

A framework for infrastructuring commons creation

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In this paper, we present a framework that combines design principles and approaches from the co-design and commons fields to support a community to create commons. Commons are both a shared resource and the governance strategies used by a collective of people to manage that shared resource. The commons literature offers robust frameworks for analysing an existing commons but lacks approaches to support communities to create commons. To address this gap, we turn to co-design to develop approaches that support communities in commons creation. We draw on co-design's use of frames, tools, and infrastructuring to develop a 'commons creation framework'. Infrastructuring approaches seek to design structures that outlast designer involvement for use and adaptation by communities. The proposed framework is a design support to guide communities in their ongoing exploration of the critical components of a functional commons. The commons creation framework is composed of a commons creation matrix that assists people in selecting tools to address critical factors of a functional commons and a tool improvement matrix that assists people to tailor selected tools for localised use. To test this framework, we applied it to a previous co-design project in which a community co-designed tools to transition public libraries into community-based neighbourhood centres. This application provided insights into how the framework guided the categorisation of tools and framed the improvement of tools explicitly for commons creation. Future research involves sharing the framework with communities to gather insights on its evolution.

Keywords: infrastructuring co-design; commoning infrastructure; creative engagement; tool appropriation

1 Introduction

In this paper, we present a framework that combines the design principles and approaches from the co-design and commons research fields to support people to create commons. Commons are both a shared resource and the governance strategies used by a collective of people to manage that shared resource. The governance strategies or social practices are increasingly called commoning. Fisheries and woodlands are two natural resource commons that have long been managed as commons. Linux

and Wikipedia are more visible and well-known examples of knowledge commons. The design principles for managing a commons, first published by Ostrom (1990, p. 90), complement co-design principles. Similar to a co-design project, people affected by the governance of a commons should participate in decision-making about it. Additionally, those affected by rules governing a commons should be able to participate in modifying and enforcing these rules. In other words, a commons is a product of constant co-design by commons members. Applying this commons lens to co-design could address contemporary co-design challenges that involve sustaining co-designed resources after the research team leave the project (Iversen and Dindler 2014; Smith & Iversen 2018).

The commons literature offers robust analytical frameworks to understand the infrastructure of an existing commons. Similar to co-design, commons infrastructure refers not only to physical and digital objects but also institutional structures or 'institutioning' (Huybrechts, Benesch & Geib 2017; Cibi, Teli & Robinson 2019) that people use to govern, 'how a commons can be utilised, the extent to which waste can be reduced in resource use, and the degree to which the physical conditions of a resource and the behaviour of users can be effectively monitored' (Hess & Ostrom 2007, p. 68). These analytical frameworks are, however, largely inaccessible to communities seeking to create commons or commoning infrastructure.

In making this generative turn, we draw on the co-design literature for approaches to support commons creation. Co-design researchers are experts in framing a situation and creating design structures that frame the way people engage with problems, enabling people to co-design desired outcomes to a specific situation. Co-design researchers are interested in creating design structures (e.g. tools, spaces, platforms) to support infrastructuring approaches (Bjögvinsson et al. 2012) that support different social practices, like commoning. In co-design events, a community of people work together to make sense of their current situations and co-create ideas using familiar elements that enable them to be creative in their own social practice (Galabo 2020). In the case of commons creation, co-design might focus on creating design structures that support creation of the physical, digital, and institutional infrastructures of a commons.

We consider how co-design's attention to infrastructuring can address the gap in the commons literature. For this paper, infrastructuring means aligning creative engagement tools with commoning practices, enabling communities to further appropriate these tools to create a functional commons. We draw on Illich's claim (1973, p.34) that 'people need new tools to work with rather than tools that work for them'. To enable communities to have control over the way they deploy tools, there is a need for selecting and tailoring tools to accommodate the skills of people involved in commoning practices.

We combine design principles and approaches from the co-design and commons literature to develop a framework that addresses the research question: How can co-design support communities to create commons? We present our proposed framework in four steps. First, we outline the primary framework and language used to analyse an existing commons. Second, we present our understanding of co-design and how it can support the creation of commons. Third, we propose a combined framework to address the gaps in the commons and co-design fields to support communities to engage in an infrastructuring approach. Fourth, we apply the combined framework to a community library project to test how this framework could be populated by engagement tools to support commons creation. Finally, we discuss how the framework could support the agendas in

both commons and co-design research and praxis to foster new social forms, knowledge, and collaborative community processes.

2 Key theoretical concepts about commons and commoning

Commons are both a shared resource and the governance strategies used by a collective of people to manage that shared resource. Commons have always been a part of human civilization, but formal commons scholarship in the Global North originated in the 1970s with the study of natural resource systems like irrigation and pastures. Wikipedia and Linux are perhaps better known to people as examples of digital/knowledge commons (Benkler 2006). More recently, open source digital fabrication has made visible peer-to-peer production for products like farm tools and prosthetics (Bauwens, Kostakis, and Pazaitis 2019). While early scholarship focused on commons as a resource, modern scholarship and definitions recognise that the social practice of ‘commoning’ is an indivisible feature of commons (Linebaugh 2008, Bauwens 2017, De Angelis 2017, Bollier & Helfrich 2019).

2.1 Institutional Analysis for Development (IAD) framework

The IAD framework is one of most robust and respected frameworks in commons scholarship for understanding commons infrastructure. The IAD framework was first published by Ostrom (1990). Since the initial publication of the IAD framework, scholars, including Ostrom, have adapted the IAD framework and created additional frameworks (see Cole, Epstein & McGinnis 2019 for coverage of the principle frameworks over time). This paper uses the revised IAD framework (Figure 1) by Ostrom (2010, p. 646) as it is both clear and respected. As the name implies, the IAD framework provides a framework for analysing the development of ‘institutions’ that communities use to govern and sustain a commons. In economics, ‘institutions’ are not physical buildings but rather ‘the prescriptions that humans use to organise all forms of repetitive and structured interactions’ (Anderies & Janssen 2013, p. 28), which can range from social norms to artefacts. In this respect, institutions are similar to co-design’s interest in design Things and infrastructuring for social practices, such as the social practice of commoning.

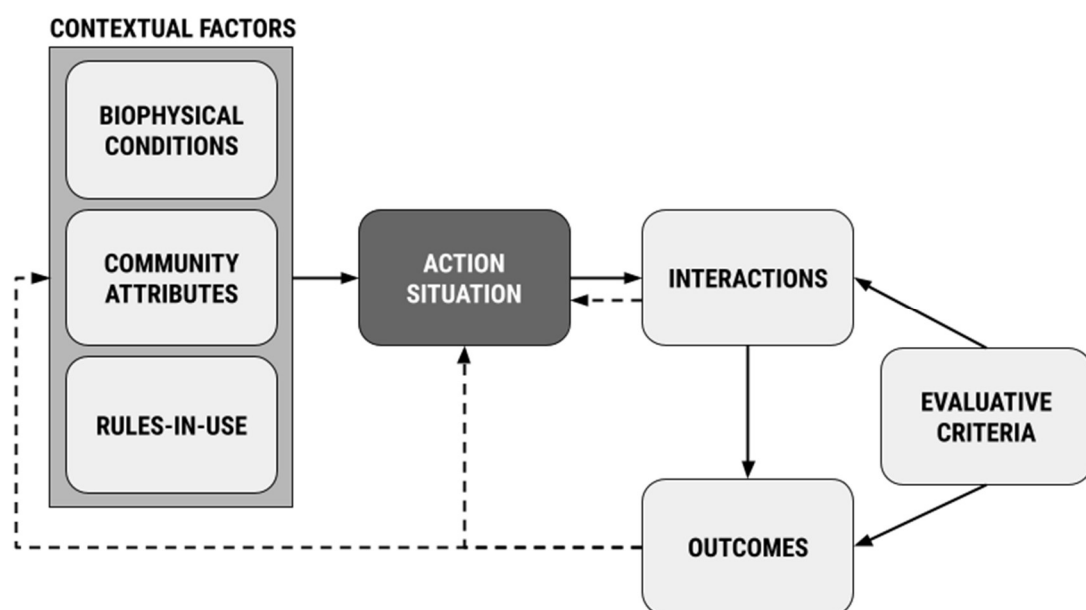


Figure 1. IAD framework. Source: Ostrom (2010, p. 646), adapted from Ostrom, Gardner, & Walker (1994, p. 37).

We can divide the IAD framework into three sections: contextual factors, action situations, and interactions and outcomes. The three contextual factors on the left side are the foundation for a commons: resources (Biophysical Conditions) people (Community Attributes), and formal and informal rules (Rules-in-Use). The Action Situation in the middle of the framework can be thought of as a co-design scenario where ‘two or more individuals are faced with a set of potential actions that jointly produce outcomes’ (Anderies & Janssen 2013, p. 43). The actors in a commons likely face multiple action situations that they must resolve to sustain the commons. The three boxes on the right side depict Interactions and Outcomes resulting from the Action Situation. The dotted lines leading from Outcomes back to the Contextual Factors and to the Action Situation illustrate the iterative nature of the IAD framework. People learn from the outcomes of their interactions in an action situation, which may alter their behaviour in the future and/or lead to changes to the contextual factors. For example, if you lose a library book, how will your interactions with the library (from fee waived to temporarily losing library privileges) affect your future behaviour?

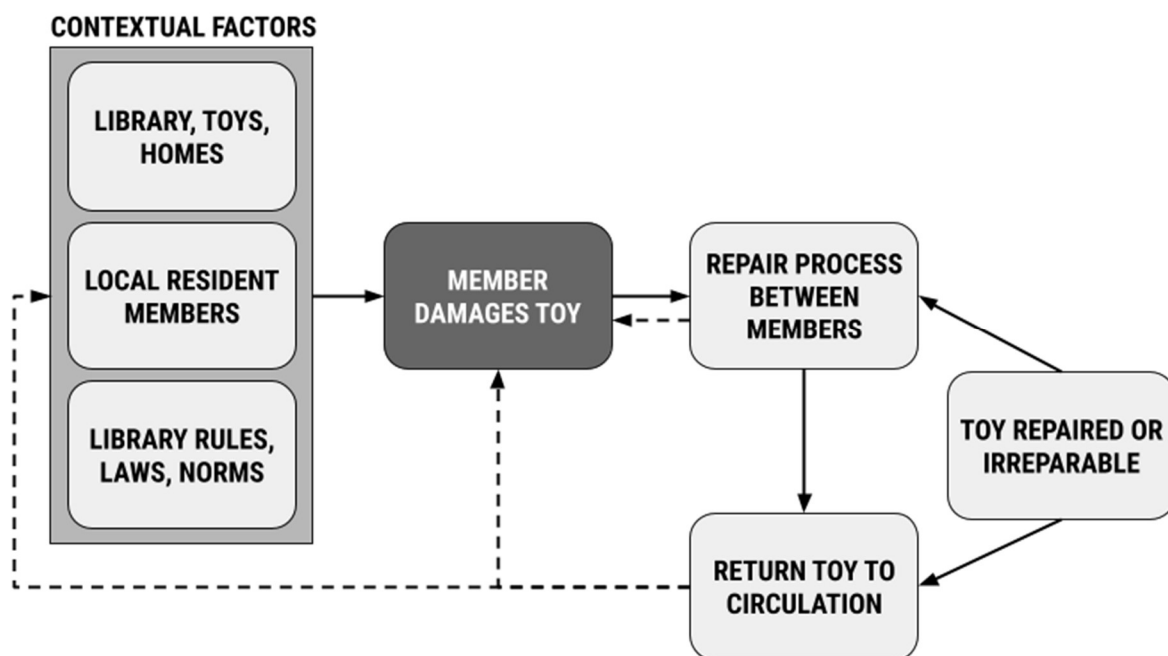


Figure 2. IAD framework showing the action situation of ‘member damages toy’ for a toy library commons

In Figure 2, we populate the IAD framework using the example of a community-run toy library. In this example, the action situation considers what happens when a member damages a toy. The contextual factors in this toy library commons are:

- Biophysical conditions: Library building, toys, members’ homes
- Community attributes: Toy library members
- Rules-in-use: Toy library regulations, local laws, and social norms

Imagine you are part of a community creating this toy library. What rules would you put in place to address toy damage? This is a real question that most toy library commons face. You might look at what other toy libraries do, but you will still need to explore these rules within your community and likely adapt them to your context. The IAD framework offers guidance on how to start thinking about what contextual factors your community needs for its toy library commons. However, how does a community make use of the IAD framework to create or improve the contextual factors for their

commons? This gap, moving from analytical to generative, is the gap we propose could be addressed through engagement tools.

2.2 Choice levels

The rules guiding the action in the action situation take place at three levels of 'choice' (Ostrom 1990, p. 53). We use the term 'choice levels' in this paper, though 'arenas of choice' (McGinnis 2011, p. 52) is an alternative term. Choice levels describes how different groups of people are involved in different types of decision-making. If you think about an association or community group, maybe one you are part of, you may participate in rule-making for a specific committee as well as vote on group-wide issues. The three choice levels are:

- Constitutional choice rules determine who can participate in managing a commons,
 - Collective choice rules determine how decisions are made, and
 - Operational choice rules address everyday management.

These three choice levels are shown as cascading because constitutional choices affect who can participate in making collective-choice rules, and collective-choice rules affect who can modify operational-choice rules. Operational-choice rules tend to change more easily and more often, while changing constitutional-choice rules is more difficult and less frequent.

A brief scenario using Figure 2 illustrates how these choice levels interact in both directions. In Figure 2, the action situation is that a member damages a toy. In this example, the toy library community had previously determined that members must live within the county to be members, a common library policy. The current operational choice rules are that a member contacts a member with repair skills to repair the toy. A year into operations, the community notices repeated complaints that members with damaged toys cannot find members with repair skills. This is a problem occurring at the operational level that must now be addressed at the collective choice level. How should the rules change to address this problem? There are a variety of solutions, but one solution might be that the community decides to expand membership beyond the county to people with repair skills. This change to who can be a member (who constitutes the commons) is a constitutional choice change.

The question we seek to address in this paper is how can co-design help transform this choice level structure into infrastructure that supports a community to create a commons?

2.3 Design principles for managing a commons

The third concept this paper presents is design principles for managing a commons. There are eight 'design principles' that scholars consistently find present within a functional commons. These eight design principles were first articulated by Ostrom (1990 p. 90) and have remained intact after decades of interrogation by scholars. Scholars and practitioners continue to change the wording of the principles for different audiences, but the principles remain the same. Table 1 presents the eight design principles using language from multiple posts on the popular website *Medium* to reflect how these principles are explained to mass audiences.

Table 1. Design principles for managing a commons

1. Define clear group boundaries.
2. Rules need to fit local circumstances.
3. Those affected by the rules can participate in modifying the rules.
4. Rule-making rights of community members are respected by outside authorities.
5. Rules are enforced by effective and accountable monitoring.
6. Use graduated sanctions for rule violators.
7. Provide accessible, low-cost means for dispute resolution.
8. Commons may be part of nested ecosystems within larger commons.

Sources: Ostrom (1990, p. 90), Emmet (2019), Landua (2019), Schadeck (2019).

The design principles point to specific issues that a functional commons should address, mostly how members resolve conflicts. Since the design principles deal with rule-making, they are most easily identified within the Rules-in-Use in the IAD framework. In the toy library example, the members will need to develop rules that address what members do when they irreparably damage or lose a toy, for example.

Ostrom named these ‘design’ principles even though the role of design and designers is absent from most commons literature. In recent years, design researchers have begun to explore how these design principles intersect with co-design and participatory design (Baibarac, Petrescu & Langley 2021; Marttila, Botero & Saad-Sulonen 2014).

The design principles have proven more accessible than the IAD framework to scholars and practitioners outside of the commons field. We believe this is likely in part because the design principles are easier to grasp, and in part because they more readily speak to subjects outside of the commons field. For example, among the *Medium* posts used to produce the design principles in Table 1, one post is about cryptocurrency and another post is about blockchain-based decentralized autonomous organizations (DAOs).

The design principles provide a checklist of sorts for what a functional commons must contain, but a community must still figure out how to build the commons. In the next section, we turn to co-design to see how to address this gap.

3 Understanding co-design, design ‘things’ and infrastructuring

Co-design has developed in parallel to participatory design (Cruickshank 2014), but both practices have started to share the challenge of designing ‘things’ for specific projects (Bjögvinsson et al. 2012) that project participants can adapt and use well beyond the period of involvement by researchers (Iversen & Dindler 2014; Smith and Iversen 2018). Design ‘things’ (hereafter referred to as Things) include not only digital and physical elements but also intangible outputs, such as tools, platforms, spaces, processes, and strategies. Here, we focus on tools (e.g. pro formas, templates) as design Things used for creative engagement.

Similar to participatory design, co-design uses creative engagement approaches to involve participants in the design process. In participatory design, designers draw participants into designerly processes (e.g. customer journey map, mood boards) and control the analysis and synthesis of outcomes. Co-design processes are more flexible, where facilitators encourage

participants to carry out complete cycles of research, synthesis, implementation and evaluation through a process that is familiar to participants. In short, participants implement conventional design process autonomously or alongside designers using familiar elements of participants' social practices. In both design practices, expert designers frame the problems, often supported by design Things, to enable participants to explore and co-create desired outcomes for specific situations. Some of these design Things are later appropriated and used in unexpected ways by participants after researchers leave the project.

There has been a broader shift in participatory design and co-design research from designing Things for a specific project or project phase (e.g. idea generation, design, evaluation) to designing Things for envisioned use and also ongoing design in use (e.g. adaptation, improvement, re-design). This approach, known as infrastructuring, involves designing Things to support social practices (e.g. commoning, youth engagement), as well as to enable further appropriation towards new projects and applications (Bjögvinsson et al. 2012). In addition to creating these infrastructuring approaches, design researchers are interested in sustaining design outputs and generating long-lasting positive impacts in communities involved in designing these outputs. Bringing the commons perspective to co-design could better enable communities to gain control over design Things and create a functional commons to manage co-design outputs. In the following sub-sections, we review tools and frames as design Things for creative engagement (3.1) and a framework that supports infrastructuring approaches (3.2) to understand how co-design can support commons creation.

3.1 Framing, frames, and tools

Within design, the notion of frames and the act of framing and re-framing a problem is recognised as a core skill of expert designers (Schön 1983; Lawson 2005; Lawson & Dorst 2009; Paton & Dorst 2011). Expert designers understand that how problems are defined affects how solutions are devised and represented (Paton & Dorst 2011). Reframing a problem is a way for designers to overcome barriers in the design process by altering the perspective from which a design problem is explored. Once a frame is proposed, designers develop a design Thing that embodies a perspective that allows people to devise a desired solution (Dorst 2011). For this paper, engagement tools are design Things that support social practices enhancing creative skills people use to conduct a task. In the context of co-design, deploying tools for creative engagement involves framing a collaborative situation to facilitate a desired outcome.

In co-design, there are many different ways to conduct a creative engagement task. Some of them are formalised non-designerly techniques (e.g. voting, ranking) while others are developed through reflection in and on practice (Forester 1999) to draw participants into design processes. Tools can be used to structure an engagement process, supporting a variety of techniques and enabling people to creatively deploy tools as part of a larger set of methods in various social practices (Brandt et al. 2012), such as deploying tools to engage in commons creation. There are a variety of tools that can be used to support this practice. Here, tools are not seen as off-the-shelf methods, but rather as structures that need to be tailored to particular engagement situations.

Bringing the concept of frames to the practice of commoning, a commons expert (practitioner or scholar) understands the requirements for a functional commons but often does not have experience in engaging people creatively in producing a commons. To address this need, we propose a framework that primarily supports commons experts to improve tools that frame commons requirements in a commons creation process. A secondary audience could include lead-users who

understand the requirements for functional commons in a specific context. In the innovation literature, lead-users have an embedded experience of a particular situation and are strongly motivated to modify their situation to directly benefit themselves (von Hippel 2005). Although the lead-user concept is applied to product innovation, it could also be applied to community leaders with similar characteristics motivated to modify the community’s situation.

3.2 Improving creative engagement tools for commons creation

Galabo and Cruickshank (2021) previously developed a co-design infrastructuring framework to enable people to improve existing tools used for creative engagement (e.g. patient engagement in healthcare) as well as further applications in another context of activity (e.g. public consultation). They proposed an approach that prompts practitioners to appropriate existing tools by improving the instructions and functionality of tools to fit their local practices and also implementing flexibility to the tools to enable future uses. To form an improvement matrix, the three dimensions of tools (Instruction, Functionality, Flexibility) were placed against three layers of practice in co-design that involve people Planning activities before engagement events, Facilitating human-human interactions, and Doing activities to exchange ideas and experience to achieve a desired outcome. The developed framework presents a matrix of nine components (Table 2) that can support people to explore and propose improvements to engagement tools to develop their social practice.

Table 2. Improvement matrix

Layers \ Dimensions	INSTRUCTION	FUNCTIONALITY	FLEXIBILITY
Planning	Challenge / Briefing	Interaction models	(Build) Resilience
Facilitating	Facilitator notes	Resources produced for facilitators	(Encourage) Facilitator response
Doing	Example or use notes	Design of material	(Enable) Contrary activity

Source: Adapted from Galabo & Cruickshank (2021, p. 9)

This matrix was tested with design experts and health and social care practitioners, enabling them to learn how to improve tools and further adapt tools beyond original uses. Galabo and Cruickshank (2021) offered an approach that enables practitioners to co-design improvements directly on tools, where they critique, suggest improvements using basic materials (e.g. sticky notes, sharpies), and evaluate how their proposals affect their social practice. To extend the improvement matrix and address the challenge of sustaining and extending co-design impacts, we turn to the commons field to build a framework to support the creation of commons that enable communities to manage resources produced in co-design projects. We also provide examples of how each component of the improvement matrix supports the development of improved versions of tools for commons creation in Section 5.

4 A framework for infrastructuring commons creation

The key commons concepts explained in section 2 are primarily used to analyse existing commons. How can communities make use of these frameworks to support the creation of commons? To meet

this gap, we draw on commons and co-design frameworks to support communities to infrastructure commons creation, like the toy library, by improving tools used for creative engagement. We propose a framework that uses two matrices to support infrastructuring approaches for commons creation: a commoning matrix (Table 3) and an improvement matrix (Table 2). These matrices work as guides that assist people to select design Things (engagement tools) and appropriate them to support community co-design of commoning infrastructure.

To create the commoning matrix, we placed the contextual factors of the IAD framework on one axis because a functional commons relies on these contextual factors. The other axis contains the three choice levels, which represent nested levels of decision-making. To frame this matrix, there is the action situation. In this example, the action situation is ‘Repair damaged toy’. This frame will generate its own set of questions and tools for exploring how to solve this action situation. A functional commons is composed of many action situations (or scenarios), and the community would need to explore each action situation using this process to construct a commons. For example, the community would likely want to explore action situations addressing what happens when a member loses a toy or a member donates a toy to the commons. The community might go on to create a commons by exploring the action situations members find are most critical or likely to occur.

Table 3. Commoning matrix for a toy library commons

Action Situation: Repair damaged toy			
Factors \ Choice	Rules-in-use	Biophysical conditions	Community attributes
Constitutional	Who should be involved in making this policy?	Should we buy toys that are harder to damage?	Do we have members with repair skills?
Collective	What toy repair policies will we put in place?	How will we acquire repair materials?	How can we help members repair toys?
Operational	How will we enforce our toy repair policies?	How do members use repair materials?	How do members get repair materials from the library?

We combine the commoning matrix and the improvement matrix to propose a framework that supports a community to co-design commoning infrastructure. In this approach, a commons expert or community lead-user would use the commoning matrix to guide the selection of tools that could be appropriated and used by the community. In this manner, the commoning matrix acts as a frame for tool selection as well as a tool box for organising tools for commons creation, replacing the traditional role of design experts. For each engagement tool identified, the commons expert would use the improvement matrix to make the tool appropriate to an action situation (Figure 3).

An infrastructuring approach for commons creation

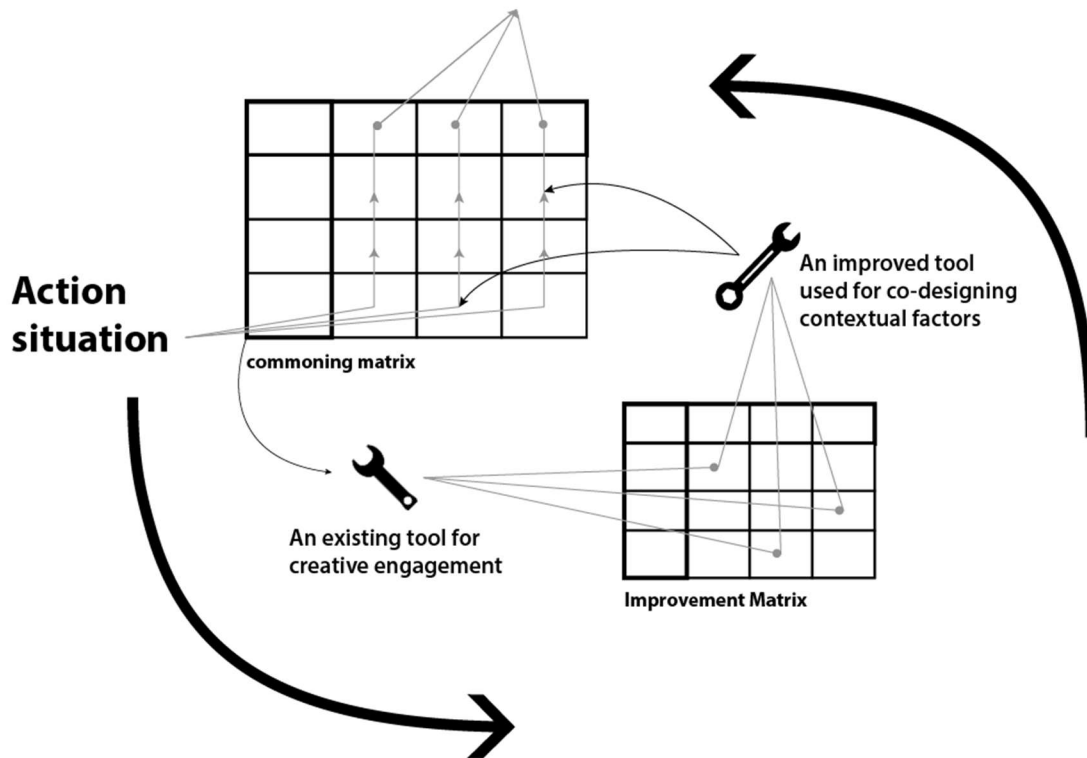


Figure 3. An approach for improving tools to enable the co-design of contextual factors to sustain a commons.

5 Applying the framework to a co-design project

We test and reflect on the viability of this framework by applying it to a recent co-design project involving the called Leapfrog (2017). The purpose of the Leapfrog project was to improve approaches to public consultation informed by co-design, tested across several service areas. The specific project we draw on is library practitioners exploring how to transition county libraries into ‘neighbourhood centres’ offering a more diverse range of services (Figure 4). The project team worked in partnership with the library practitioners to co-design a set of tools to support their community engagement to transform the libraries in response to local needs. While neither the research team nor the participants referenced the commons in this project, the co-design partners were effectively engaged in creating a commons in the form of a neighbourhood centre, and the tools participants developed mirror the contextual factors of the IAD framework.



Figure 4. Co-designing and sharing tools during the Leapfrog neighbourhood centres project.

Over the course of the Leapfrog project, co-design partners created seven tools to support librarian engagement with their local community, all of which are available from the Leapfrog website (<http://leapfrog.tools/>) as 'New Team Tools'. For the scope of this paper, we have selected three tools for analysis: Building Success, Flow Customer Tools, and The Small Things. We selected these tools because each tool addresses one of the three contextual factors that form one axis of the commoning matrix (Table 3). We then use the toy library example from this paper to explore how these tools could be improved to support the co-design of contextual factors of a toy library commons.

5.1 Tool 1: Building Success

Co-design partners created the 'Building Success' tool (Figure 5) to support community groups to explore what activities they would like a space to support and how both the space and the group might adapt to support those activities in that space.

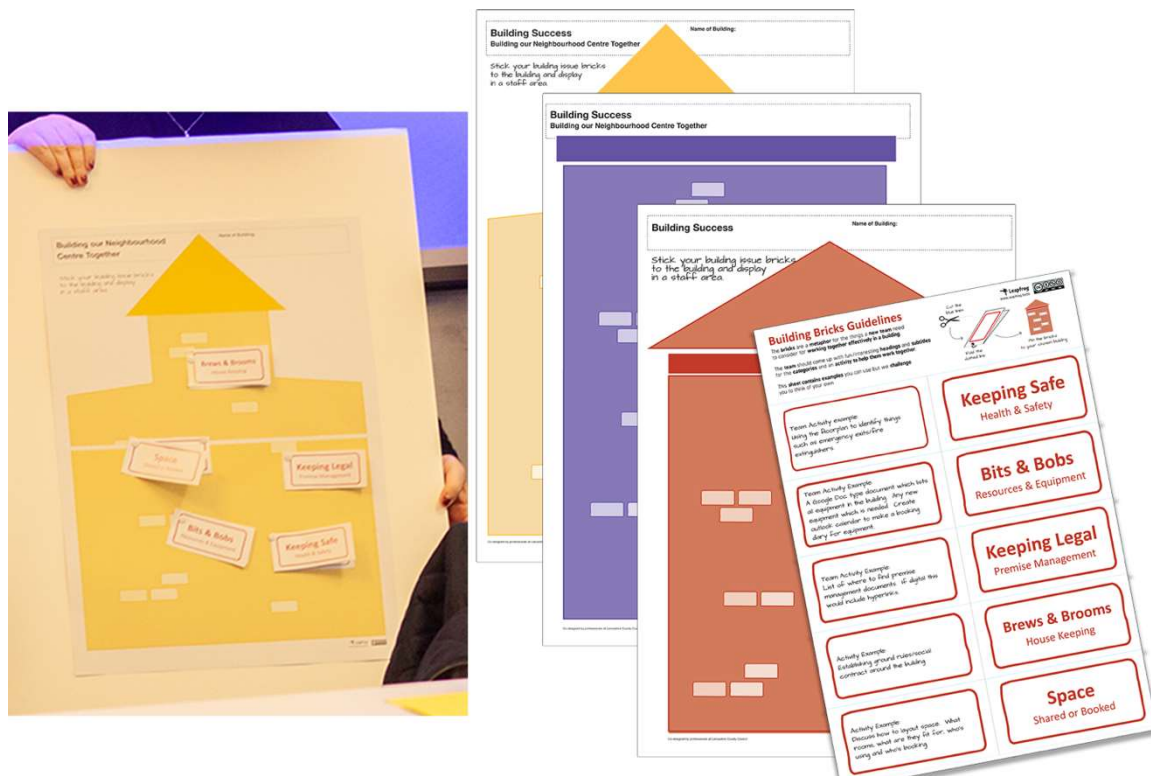


Figure 5. Building Success tool. Source: Leapfrog project (2017).

In Leapfrog, the co-design partners used Building Success to explore health and safety procedures, among other issues, for the neighbourhood centre. In the toy library example, the community might use this tool to explore a number of issues related to the *biophysical conditions* of the toy library commons (Table 4).

Table 4. Constructing biophysical conditions using the Building Success tool

Choice \ Factors	Biophysical conditions	Community attributes	Rules-in-use
Constitutional	Where will we store these repair tools?		
Collective	How to prevent children from hurting themselves?		
Operational	Who monitors these repair tools throughout the day?		

To consider tool improvements, we return to the toy library example and the action situation of members solving what to do about a damaged toy. For this action situation, the biophysical conditions the community might explore through Building Success are where to store repair tools and materials. Spatial questions might be: where these repair tools will be stored, how to prevent children from hurting themselves, and who monitors these repair tools throughout the day. The improvement dimension of greatest relevance is Functionality, although other dimensions could be considered. In the Leapfrog project, the community is transforming an existing space. For the creation of a toy library commons, this tool could use more physical interaction in the space, such as role play. A facilitator could draw on scenario descriptions from which to build scripts that members use for role play. Members can play a role and then record the results using the Building Success written tools.

To improve the tool for this situation, we propose changes in the design concept to support multiple scenarios, where each scenario is a module that could be added to the building (Interaction model). The tool could provide practical elements on how to facilitate role play, such as adding prompting narrative cards to create conflict in the participants' role play (Resources produced for facilitators). The other proposal would be to provide participants with templates to enable them to write down a role each participant has to play. This could involve the use of the Flow Customer cards to write role scripts discussed in Section 5.2. These improvement suggestions are mapped in Table 5 below.

Table 5. Improving the Functionality of the Building Success tool

Dimensions	Instruction	Functionality	Flexibility
Layers			
Planning		Role play	
Enabling		Scenario descriptions	
Doing		Scripts for role play	

5.2 Tool 2: Flow Customer tools

Leapfrog co-design partners created the Flow Customer cards and tools (Figure 6) to understand how to meet the service needs of the diverse groups within the community. This tool looks like an adaptation of user personas to guide library practitioners with categories tailored to the neighbourhood centre.

The image displays the 'Flow Customer tool' which consists of a 'Flow Map' grid and a 'Flow' card template. The 'Flow Map' is a grid with columns for 'Customers' and rows for 'Flow'. It contains handwritten notes and illustrations of people. The 'Flow' card template is a form for creating a customer persona. It includes the following sections:

- Flow**: what do customers want & need?
- Name**: Person's Name
- Description**: Short Description of user. For example, how old are they, what do they do for a living, what do they like to do?
- Centre**: Your Centre's Name
- In the Space**:
 - Visiting Times: AM/PM/Evening, Weekdays/Weekend, Often/Occasionally/Rarely
 - Questions they Frequently Ask: "Where is this?", "Who should I speak to for this?", "Do you have this?"
- Common Needs**: Homework support, Place to meet friends, Study space
- Services Used the Most**: Homework club

The card also features a small illustration of a person and a heart icon. The bottom of the card includes the Leapfrog logo and the text 'Co-designed by professionals at Lancashire County Council www.leapfrog.co.uk'.

Figure 6. Flow Customer tool. Source: Leapfrog project (2017).

In Leapfrog, the co-design partners used Flow Customer Tools to understand who else should be involved in decision-making for the neighbourhood centres. In the toy library example, the community might use this tool to understand the *community attributes* of their toy library commons (Table 6).

Table 6. Identifying community attributes using the Flow Customer Tools

Choice \ Factors	Biophysical conditions	Community attributes	Rules-in-use
Constitutional		How would the community know if a member has repair skills?	
Collective		How will we connect members with repair skills to members with damaged toys?	
Operational		How will a member with a damaged toy convey the toy to the member-repairer?	

For the toy library action situation, the community attributes the community might explore through Flow Customer tools are how members repair toys, moving between the members with the damaged toy and members with repair skills. Community attribute questions might address: how would the community know if members have repair skills, how will the community connect members with repair skills to members with damaged toys, and how will a member with a damaged toy convey the toy to the member with repair skills? To make the Flow Customer tools more appropriate to this situation, we consider the Instruction dimension to reframe how community members deal with a damaged toy issue. The primary improvement required of this tool is moving from thinking about traditional customer-provider relationships to thinking about members. Members can have different positions in a commons (in the commons literature, these are called position rules), but they remain members rather than customers/providers. Since both the person who damaged the toy and the person repairing the toy are both members, the facilitator might instruct the community to run through this tool using both members' perspectives rather than just that of the 'customer'.

To improve the Flow Customer tools to make them appropriate for this situation, we propose changes in how the tool should enable a two-way communication between members rather than a one-way understanding between service providers and users (Challenge/Briefing). The tool could provide facilitators with instructions on how to enable creative dialogue between the person who damaged the toy and person repairing the toy (Facilitator notes). The other proposal would be changing the words that are appropriate for a commons and use examples of other issues in the toy library to support them to complete the current issue (Example or use notes). These improvement suggestions are mapped in Table 7 below.

Table 7. Improving the Instruction dimension of Flow Customer tools

Layers \ Dimensions	Instruction	Functionality	Flexibility
Planning	Describe how the tool can enable two-way communication		
Enabling	Written instructions to enable creative dialogue		
Doing	Replace customer with 'member'		

5.3 Tool 3: The Small Things

Co-design partners created 'The Small Things' tool (Figure 7) to offer a fun and creative way for teams to prompt questions, share quick notes, and obtain feedback from each other. As the tool name suggests, it is intended to support the community to identify and solve everyday issues like who cleans the dishes in the staff kitchen sink.

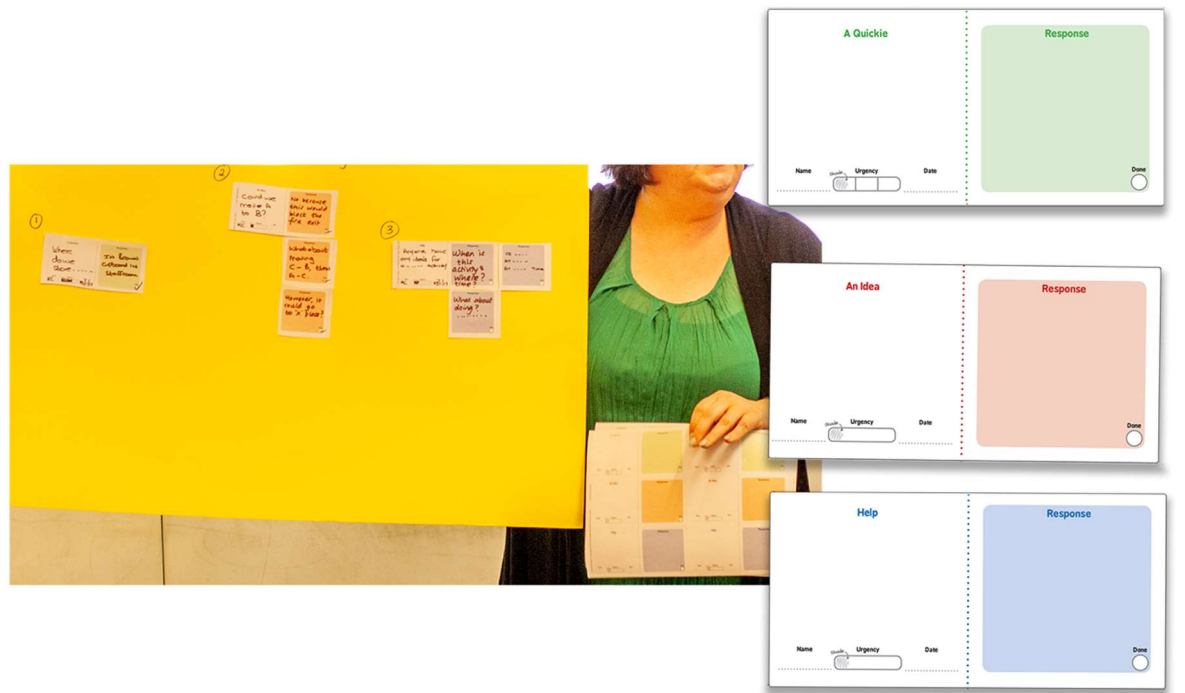


Figure 7. The Small Things tool. Source: Leapfrog (2017).

In the toy library example, the community might use this tool to understand the *rules-in-use* of the toy library commons (Table 8).

Table 8. Constructing rules-in-use using *The Small Things*

Choice \ Factors	Biophysical conditions	Community attributes	Rules-in-use
Constitutional			How do we assess if rules for monitoring toy damage are working?
Collective			Who create rules for monitoring toy damage?
Operational			How does a member evaluate toy damage?

For the toy library action situation, there are many rules-in-use that the community could explore. Improving *The Small Things* might focus on incorporating the design principles for managing a commons as a way to explore specific rules that the toy library must include to function. In this respect, adaptations to Instructions are important. Let’s take design principle 5, ‘Rules are enforced by effective and accountable monitoring.’ The community might need to monitor how damaged toys are reported, the use of repair materials and tools, and what happens to the damaged toy. Questions might include: how do we assess if rules for monitoring toy damage are working, who creates rules for monitoring toy damage, and how does a member evaluate toy damage? To round out our analysis, we’ll look at the Flexibility dimension for this tool. This dimension poses a greater challenge to our analysis and cause for reflection. Community members must be prepared to adapt tools for their local context at the Planning or Enabling phase, and facilitators must be prepared for unexpected adaptations made by the community while using the tool (Doing).

To improve the Flexibility of the *Small Things* tools, we propose changes in the tool design to enable community members to apply it in different action situations. We suggest six different colours for the tool instead of three colours to support different uses for managing and exploring different rules in the toy library (Build resilience). Another suggestion for improvement involves providing different facilitation approaches, which could be added to a guideline sheet as the toy library members use the tool to explore different rules (Encourage facilitator response). The other suggestion could involve printing *The Small Things* in a bigger format to enable members to draw or express their ideas in different ways (Enable contrary activity). These improvement suggestions are mapped in Table 9 below.

Table 9. Improving the Flexibility dimension of *Flow Customer tools*

Layers \ Dimensions	Instruction	Functionality	Flexibility
Planning			Provide six colours instead of three
Enabling			Provide approaches that work in a toy library
Doing			Print out tool in a different format to enable unexpected uses

6 Discussion and conclusion

This paper sought to initiate a discussion about how co-design can support communities to create a commons. We proposed a commons creation framework as a combined commons and co-design approach to address an intersectional gap between both fields. In this framework, we appropriate the IAD framework, arenas of choice, and design principles for managing a commons as robust components of commons analysis to first build a structure to support a community to frame commons requirements in a commons creation process. We also drew on a co-design framework for improving engagement tools as another structure to support people to engage in an infrastructuring approach. We applied this commons creation framework to a relevant case study of a community exploring how to transform a library into a neighbourhood centre that resembles commons governance.

The examples presented in this paper demonstrate how the framework can support communities to select and improve tools to create a functional commons. In reflecting on this application, we have identified that:

- The Commoning Matrix was useful in guiding selection and categorisation of tools to support the community to create a type of commons. We observed that tool selection and categorisation was more easily done based on contextual factor (biophysical conditions, community attributes, rules-in-use) than based on arenas of choice (operational, collective, constitutional).
- The Improvement Matrix proved helpful in organising thinking about what improvements were required, e.g. was it a matter of interaction model or did the instructions need to change?
- The Instructions dimension acted as a frame for using the tools explicitly for commons creation, e.g. framing the one-way Flow Customer tool as a two-way Flow Member tool. Further improvement of the Improvement Matrix as a tool might therefore require input from commons experts to inform the Instructions dimension.

In summary, the commons creation framework enables people to engage with requisite features of a functional commons in an accessible way by framing an infrastructuring process specifically for co-designing commoning infrastructure. Our study offers important implications in two fields: (1) for co-design, it offers an accessible framework for a community to engage in creating a commons to sustain outputs after researchers leave a co-design project; and (2) for commons, the framework offers a way to engage in co-design of a commons rather than only analysing an existing one. The proposal empowers a community to have control over the way they can creatively deploy tools to co-design commoning infrastructure as well as control over the resources and spaces they produce and use in a functional commons.

A question for the frameworks is: Who is the intended user? Within a community, there are likely lead-users who will lead commoning processes. Future research and development might focus on engaging with lead-users, who may also act as facilitators, to identify how the framework could change to be useful to commoning communities. Another further project involves sharing this framework with commons scholars to discuss ongoing improvement.

Acknowledgments. This research was carried out as part of the Beyond Imagination project at ImaginationLancaster funded by Research England Expanding, Excellence in England (E3).

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