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Article

A Framework for Co-Design Processes and Visual Collaborative Methods: An Action Research Through Design in Chile

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Abstract

With the urgency to adapt cities to social and ecological pressures, co-design has become essential to legitimise transformations by involving citizens and other stakeholders in their design processes. Public spaces remain at the heart of this transformation due to their accessibility for citizens and capacity to accommodate urban functions. However, urban landscape design is a complex task for people who are not used to it. Visual collaborative methods (VCMs) are often used to facilitate expression and ideation early in design, offering an arts-based language in which actors can communicate. We developed a co-design process framework to analyse how VCMs contribute to collaboration in urban processes throughout the three commonly distinguished design phases: conceptual, embodiment, and detail. We participated in a co-design process in the Atacama Desert in Chile, adopting an Action Research through Design (ARtD) in planning, undertaking and reflecting in practice. We found that VCMs are useful to facilitate collaboration throughout the process in design cycles. The variety of VCMs used were able to foster co-design in a rather non-participatory context and influenced the design outcomes. The framework recognized co-design trajectories such as the early fuzziness and the ascendent co-design trajectory throughout the process. The co-design process framework aims for conceptual clarification and may be helpful in planning and undertaking such processes in practice. We conclude that urban co-design should be planned and analysed as a long-term process of interwoven collaborative trajectories.

Keywords

co-design; co-design process; public space; urban co-design; visual methods

Issue

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1. Introduction

Urban design and planning practices have a long tradition of dealing with change and uncertainties (Healey, 1992; Jupp & Inch, 2012; Sanders & Stappers, 2008). Collaborative approaches have emerged as ways to cope with such complexities while dealing with power inequities towards more resilient, legitimate, context-specific, and feasible outcomes (Enserink et al., 2003; Gaete Cruz et al., 2021; Palmås & von Busch, 2015; Smaniotto Costa et al., 2020). Such approaches aim for democratic, deliberative, and participative approaches following debates such as the *communicative turn* in

planning (Healey, 1992), the *cross of the great divide* (Ostrom, 1996; Parks et al., 1981), and the emergence of *new languages and landscapes* of design (Sanders, 2000; Sanders & Stappers, 2008). They represent a shift towards involving a more comprehensive range of actors and incorporating formal and experiential knowledge in dialogue and design (Sandercock & Attili, 2010; Sanders, 2000). Scholars have given special attention to new methods to initiate dialogue, awaken imaginaries, and facilitate collective knowledge co-production (Carpenter et al., 2021; Ersoy, 2017; Mattelmäki et al., 2014; Sanders et al., 2010; Sanders & Stappers, 2008).

Co-design is a term that is often used for participation in design processes where collective creativity is fostered involving users as sources of knowledge (Sanders & Stappers, 2008). The term acknowledges the diversity of stakeholders involved in design processes (Smaniotto Costa et al., 2020) while emphasising a need for active collaboration in urban design (Van de Ven et al., 2016). Tools and methods have been used to represent urban complexity for participants to visualise the diverse natural and human layers of urban spaces (Baibarac & Petrescu, 2017; Hooimeijer & Maring, 2018; Van de Ven et al., 2016). Yet public space governance is often contested and deals with multiple converging and confronting aims and requirements (Van Melik & Van Der Krabben, 2016). This is the case in multiscale and multi-dimensional settings where co-design unfolds in various institutional frames or arenas (Gaete Cruz et al., in press; Huybrechts et al., 2017). Moreover, in urban co-design processes, participants should feel comfortable expressing their points of view and being flexible to change their minds (Gaete Cruz et al., 2021). In collective decision-making settings, participants should be available to deliberate or negotiate when necessary (Castro, 2021). This may not be the case when actors come from diverse sectors and backgrounds or are unacquainted with design practice (Enserink et al., 2003). But when some forms of collaboration are achieved in urban design processes, outcomes are more likely to be more appropriate and locally suitable (Ersoy & Yeoman, 2020; Smaniotto Costa et al., 2020).

While many participatory methods are said to facilitate collaboration, there are different interpretations of the use of visual collaborative methods (VCMs). For example, some studies have focused on their use to communicate and exchange design ideas (Rose, 2014), initiate dialogue, or communicate experiential knowledge (Sanders, 2008; Sanders & Stappers, 2008). Some argue that the visual language is conventionally used by urban professionals and can thus serve as an additional language in which non-designer actors can communicate and collaborate (Sanders, 2009). Many studies focus on the use of VCMs in the early stages of design. However, more conceptual clarification is needed to understand how such methods facilitate collaboration throughout the design phases. The question remains of how VCMs can facilitate collaboration in the urban landscape design process in practice. This study explores the potential of VCMs as modes of collaborative knowledge inquiry, analysis, projection, and selection throughout the design processes.

In the next section, we propose a framework to conceptualise the use of VCMs in the co-design process. Then we present the case we studied and explain the methodological approach we adopted to act and reflect on practice. The results section defines the VCMs used in the co-design process and maps them in the framework. We define the contributions of VCMs in co-design processes and clarify the complexity of such practice.

2. Visual Collaborative Methods and Co-Design

2.1. The Use of VCMs in Co-Design Processes

Co-design brings designers, citizens, and people not trained in design to collaborate in design processes (Sanders & Stappers, 2008). Co-design initially focused on users as sources of experiential knowledge and has evolved towards new forms of diverse stakeholder involvement (Mattelmäki & Visser, 2011; Sanders & Stappers, 2008). In doing so, actors intervene in design processes in diverse ways, from sources of practical expertise, speakers of their aims, and collaborators in creativity, exploration, and learning (Mattelmäki et al., 2014; Mattelmäki & Visser, 2011). Such ways require integrating diverse (and sometimes contradicting) knowledge, values, aims, and skills. For the actors to effectively collaborate, they should feel comfortable expressing points of view, be willing to develop shared understandings, and have some knowledge on the subject (Metze, 2020). Urban actors often come from diverse sectors (public, private, academia, non-profit, community), have different backgrounds (formal or informal expertise), and pursue specific aims (strategic, transdisciplinary, socio-cultural; Gaete Cruz et al., in press). Co-design occurs in dynamic, multilayered, and multi-sectorial ways in transdisciplinary teams integrating formal and informal expertise (Baibarac & Petrescu, 2019; Gaete Cruz et al., 2022).

We understand urban co-design as the collaborative approach to urban design acts that involve diverse strategic, transdisciplinary, and socio-cultural actors aiming for more context-specific, legitimate, and feasible outcomes (Gaete Cruz et al., in press). Yet, despite the often recognised legitimate contributions of collaboration, bringing actors together raises many practical challenges (Switzer, 2018). They might not always understand the urban spaces and interactions to analyse and design them, which may lead to misunderstandings, conflicts, mistrust, or even the end of an involvement. In this sense, applied research studies may clarify co-design in practice.

Urban design professionals conventionally use visual language to communicate their projects. Visual representations can put information in front of others' eyes (Whyte et al., 2017) and are sometimes more effective than words (Tufte, 1997). Yet communicating with non-experienced designers is not always straightforward, and fostering collaboration involves a lot of challenges (Sanders, 2009). Collaborative processes often use visual methods to facilitate knowledge production, brainstorming, the development of shared understandings, and the engagement of the participants (Carpenter et al., 2021; Enserink et al., 2003). Different forms of VCMs are used in co-design processes to foster communication and exchange ideas by offering an additional language in which actors can communicate (Mattelmäki et al., 2014; Sanders, 2009). And while urban designers communicate

through plans, diagrams, and renders, they conventionally do so to communicate for construction or persuade in a one-way direction (Sanders, 2009).

The use of visual methods is often studied in practice because it is in their use that the main challenges and contributions can be observed. In recent years a wide variety of such methods have been studied (posters, reports, videos, storyboards, card sets, animations, pictures, diagrams, sketches, amongst others; Sleswijk-Visser, 2009). Many studies have attempted systematisation towards conceptual clarification, yet the approaches vary widely and sometimes follow different lines of argument or theoretical traditions. Some have highlighted the value of open-ended dialogue approaches of participatory visual methods in community-based research (Switzer, 2018). Others recognise arts-based methods as knowledge co-production devices for social justice (Carpenter et al., 2021; Metze, 2020). Worth mentioning is the academic work by Elizabeth Sanders, who spent years developing an approach for the use of methods in co-design processes and proposed a map to classify design research tools concerning user participation and research (Sanders, 2006; Sanders et al., 2010; Sanders & Stappers, 2014). Although the conceptual approaches are interesting, they often fail to capture the collaborative dynamics in urban design processes. It has been said that the contributions of such visual methods need to be clarified (Carpenter et al., 2021).

In this study, we understand VCMs as methods that use visual language as a tool for collaboration in design practice. We recognise that such language is useful for the inquiry and communication of information and promotes stakeholders' engagement (Pocock et al., 2016). While some study arts-based methods to interpret personal expressions (Carpenter et al., 2021; Switzer, 2018), we aim to explore how they are boundary-spanning (Whyte et al., 2017) and prompt collaboration in design (Switzer, 2018) to set a complementary language in which everyone can actively intervene. VCMs can use a range of visual representations, from conventional urban design tools to analytical ones and even more art-based and ethnographic forms. Their value relies not only on their capacity to ignite personal expressions but to do so with others in design acts. Visual language is used to depict aspects of reality, communicate and translate information, and prompt dialogue (Metze, 2020), but most importantly, to foster ideation and creation. In working with VCMs, it is content and form that is important (Switzer, 2018), but also how collaboration is achieved in its use (Gaete Cruz et al., in press). So, while some of the VCMs in this study are relatively conventional, their open-ended content creation approach matters to co-design. In this study, we understand VCMs as those using visual language as a tool for collaboration in the design steps of research, analysis, ideation, and decision-making throughout co-design processes.

2.2. Expanding the Co-Design Process

In a previous study, we developed a co-design framework offering a landscape in which the different design steps could occur in diverse levels of collaboration (Gaete Cruz et al., in press). The framework builds on reinterpretations of the ladder of participation (Arnstein, 1969) and the design cycle (Jonas, 2007; Roozenburg & Eekels, 1995; Zwart & de Vries, 2016). We defined the levels of collaboration and the design actions of co-design. We distinguish four design actions that occur throughout urban design processes: research, analysis, projection and selection. A collaborative research approach might allow for knowledge co-production, allowing for better-informed outcomes. The collaborative analysis and synthesis of information might result in shared understandings and social learning. Accordingly, the shared projection and ideation of solutions, or part of the solutions, might improve the sense of participation. At the same time, a collaborative evaluation, prioritisation and selection of design solutions might most likely result in legitimising the outcomes. If these steps involve other actors, then different collaborative levels can be observed as: informative, consultive, participative, and long-term collaborative (Gaete Cruz et al., in press).

The design concept is commonly referred to as the process and the end result (Zwart & de Vries, 2016). Design has also been conceptualised as a timeline in which design solutions, through repetitive design cycles, evolve increasingly from one phase to another one. Some have coined that three main design phases are recognised: the conceptual, the embodiment and the detail phases (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). In the conceptual phase, the problem is defined, and conceptual solutions are ideated. In the embodiment phase, a preliminary design is selected amongst possible spatial layouts, functional displays, and material propositions for further development. The final design phase determines specific aspects and documents the project to be built according to technical requirements, regulations and evaluations. We extended the co-design framework into the three design phases as shown in Figure 1.

We adhere to the process-oriented approaches that simultaneously conceptualise design as cyclical and linear (Cross & Roozenburg, 1992; Roozenburg & Eekels, 1995). We incorporated the linear approach in the co-design framework by emphasising that the design steps occur in a cyclical iterative way towards the development of solutions throughout the three design phases. This allows us to map and analyse the use of VCMs and how they facilitate a diversity of design actions throughout the process. Accordingly, actors may go back and forth between the steps and repeat the whole cycle several times throughout the process. We argue that such methods may facilitate collaborative research, analysis, projection, and decision-making throughout the conceptual, embodiment, and detailing design phases.

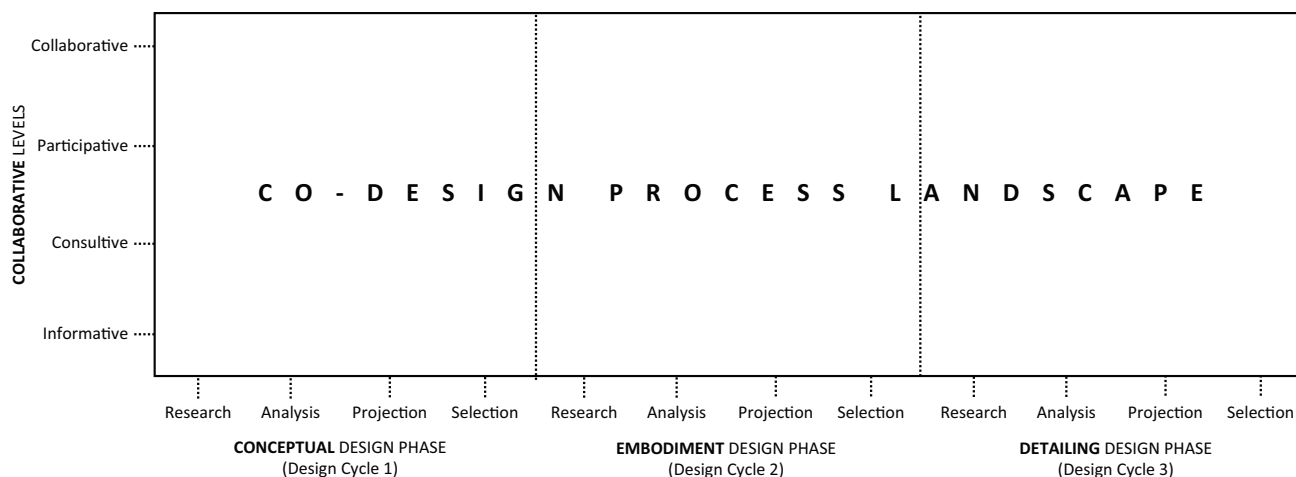


Figure 1. Framework for the urban co-design process. Levels of collaboration on the Y-axis and the design acts throughout the design phases on the X-axis.

3. Methodological Approach to the Co-Design Process

3.1. Description of the Co-Design Process From Practice

We conducted a case study of a public space co-design process while acting in practice. This occurred in the context of a public design consultancy commissioned by the Housing and Urbanism Ministry of Chile to Co-Diseño Urbano Consultants. The ministry aimed to update the Kaukari Urban Park project designed by Teodoro Fernández Associate Architects in 2012 in the Atacama Region. They acknowledged the need for updated mixed sports functions in the park.

The Slope Sports Square was designed as an open public space with skating elements and a climbing wall as shown in Figure 2. Various sports organisations were sum-

moned as the future end users, and some had played a role in requesting such structures. We involved them early in the process as relevant actors aiming to co-design the space to prepare the grounds for future co-management and co-operation. They were actively involved throughout the embodiment and the detailing phases providing expert technical knowledge and even leading strategic interactions with relevant local sports actors.

The first author participated in the planning and development of the design consultancy. The case study for the article was selected because we could plan the process and act in practice. This allowed us to evaluate the use of VCMs. The Kaukari Urban Park co-design process had also previously been studied by the authors, and the timing of the consultancy matched this study. It is important to note that the co-design approach was



Figure 2. Work-in-progress visualisation of the Slope Sports Square. Source: Courtesy of Co-Diseño Urbano Consultants.

suggested as a mode of practice amongst the involved actors. This was a real-life rooted practice of co-design applied research in a rather top-down setting, and was thus not a completely autonomous research endeavor. This article evaluates such processes of planning and interacting in practice.

The co-design process planned to integrate a diversity of strategic, design, and assessment professionals, and the prospective users of the project. The leading actors were the ministry in charge and the design team of which the lead author was in charge. The first author played the urban designer and project manager role fostering co-design interactions.

3.2. Acting and Reflecting in Design Practice

This study was planned, conducted, and reflected upon a co-design process undertaken from 2020 to 2022. The lead author of this study was involved in the design team and was able to plan and undertake the co-design process. Such an approach allowed us to act and analyse at three operational levels: in planning the design processes, in conducting the design processes to produce the design outcome, and finally, in reflecting upon such endeavours. The steps taken in these levels are detailed in Table 1. This article reflects mainly on the use of the multiple VCMs that facilitated the co-design process.

This study took an action research through design (ARtD) methodological approach to generate knowledge from practice by acting in an actual ongoing design process (van Stijn, in press), aiming to intervene in the urban environment through problem and solution definition (Buchanan, 1992). This approach combines action research with research through design methods. Action research aims for knowledge inquiry with active participation from stakeholders in open-ended processes with flexible objectives (Baum et al., 2006; Bell et al., 2004). Research through design supports the research inquiry process where new design knowledge is generated through the action and reflection in design (Cross, 2001; Frankel & Racine, 2010; Jonas, 2007; Roggema, 2016). We acknowledge these two approaches pursue different aims and have different disciplinary trajectories, but a combined approach was appropriate to address such collaborative design-oriented research in practice.

The co-design processes ran from November 2020 until April 2022. Given the global pandemic, the process was mainly conducted in an online format. With such challenging circumstances, the process benefited from digital tools in which visual language played an important role in facilitating collaboration and design.

This study's first author was personally involved in practice with an ARtD approach. She managed the design team within the public design consultancy team. This allowed her to plan the process's co-design moments and undertake such endeavours with a collaborative and flexible mindset. Due to her expertise as an urban designer in broad innovative and multiactor urban development processes, she was able to focus mainly on how collaboration amongst the diverse actors contributed to the design process and their resulting outcomes. We acknowledge that the involvement of researchers in practice may raise legitimacy issues, but such an applied approach deepens the conceptual reflections while operating in practice (van Stijn & Lousberg, in press). To avoid personal or professional bias, the results were shared with certain involved actors for feedback and verification through interviews at the end of the process.

4. Results and Discussions

This study explores the contribution of VCMs as modes of collaborative knowledge inquiry, analysis, projection, and decision-making in design processes. First, we define the methods we used and then map them regarding their collaboration level in design steps throughout the phases. The results showed that even though most VCMs were planned for the early phases, their use was maintained throughout the whole process. The framework helps conceptualise the use of VCMs and visualise the co-design trajectories within such a process.

4.1. Visual Collaborative Methods Used in the Co-Design Process

The variety of VCMs are explained in Table 2 and some are shown in Figure 3. They are described according to the moment when they were used, the actors involved, the level of collaboration in design steps, and their main contributions.

Table 1. ARtD steps were undertaken to plan, conduct, and reflect upon the co-design process.

Operational Levels	Approach
Planning	AR approach to the collaboration of actors
	RtD approach to the design of objectives
Conducting design	AR approach to collaboration with actors
	RtD approach to the outcomes and objectives
Reflecting	AR approach to collaboration and the process
	RtD approach to evaluate the design and outcomes

Table 2. VCMs used in the design process.

VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
1 Interest and power matrix of actors	Conceptual phase. The matrix was used as a visual tool for dialogue and to sketch during the interviews with key actors to identify and classify a wider variety of actors that could be relevant to the design process and the operation of the square.	The interviewees belonged to public organisations, sports associations, local NGOs, and sportspeople. The facilitator of the citizen participation (socially-oriented expertise) within the design team leads this process.	Consultive research of actors and participative analysis of their position in the matrix.	This VCM allowed to identify and consequently summon relevant sports associations and organisations operating in the city.
2 Exercise booklets for experience registration	Conceptual phase. Pre-designed booklets (experience journals) for participants to fill in during their spare time while enjoying their sports in the park. The booklet layout addressed some specific aspects of the sports experiences, ideas and aims of the sportspeople for the square.	Diverse sportspeople filled in the booklets (skate, climb, circus art, parkour, running, walkers, cycling, football, basketball, Zumba dance, boxing, and crossfit).	Participative research of sports experiences. Members of the design team then systematised the booklets.	These booklets allowed for a shared understanding of the sports practices' feelings, experiences, and functional dynamics amongst the involved actors. These notions were then incorporated into the public space designed.
3 Sports experience and conditions matrix. (Booklet's workshop)	Conceptual phase. This interactive board (Miro online platform) was used in the meeting where the analysis and results of the Exercise booklets were presented, discussed and further systematised. The interactive board was filled in during the meeting integrating the discussed issues. In a focus group setting, the conversation tackled the sport's needs, everyday needs, and the conditions of an inclusive and public urban space.	The actors summoned to the meeting were the sportspeople, the design team, and the public servants of the ministry in charge.	Informative and consultive analysis towards the participative systematisation of the results.	The meeting aimed and contributed to finding converging issues amongst the sports, developing shared understandings about the sports activities, and empowering the collective use of the future space.

Table 2. (Cont.) VCMs used in the design process.

VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
4 Online post-its board in the Co-design workshop	Conceptual phase during the Co-design Workshop with the skaters, climbers, and circus art performers. The workshop was initiated by sharing the requirements of the sports gathered during the process. This was done on a digital board (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	Since the requirements of the sports had been discussed beforehand, the collected information was informed and consulted.	This method allowed the confirmation of the collected information and the development of a shared understanding of each sport's collective needs and specific requirements. There were no further discussions in this respect.
5 Live sketching in the park and site architectural plans (Co-design workshop)	Conceptual phase in the Co-design Workshop. The workshop followed with the live digital sketching of the lead author on a digital plan of the park and site (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	This method aimed to communicate and explain the urban park design criteria and the site's spatial and budget limitations (informative analysis).	This method helped set a collective understanding of the project's main design criteria and limitations. This allowed the levelling of expectations of the participants. This was useful for the next step of the co-design process, in which the groups had to develop a spatial layout for the square.
6 Live collective sketching of spatial layouts (Co-design workshop)	Conceptual phase in the Co-design Workshop with the skaters, climbers and circus art performers. The workshop followed with the collective sketching of possible layouts of the square using arrows and lines in smaller mixed groups on a digital plan of the site (Miro platform).	The workshop was led by the urban design team and summoned the skaters, climbers and circus art performers, and the public servants of the ministry.	This method allowed a participative analysis and projection of spatial layout sketches.	This method allowed a collective layout building forcing participants to think spatially and encouraging them to comprehend the implications of a shared public space. In this exercise, new spatial ideas were raised for the project.
7 Diagrams, plans, and renders (Revision meetings)	Conceptual phase, embodiment phase, and detailing phase. Multiple diagrams, plans, and renders were used throughout the process to communicate the project's development in formal revision meetings.	These revision meetings were held with the design team at the ministry's request. The ministry had the final decision in approving the project.	In these meetings, visual representations were used to inform the analysis of the design team, consult about the projection, and decide collaboratively on the design for its further development.	Even though these visual tools are rather conventional in this design field, we highlight the collaborative approach with which they were used to communicate the analysis and ideation, allowing for collective decision-making.

Table 2. (Cont.) VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
8	Sketching in social media visuals * (WhatsApp exchange).	Conceptual phase, embodiment phase, and detailing phase. The photography and videos from social media (Instagram, YouTube) were used throughout the process to share knowledge and understanding regarding skating and climbing sports.	The design team and the sportspeople participated in this reiterative exchange of sketched visuals.	Pictures and videos were used to inform and analyse the sports practice, spaces and construction details.	Even though these visual tools were not envisioned in the planning process, they contributed to sharing knowledge in a twofold direction between the design team and the most active sportspeople.
9	Sketching in details and sections *	Conceptual phase, embodiment phase, and detailing phase. The sections and details were used to share technical knowledge and verify that the project met the skate and climbing-specific requirements.	The design team and the sportspeople exchanged sketched sections and details.	Sections and details were used to ideate and select better solutions for the specific sports building solutions in a participative way.	The early exchange of architectural sections and building details amongst the design team and the most active sportspeople allowed the development of construction solutions to implement the sports structures and elements such as the climbing wall, the ramps, protections, and sliding elements.
10	Work-in-progress renders in social media *	Embodiment phase. Some work-in-progress (WIP) renders were posted on the Kaukari Urban Park's social media, which raised many controversial public opinions.	The ministry in charge, various skaters and citizens, especially some sportspeople who had dropped the co-design process.	The WIP 3D models and renders were posted online to inform the ongoing design project.	The public exposure of draft images generated much public confusion. The images were not finished and had technical detail mistakes that gave a confusing message to the skating community. They were WIP drafts far from being ready to publish.
11	Plans and renders *	Detailing phase. The project plans and images were presented to skate organisations that demanded participation in the process (even though they had voluntarily dropped off earlier).	Involved parties were the design team, the ministry in charge, and skating organizations who had dropped the co-design process earlier.	The design team presented the project to skaters. The ministry allowed the skaters to suggest changes in the project.	The main contribution of this unplanned exchange was the acknowledgement that more beginners' skating spaces could enhance the training vocation of such a public square. Since the ministry was in charge of approving the project, the suggestions had to be taken into account.

Table 2. (Cont.) VCMs used in the design process.

	VCM	Design Phase and Description	Involved Actors	Collaboration in Design Steps	Contribution to Collaboration and Design
12	Photographs in a report *	Detailing phase. The skate organisations developed a report in which, through photography and written notes, they expressed their suggestions for new beginners' structures in the square. They requested lower skating structures such as ramps and sliding rails.	The skate organisations developed a report and submitted it to the ministry. The design team received the report and integrated the suggested beginner elements.	The visual report aimed to inform and consult about some project changes. It was a bottom-up way of proposing alternative structures for the inclusion of a beginners' area in the sports square.	This non foreseen report helped clarify the skate organisations' requests and allowed the design team to integrate the beginners' training space. Even though it did not allow for true collaboration toward design, the report format did add to the specificity of the requests with the use of visual images and notes.
13	Sketches in a printed architectural layout *	Detailing phase. The design team insisted on verifying the modified design proposal (implementating the beginners' area) with the local skate organisations. This was just accomplished after months. The architectural layout printed plan was used to explain the process, but the ministry was also willing to allow new changes to the whole project even though the consultancy was about to finish.	The skate organisations, the ministry, and the design team.	The meeting aimed to consult and verify how the project had incorporated the beginners' area. Nevertheless, the meeting resulted in a participative projection and modification of the overall layout of the square without an active participation of the design team.	The participants were allowed to sketch the printed plan and develop changes to the project without dialogue between the design team and the skaters. This resulted in somehow a prejudice to the final project. The lack of dialogue may have resulted in missed opportunities and overall sense of miscommunication.
14	Sketching in sections and details *	Towards the end of the process, in the detailing phase, the technical revisors changed, so new professionals arrived and requested a series of detailing and layout changes that had to be addressed by the design team.	The ministry professionals in charge of the technical approval of the project and the design team.	Such interactions started with a participative analysis but resulted in consultive projection and informative decision-making.	Such an approach is common when one actor (ministry) has the control over the process. In this case, some parties within the ministry felt uncomfortable with the top-down attitudes of others at the end of the process.

Note: Methods with * were not part of the initial plan.

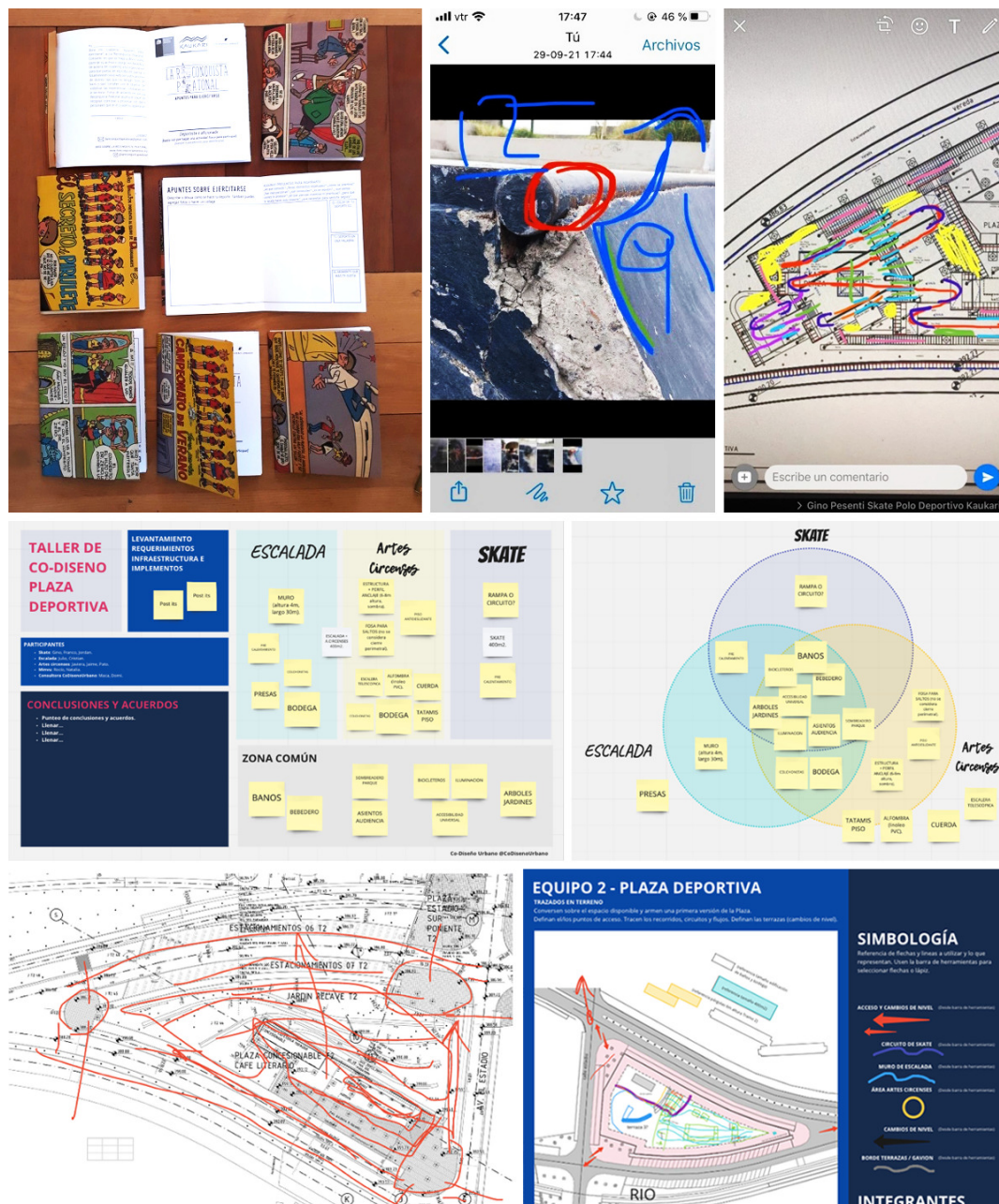


Figure 3. Some VCMs used: Exercise booklets (2), boards of sports requirements (4), live sketching plans (5), spatial layout exercises (6), and sketched visuals (8). Source: Courtesy of Co-Diseño Urbano Consultants.

VCMs were combined with either verbal or written forms of communication to explain and use them. This was the case in the report (12), in which the visual requests were further explained in the text. Also, during the live sketching (6), the design strategies and site limitations were explained verbally to the participants. Accordingly, a variety of verbal and written forms complemented the multiple VCMs.

It is worth noting that most VCMs were digital as meetings and interactions were held online due to the pandemic. Despite this, participants seem to have felt comfortable communicating, learning and using digital tools. This probably worked out because most of them are younger than 40 years old and had already worked

remotely during the previous year. Also, digital meetings allowed more people to be present and available, and a couple of actors noted this during the process. Additionally, a couple of in person meetings were held without a successful attendance rate. Also, occasionally, hard-copy booklets and plans were used as non-digital devices for people to fill in or sketch. In this sense, the VCMs studied are both digital and hard copy.

4.2. Mapping the VCMs in the Urban Co-Design Process Framework

The VCMs used in the process were mapped in the urban co-design framework, as shown in Figure 4. Within

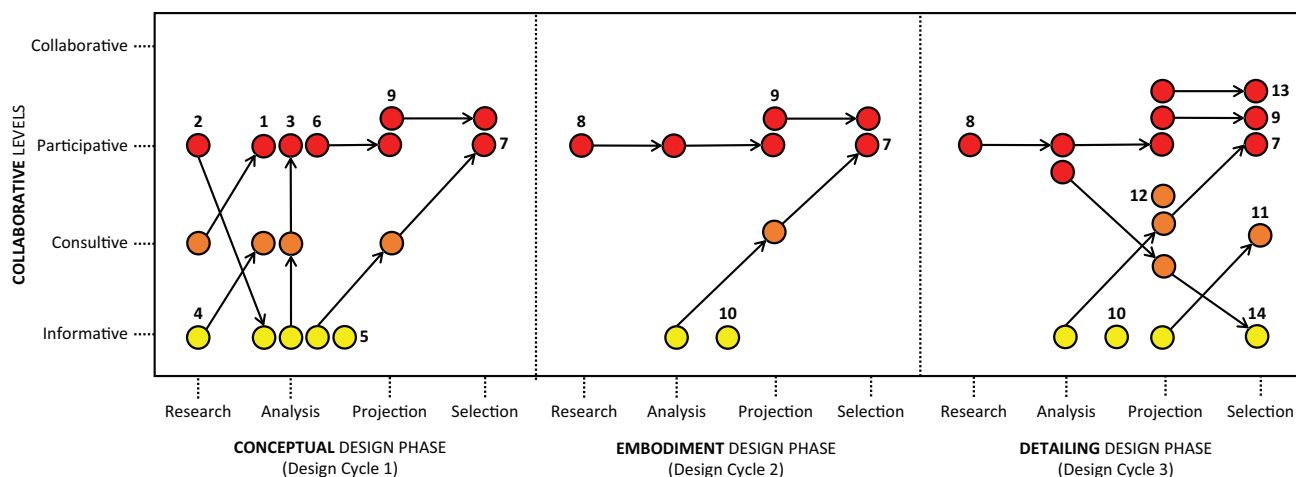


Figure 4. Mapping the use of VCMs in the co-design process framework. Collaborative levels on the Y-axis and the design cycle and phases on the X-axis.

the co-design landscape, VCMs were placed according to the level of collaboration achieved by the involved actors in the design actions. In such a way, methods aiming for knowledge inquiry were classified as “consulting research,” methods to present design solutions were mapped as “informative projection,” and methods aiming to generate new solutions in collaboration through time were mapped as “participative projection and decision-making.”

Some VCMs were placed in one position, while others in more than one. The numbers in Figure 4 refer to the methods described in Table 2. For example, the actor matrix (1) was used as a consulting device during the interviews and a participative analytical tool in consecutive meetings. In other cases, more than one VCM was used in a meeting. This is the case of the co-design workshop during the conceptual phase, which consisted of three methods (4, 5, 6). The first (4) consisted of a presentation of the sports requirements collected and compiled using digital diagrams. Then the context-specific opportunities and limitations of the site and the projects were presented by the urban designer through live online sketches of architectural plans of the site and surroundings (5). Finally, the collaborative development of spatial layouts for the square with digital sketches and symbols on a site plan (6). The workshop lasted two and a half hours, ranged from informative to participative levels, and operated in three design steps: research, analysis, and projection. This explains that the use of VCMs sometimes concentrate at one point, while others draw a trajectory within the co-design landscape.

The fuzziness in the conceptual phase has been said to foster shared understandings and the empowerment of the participants (Sanders, 2005; Sanders & Stappers, 2008). The initial plan even considered some arts-based VCMs in the early phase to elicit experiences and foster knowledge-sharing of the participants. Those methods aimed for participants to communicate, feel comfortable, and provide personal knowledge, aims, and values that

could then be considered, prioritised, and integrated into the designed outcomes. Most of the VCMs planned for the conceptual phase allowed shared pre-design and exploratory solutions (Sanders, 2014), as was explicitly requested in the design consultancy. Yet, new collaborative and design needs emerged in the following phases, so new VCMs were incorporated.

A selected group of sportspeople were involved in the early shared understandings to define the requirements of the sports and analyse the opportunities and limitations of the site. However, due to the high specificity of the designs and the lack of national sports regulations for climbing and skate structures, a more permanent technical collaboration was required and sustained in the following design phases. Other visual methods were used in a twofold direction for knowledge exchange, brokerage and design. This was the case in which conventional technical visuals that communicated the project were then used as tools for collaboration. Throughout the process, we used conventional visual tools that were at hand. This was possible because one of the skaters was trained and had professional experience in technical drafting, supporting collaboration even in detailing technical specifications.

The shared understandings and sports requirements were integrated in the spatial layouts and preliminary construction solutions during the embodiment phase. As illustrated in Figure 3, the VCMs in this phase reflect the co-design interactions within the transdisciplinary design arena (Gaete Cruz et al., in press). Such methods allowed collaboration in the revision meetings (7) and sketching in images, videos, plans, and details (8, 9) exchanged weekly using WhatsApp, Instagram, or Zoom meetings.

During the detailing phase, the most specialised decisions are made, and this is the last collaborative phase of the process. Some of the VCMs mapped in the previous phase are maintained. Nevertheless, we observe some rather unusual collaborative trajectories due to changes

in the involved actors. Sports organisations who complained were included towards the end. And some professionals in charge of the technical approvals left the process or were changed towards the end.

After the WIP renders were posted in social media, some sports organisations had to be involved in the process. This was done time-barred and affected the overall sense of collaboration. The modifications they demanded had been already decided collaboratively in the conceptual phase. At that point most of them had been involved in the process but decided to abandon it at some point. After several months, a new meeting was held in person (13), and wrong expectations were given about possible project changes. The ministry opened up the project for modifications (11, 12), disregarding the urging of the design team for closure. The changes affected the layout and project details. This occurred at the end of the detailing phase raising budget and timing issues that the design team absorbed alone. This demonstrates how co-design approaches may be disrupted when actors make use of the power they have, damaging collaboration.

Some public servants in charge of the technical approvals within the leading public organisms left the process for personal reasons. This is depicted in the collaborative descent of number 14 in Figure 4. Processes deal with human beings, so interactions are simultaneously personal and technical. Whenever someone is missing or new actors are integrated, problems may arise due to lack of awareness or willingness to collaborate. Moreover, professional boundaries often blur if participants are connected outside the spheres of the co-design arenas. This may have been the case when subjective technical requirements were demanded as norms due to the lack of national skatepark regulations. The descending line depicted in the detailing phase contrasts with the overall ascending lines observed in the previous phases. It shows one of the main risks in pursuing co-design since there are no power-free institutional settings.

We concluded that VCMs facilitated all four design acts at different collaborative levels in each phase. Some focused on the consultation of strategic actors such as citizens or public organisations, and others facilitated participative approaches to analysis and projection with the public sector and some sportspeople. VCMs allowed the different parties' information, consultation, participation, and collaboration. Yet, according to the framework, the collaborative level was achieved because participation was fostered consistently throughout the process.

4.3. The Contributions of VCMs in Urban Co-Design Processes

One of the main contributions of using VCMs in urban co-design processes is that they can be diverse and flexible enough to be used throughout the design process. Their original plan evolved, so flexibility had to be kept throughout the process. Such flexibility is a prerequisite

for collaborative endeavours but may also blur professional limits. This may have been the case of the sportspeople participating actively in the development of the project. They were not formally part of the team or were economically retributed. Scholars have previously highlighted such possible social justice issues in participatory endeavours (Ersoy, 2017).

An interesting contribution of VCMs to the process is how they influence further steps of the process or the use of other methods. This is the case of the actor matrix (1) that allowed the identification of actors with whom we continued to collaborate. Also, the ideation steps (6, 7, 8, 9) used conventional visual tools in unconventional ways to foster collaboration. VCMs used in the analysis and ideation steps (1, 3, 4, 5, 8) contributed to shared understandings and design outcomes.

The use of VCMs also influenced the design outcomes. The booklets (3) made explicit that gathering and warm-up spaces needed in the square to complement the sports structures and that natural sunset shadows could be tapped through the position of the climbing wall against the sun. Their discussion allowed for shared understandings of the sportspeople's values, motivations, and practices, which generated empathy and a sense of community. There was an additional agreement (5, 6) on the sports' formative and performative character, considering the park's scenic and central setting, so viewpoints, grandstands, staircases, and gathering spaces were incorporated into the design.

Finally, in a non-participatory context like Chile, the VCMs fostered co-design in a rather top-down urban development setting led by the public sector. The pandemic might have benefitted the processes in two ways: allowing for multiple images to be sketched and interchanged digitally and making it possible for team members to collaborate while dispersed worldwide. Anyhow, striving for co-design in a context where participation is not the standard always raises practical challenges.

4.4. The Contributions of the Urban Co-Design Framework in This Study

The use of the framework as an analytical tool allowed us to conceptualize a co-design process. We observe that the starting point in the lower-left area in Figure 4 is full of opportunities. We consider informative research as a building block for further collaboration (Gaete Cruz et al., in press). From this point up, a co-design process can be mapped and analysed. The use of the framework allowed us to identify co-design trajectories and shifting arenas.

Three main co-design trajectories were recognised from this study: the early fuzziness, the collaborative trajectory, and the final fuzziness. The early fuzziness is where arts-based tools, and VCMs contributed experiential knowledge and values to the process. Previous studies have highlighted the fuzzy front end as the most fruitful co-design moment (Sanders, 2005). In the conceptual phase all strategic, transdisciplinary, design, and

socio-cultural arenas interacted. Then, the transdisciplinary design arena ascended and achieved a collaborative trajectory with sustained transdisciplinary co-design moments in the embodiment phase. Finally, we recognise a fuzziness towards the back-end that may be considered rather unconventional and certainly not desired. In this case, it happened due to the change in the professionals and sportspeople. This breakdown towards the end had a significant rise in the costs and duration of the process. This highlights the importance of maintaining communication, awareness, and willingness to collaborate throughout the process.

Some actors were recognised to have crossed the boundaries of design arenas (Gaete Cruz et al., in press). We could say that some sportspeople transitioned from the sociocultural towards the transdisciplinary design arena to sort more locally-suitable building solutions. One of the main facilitators of the collaboration achieved with one of the skaters was that he was a technical draftsman. So he knew how to understand, proofread and produce a technical design tool in the way the design team did. Using such visuals was easy and became a permanent communication language. Maintaining this long-lasting relationship throughout the process encouraged the skater to pursue strategic aims. His started to collaborate with the Ministry in charge, the National Sports Institute, and some other relevant actors in the field pursuing the implementation and early activation of the space. Somehow this depicts how an actor may transition from the sociocultural towards the transdisciplinary design arena and end up acting in the strategic one.

5. Conclusions

This study developed a framework for co-design processes to conceptualise and analyse design in collaboration. The framework follows a previous study and extends it into the three main design phases. We tested the framework by analysing a case in which the first author was involved in practice. Although a linear sequential framework, it clarifies the diverse collaborative interactions that occur in the cycles of problem-solving and solution-generation (Cross, 2018a). It depicts the variety of design aims pursued using VCMs and contributes to measuring co-design (Szebeko & Tan, 2010).

The study suggests that VCMs may contribute to co-design throughout the whole process. During the conceptual phase they mainly contribute to knowledge inquiry and collective brainstorming toward shared understandings. In the embodiment phase, they facilitate the analysis and evaluation of alternative solutions. In the detail phase, they contribute to integrating technical knowledge of experienced actors (Sanders, 2009). The analysis of planned and non-planned methods goes one step further in conceptualising the complexities of co-design processes, and the need for flexibility (Gaete Cruz et al., 2021). This study suggests that fostering col-

laboration and shared decision-making throughout the design phases may improve the suitability of the projects (Gaete Cruz et al., 2021).

This study from practice showed that co-design, while often understood as an idealist endeavour, has genuine and concrete benefits and challenges. One of the main difficulties experienced in the study was maintaining the awareness and willingness of the actors to maintain a collaborative approach. We conclude that awareness and willingness to collaborate are needed for the successful use of VCMs, and to achieve the aims of co-design (legitimacy, context specificity, and feasibility; Gaete Cruz et al., in press). The collaborative aim of the overall process should be known by all parties to manage expectations and deal with power issues. Such awareness and willingness will condition the availability to get involved, listen to others, and ultimately co-design. On the other hand, while some might think that co-design questions the contribution of urban landscape designers, in such diffuse collaborative settings, it may emphasise their leadership and facilitators role highlighting the value of their problem-solving and solution-generation expertise (Cross, 2018b). The previous, only if achieved with high doses of empathy.

We also conclude that co-design is forcefully a flexible process. Flexibility is needed in planning such processes, undertaking them, and evaluating them. However, such flexibility in co-design processes has drawbacks: Co-design is less linear, more time-consuming, and more expensive than conventional processes. It involves more people, activities, and innovative methods, and consequently, its management is difficult but essential. Despite the above, great democratic, inclusive, and just benefits can be achieved when co-design processes embrace their challenges and pitfalls. In doing so, more context-specific projects can be achieved, more legitimate and empowering spaces can be created, and ultimately, more feasible projects can be implemented.

In this ARTd case study, we had the unique opportunity to plan, act, and reflect throughout a co-design process. Our process-oriented approach allowed us to analyse what happened between the planned activities and experience how VCMs were used daily to exchange views, express points of view and solutions, and make design decisions. Although the process outlined is an analytical reduction of reality, it illustrates the diversity of co-design acts and allows for generalisation and further discussion. Despite being an analytical tool, the co-design process framework captures the diversity of trajectories within co-design practice.

More applied research studies are needed to fully understand how VCMs contribute to co-design processes. For instance, the use of digital and non-digital VCMs could be studied. On the other hand, the co-design process framework we developed can be used to study other non-visual methods, the evolution of collaborative images, or the use of softwares in co-design practice. It may also contribute to analyse how knowledge and

values are integrated into co-design processes. We argue the framework may be useful to plan co-design processes in practice.

Co-design may contribute to better informing the projects, legitimising the processes, and improving the appropriateness of the designed spaces (Gaete Cruz et al., in press). Further research may focus on how co-design may condition the implementation and operation phases fostering collaboration in the operation, the activation, and the maintenance of future public spaces.

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Conflict of Interests

The authors declare no conflict of interests.

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