 148-159.
- [24] Karasti, H. 2014. Infrastructuring in participatory design. In *Proceedings of the 13th Participatory Design Conference: Research Papers-Volume 1*, 141-150. ACM.
- [25] Karasti, H. and Syrjänen, A-L. 2004. Artful infrastructuring in two cases of community PD. In *Proceedings of the eighth conference on Participatory Design*, Toronto, July 2004, 20-30. ACM.
- [26] Kimbell, L., & Bailey, J. 2017. Prototyping and the new spirit of policy-making. *CoDesign*, 13(3), 214-226.
- [27] Lave, J. and Wenger, E. 1991. *Situated learning: Legitimate peripheral participation*. Cambridge university press.
- [28] Lenskjold, T. U., Olander, S. and Halse, J. 2015. Minor Design Activism: Prompting Change from within. *Design Issues* 31 (4), 67–78.
- [29] Lippitz J, M., C Wolcott, R. and Bang Andersen, J. 2013. *Innovation Communities: Trust, mutual learning and action*. Nordic Council of Ministers.
- [30] Olander, S. 2014. *The Design Lab: A Proposal for design-anthropological experimental set-ups in cultural work and social research*. Industrial PhD Dissertation. KADK, Denmark.
- [31] Polk, M. and Knutsson, P., 2008. Participation, value rationality and mutual learning in transdisciplinary knowledge production for sustainable development. *Environmental education research*, 14(6), 643-653.
- [32] Regional Culture Plan for Skåne 2016-19 (extended in 2019 to also cover 2020). Retrieved 1 July 2019 from: https://utveckling.skane.se/siteassets/publikationer_dokument/regional_kulturplan_2016-2020.pdf
- [33] Regional Library Plan 2017-20. Retrieved 1 July 2019 from: https://utveckling.skane.se/siteassets/publikationer_dokument/regional_biblioteksplan_2017-2020.pdf
- [34] Robertson, T., Leong, T.W., Durick, J. and Koreshoff, T. 2014. Mutual learning as a resource for research design. In *Proceedings of the 13th*

Participatory Design Conference, Volume 2, 25-28. ACM.

- [35] Sanders, E.B.N. and Stappers, P.J. 2012. *Convivial toolbox: Generative research for the front end of design*. Amsterdam: BIS.
- [36] Schön, D. 1983. *The reflective practitioner*. New York: Basic Books.
- [37] Seravalli, A., Eriksen, M.A. and Hillgren, P-A., 2017. Co-design in co-production processes: Jointly Articulating and Appropriating Infrastructuring and Commoning with Civil Servants. *CoDesign*, 13:3, p. 187-201.
- [38] Simonsen, J. and Robertson, T. (eds.), 2013. *Routledge International Handbook of Participatory Design*. Routledge.
- [39] Star, S.L. and Ruhleder, K., 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research*, 7(1), 111-134.
- [40] Storni, C, 2015. Notes on ANT for designers: ontological, methodological and epistemological turn in collaborative design. *CoDesign*, Special issue, Vol. 11, Nos. 3-4, p. 166-178.
- [41] Suchman, L.A. 1987. *Plans and situated actions: The problem of human-machine communication*. Cambridge university press.
- [42] Swedish Library Law: Retrieved 13 March 2020 from:
<https://svenskförfattningssamling.se/sites/default/files/sfs/2019-11/SFS2019-961.pdf>
- [43] Thorpe, A.; Prendiville, A.; Rhodes, S. and Salinas, L. 2016. Public Collaboration Lab. In *Proceedings of the 14th Participatory Design Conference*. Volume 2. ACM.
- [44] Winograd, T. and Flores, F. 1986. *Understanding Computers and Cognition: A New Foundation for Design*. Norwood:Ablex.