# CODESIGN: A NEW FRAMEWORK FOR LANDSCAPE ARCHITECTURE IN INFORMAL SETTLEMENTS

by

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A THESIS

Presented to the Department of Landscape Architecture
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Master of Arts

June 2019

THESIS APPROVAL PAGE

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Title: Codesign: A New Framework for Landscape Architecture in Informal Settlements

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Degree awarded June 2019

# THESIS ABSTRACT

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Rapid urbanization is occurring inequitably, resulting in the proliferation of informal settlements. Lack of access to adequate sanitation, clean water, and other elements of a healthy human habitat, such as green space, are among the most frequent public health issues in informal settlements. Codesign, a collaborative design approach, is particularly well suited for landscape architecture in informal settlements. However, codesign in landscape architecture lacks a guide for its process and activities. Drawing on the traditions of collaborative design in public planning and product design, this research presents a new codesign framework for landscape architecture. During development of the framework, a version was used in a green sanitation infrastructure project in an informal settlement in Lima, Peru. Lessons learned were used to improve the framework. This research is intended to make it easier for landscape architects to facilitate codesign and thus make it easier for them to work in informal settlements.

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ACKNOWLEDGMENTS

This work would not have been possible without the support of colleagues, friends, and advisors. I would first like to thank Professor Kory Russel. I will always remember that fateful day when we were sitting in his office, and he passed me a photo of a slum in Lima, Peru, and said, “I have a potential project here if you are interested.” That was the beginning of many opportunities Kory offered me and coached me through as I pursued them. I will always be grateful to him for his mentorship, his faith in me, and his ongoing support. I would also like to thank the whole x-runner staff with whom I worked in Lima. Again, none of this would have been possible without their partnership, guidance, and support. In particular, I would like thank the COO of x-runner, Arturo Llaxacondor, for his thoughtful interpreter services during codesign workshops and his commitment to the community x-runner serves. Also, I would like to thank the CEO of x-runner, Raul Breceno, for helping to build partnerships with local community leaders and provide support during my time in Lima—including granting permission for me to work in their office while I was there.

I would also like to thank the University of Oregon for providing opportunities, like the one I have had, to work internationally. And I would like to thank the entire faculty in the Department of Landscape Architecture for the unending support they have provided me during these demanding years. I would like to thank Chris Enright, in particular, for stepping in at a crucial point and providing thoughtful and much needed feedback on the creation of this document. Thanks also goes to the United States Environmental Protection Agency for funding a portion of this research.

It is also certain that I owe great thanks to my parents, Wendy Mitchell and N. Dean DeHeer, for their indefatigable moral support. And last but not least, I would like to thank Bobby Skibber for managing Solstice, my landscape contracting business, while I was focusing on my academic work.

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# CHAPTER I

# PROBLEM STATEMENT

> Professional designers in every field have failed in their assumed responsibility to predict and to design-out the adverse effects of their projects. These harmful side effects can no longer be tolerated and regarded as inevitable if we are to survive the future…There is certainly a need for new approaches to design if we are to arrest the escalating problems of the man-made world and citizen participation in decision making could possibly provide a necessary reorientation.
>
> Nigel Cross (1972)

For the first time in human history, most people live in cities. According to the United Nations (2014), 54% of people currently live in urban areas, and that number will likely rise to 66% by 2050. This rapid urbanization is not occurring equitably. The radical changes in the way humans settle and dwell are leading to deeply concerning social and environmental consequences. Some of the most troubling implications of this rapid and inequitable urbanization include increased resource scarcity, mounting pollution levels, and the accelerating growth of slums (settlements where pollution and resource scarcity are often at their worst). Informal settlements (the term used in this thesis to refer to slums) are generally characterized by a lack of administrative and legal recognition by local governments; inadequate access to clean water, sanitation, and public infrastructure; low quality and unsafe housing conditions; and overcrowding (UNHSP, 2003). Currently, informal settlements house over 1 billion people and will soon reach one third of the total global population (UN-Habitat, 2016). By 2050, the UN-Habitat estimates that 3 billion of the 9 billion people living on the planet will be living in informal settlements (Werthmann, 2013).

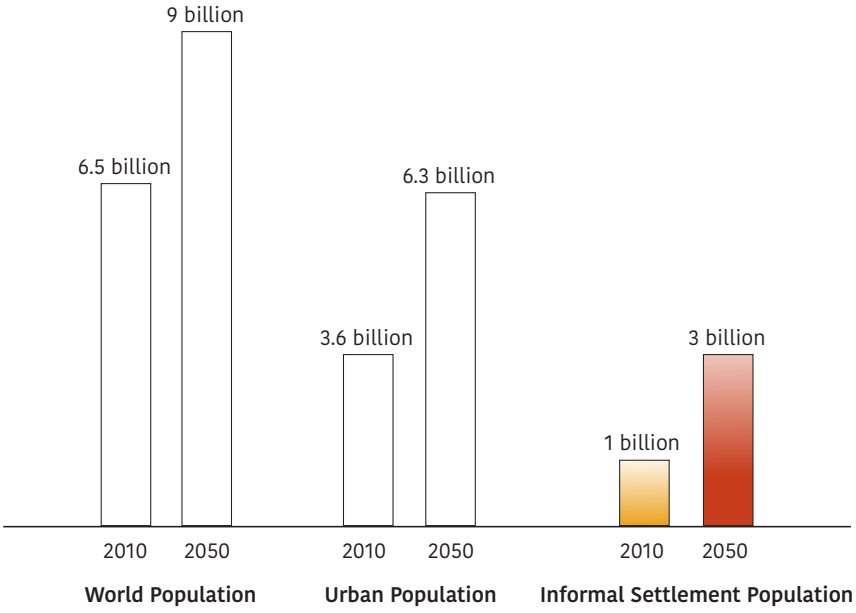



Figure 1. Global Population and Urbanization. *Note.* Image adapted from Christian Werthmann's *10 Things Designers Need To Work On* (Werthmann, 2013).

The scale of the problems associated with this type of urban growth is staggering. Consider the lack of sanitation services alone: in 2013 the excreta of nearly 58% of the world's households (4.1 billion people) was discharged into the environment without undergoing any form of treatment (Baum, Luh, & Bartram, 2013). This type of unmitigated discharge is no small matter and equates 20 million tons of feces and 1.1 billion gallons of urine flowing into the landscape each day. This lack of sanitation services represents a significant environmental hazard for human health and a substantial source of pollution and eutrophication of waterways (Katukiza et al., 2010). Also, a lack of sanitation services at this scale represents more than a landscape-scale problem: it is a global problem with global consequences (Baum, Luh, & Bartram, 2013).

Lack of access to adequate sanitation and other amenities which contribute to healthy human habitats, such as access to green space, is one of the most common public health risks confronting communities living in informal settlements. As of 2010, 2.7 billion people either relied on sanitation facilities that do not meet basic hygienic standards or had no facility at all (Joint Monitoring Program, 2017). This lack of adequate sanitation provision pervades informal settlements and is one of their defining characteristics (UNHSP, 2003). Such a service gap in basic standards of public health presents a major health risk. For example, diarrheal disease is still the second leading cause of death for children under the age of five (Walker et al., 2013). In addition to the increased risk of diarrheal disease in informal settlements brought on by inadequate sanitation, an acute lack of access to other services (including public green space) presents associated dangers to physical and mental health. There is a growing body of research showing correlations between access to green space and better human health (Maas, 2006; Maas et al., 2009; Velarde et al., 2007). The benefits range from lower rates of allergies and asthma (Ruokolainen et al., 2015) to lower rates of crime and depression (Kuo & Sullivan, 2001a, 2001b; Garvin et al., 2012; South et al., 2018; Branas et al., 2018) to higher rates of recovery from stress and illness (Thompson et al., 2012).

This global urban trend can feel overwhelming, and it may be for this reason that practitioners and scholars of landscape architecture so often overlook or push aside the subject of informal settlements, though they are the fastest-growing urban segment globally. Perhaps they do not feel they have the necessary skills to tackle such severe problems. Unfortunately, the next generation of landscape architects will have no choice but to confront these seemingly intractable social and environmental calamities. If our

existing tools have proven to be insufficient in meeting the urgency and scale of the problems we are facing collectively, how do we address these issues, which Horst Rittel has dubbed *wicked problems* (Rittel & Webber, 1973)?

It is clear that traditional design and planning approaches in landscape architecture have not done enough to address social inequity and environmental degradation (Hudson & Marvin, 2010; King et al., 1989). However, the rise of the *slum class* and the continued devastation of Earth's ecological systems have not occurred in a vacuum; thus, we can address some of their causes. In part, the rapid growth of informal settlements and other forms of inequitable urbanization are due to current global economic and political realities: dynamics of privilege and power that shape access to resources, healthy living conditions, and a dignified way of life. Melissa Leach (2010), author of *Dynamic Sustainabilities: Technology*, *Environment*, *Social Justice*, presents a recommendation for changing these dynamics. Leach writes, "Linking environmental sustainability with poverty reduction and social justice, and making science and technology work for the poor have become central practical, political, and moral challenges of our time" (p. ix).

Addressing poverty and environmental sustainability is indeed a formidable task. How do we ensure that the socially and economically marginalized have the *techne*—the tools, techniques, and technical know-how—they need to participate in building a more socially just and healthy living environment? I believe one potential answer is to expand the design and planning process in landscape architecture to include the creative capacity of the people directly confronted with the issues in question—provide marginalized

groups opportunities, tools, and techniques to enable their contribution to a design process aimed at solving problems they help to identify and articulate.

From Lawrence Halprin's RSVP cycles to James Surowiecki's testament to "The Wisdom of Crowds," researchers have celebrated the creative potential of group collaboration for decades (Halprin, 1969; Surowiecki, 2004). In addition to the generative capacity a collective process can provide, it is also claimed that collaborative design can lead to less tangible benefits as well. Stanley King (1989), a founding figure in the history of collaborative design, acknowledges that a series of codesign workshops can lead to the "growth of healthy vitality in the community" (King et al., 1989). Another guiding figure in community participation in landscape architecture projects has been Randy Hester. Hester states that the practice of collaborative approaches to design empowers participants and can lead to "community building" (Hester, 1990). Despite the conviction these authors have about the intangible benefits of collaboration, it is unclear what exactly is meant by *healthy vitality* and *community building*. Part of the answer may lie in the effects of the process itself.

It has, indeed, been argued that the participatory process itself can transform a community. This transformation may be partially due to the redefining of social roles during the process and the added level of agency given participants during the design development. As will be described in chapter three, traditional roles in a classical design approach and power relations between those roles can be redrawn during a codesign process (see Figure 2). In this way, at its essence, codesign is a form of transversal political action—non-hierarchical and role-shifting direct democracy—what some are beginning to call "Design as Democracy" (de la Peña et al., 2017).

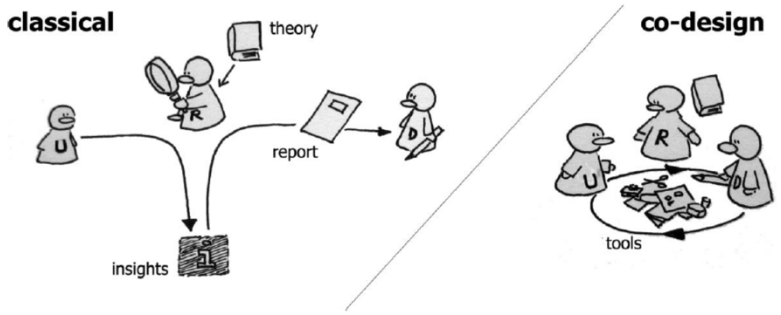



Figure 2. Comparing Classical and Codesign Roles. *Note.* Seen on the left are the typical classical roles in user-centered design, where the user is viewed as an object for study. Seen on the right, codesign incorporates the user as a subjective agent in the creative process, shifting the roles of researcher, designer, and user (Sanders & Stappers 2008).

Furthermore, the power of collective creativity to generate high-quality, tangible outcomes is evidenced by its adoption by product designers. Within the field of product design, there is a growing belief:

> Complex design problems require more knowledge than any single person can possess, and the knowledge relevant to a problem is often distributed among all stakeholders, who have different perspectives and background knowledge, thus providing the foundation for social creativity. Bringing together different points of view and trying to create a shared understanding among all stakeholders can lead to new insights, new ideas, and new artifacts. (Fischer, 2003, p. 4)

Unlike in the practice of landscape architecture, the continued success of a product depends on the willingness of consumers to purchase the product. Thus, it stands that the greater degree to which a product meets consumer demand, whether latent or explicit, the more successful that product will be. Given the degree of contextual complexity in the

environments within which contemporary products are being developed, many in the product design industry are embracing collaborative design as a means to more clearly navigate this ambiguous terrain.

Despite the evidence of the benefits of collaborative efforts, there is still a high degree of variability in the success of participatory design approaches. Hester (personal interview, Hester, April 11, 2019) has claimed that this inconsistency in the success of so-called participatory processes is that "it's hard to do well." The difficulty in providing consistent, high-quality facilitation may be due, in part, to the lack of a systematized participatory design method. Indeed, there is no clear path for accessing the ingenuity and problem-solving ability collective creativity provides. The question remains: how best to engage this generative source while designing? A clear methodological process remains absent.

In order to address this absence, the research outcomes in this thesis aim to provide a comprehensive codesign framework by establishing a clear phasing of the process and a diverse set of activities suited to soliciting creativity. This organizational tool has the potential to increase the legitimacy, rigor, and reliability of collaborative design. It is notable that this framework can be used across design fields; however, it is particularly well suited for the practice of landscape architecture in informal settlements. Given the prevailing conditions found in these locations (namely, a lack of formal government administration and a high degree of direct community participation in the organization and construction of the built environment), participatory design dovetails well with the ground conditions of informal settlements. This recognition has recently

been formalized by the UN-Habitat's establishment of a Participatory Slum-Upgrading Programme (UN-Habitat, 2016).

# CHAPTER II

# OVERVIEW OF METHODS AND OUTCOMES

The research presented in this thesis has three main goals. The first goal is to provide an overview of the history and current state of collaborative design, tracing two branches: one in planning decision making and one in product design. The second goal is to provide an organizing framework for the codesign process along with the tools, techniques, and tactics used during the process as they can be applied in landscape architecture. The third goal of the research is being fulfilled as I apply my codesign framework for landscape architecture as part of a green sanitation infrastructure project in an informal settlement in Lima, Peru. Lessons learned from this project have been used to refine and improve the codesign framework.

The first part of the research was completed using the methods of literature review and expert interviews. I began by searching databases of articles and books using the terms *codesign* and *landscape architecture* or *participatory design* and *landscape architecture*. It quickly became clear that codesign was being used in product design (specifically technology interface design) with a high degree of sophistication and rigor. However, the subject of an established practice of codesign was conspicuously absent from the literature specific to landscape architecture. This absence in the literature led me to investigate codesign more broadly. This review resulted in the mapping of two parallel histories in the development of collaborative design and a description of the current practice of codesign.

The second section of research was an act of synthesis and translation. The suggestions provided by practitioners of public planning for organizing collaborative design date back thirty years and are in need of updating.

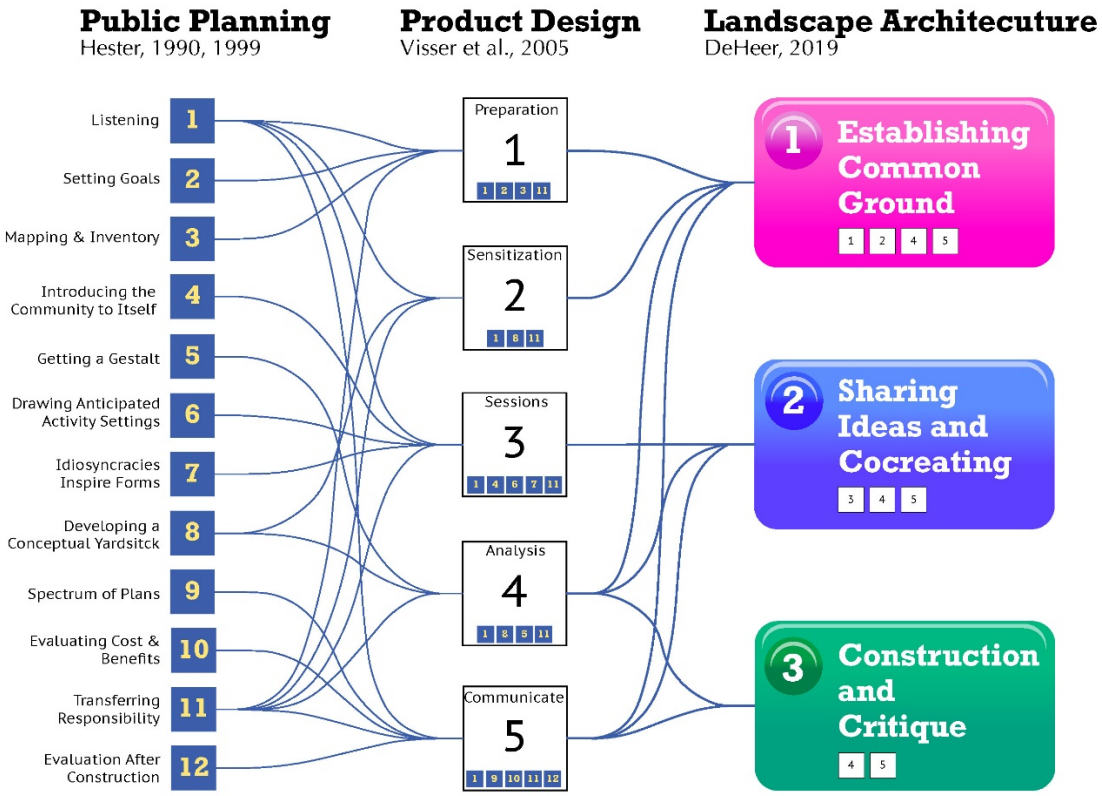



Figure 3. Existing frameworks from public planning and product design and how they contribute to the author's framework for landscape architecture.

Additionally, researchers in the field of product design have provided more recent collaborative design frameworks which can be used to inform the updating process. The research presented in this thesis synthesizes existing organizational systems to create a new framework for the process of codesign in landscape architecture particularly well-suited to working in informal settlements and, by so doing, contributes to the update

of codesign practice and provides a clear set of steps and activities for landscape architects new to codesign.

The third section describes how the aspects of the codesign framework have been applied in a green sanitation infrastructure project in an informal settlement in Lima, Peru. The framework was under development during the design period in Lima. As a result, lessons learned from this experience have been used to improve and guide the organization of the framework. Though still in a nascent form, the application of the proto-framework resulted in significant outcomes. One of which was a new concept: a hybridization of product and place, green space and sanitation. Recognized for its potential to radically transform informal settlements from insalubrious, noisome places into models for socially and environmentally just urban design, the Sanitary Green Space prototyping and pilot testing was funded by the U.S. Environmental Protection Agency.

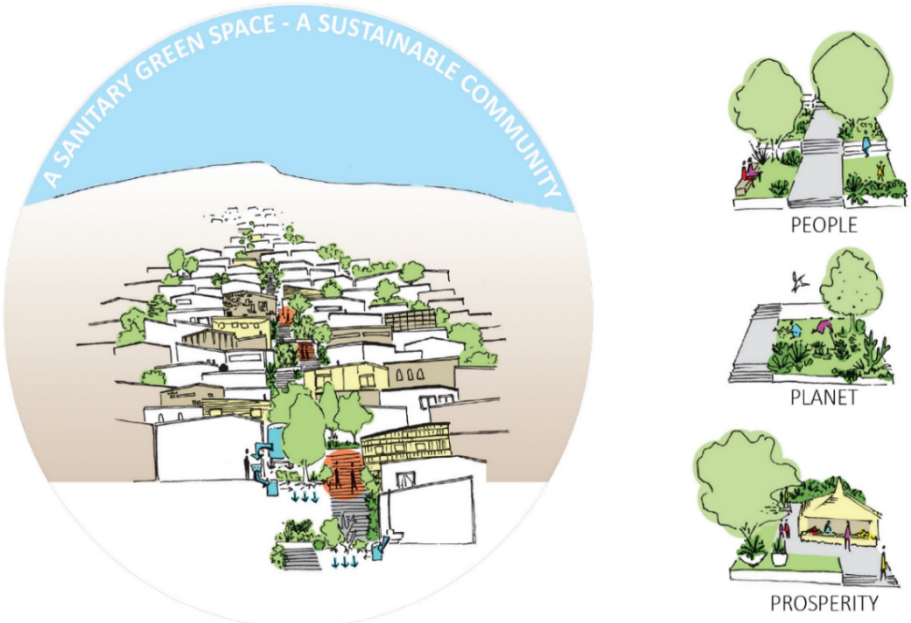



Figure 4. Images used for EPA P3 Grant proposal. *Note*. Illustrations by Nicholas Sund and Summer Young.

# CHAPTER III

# CODESIGN AS AN APPROACH TO ADDRESSING THE CONTEMPORARY DESIGN CONTEXT

> Participatory design is hands-on democracy in action.
>
> de la Piña, 2017

The contemporary design context for landscape architects is fraught with *wicked problems*—social and environmental ills of a seemingly intractable character. The complex contexts of these wicked problems makes them particularly difficult to address. How can landscape architects be sure that they are not creating new problems with their solutions to existing problems? One potential answer is to rely more heavily on collaborative design. With its many benefits, codesign can provide a more equitable approach to urban development and landscape architecture research while supplying an abundant source of generative capacity through collective creativity.

## Why Engage in Collaborative Design?

As is evidenced by the New Landscape Declaration (Landscape Architecture Foundation, 2016), it is not as if the discipline of landscape architecture has been blind to the rise in wicked problems associated with increased urbanization. However, the solutions that have been offered by practitioners of landscape architecture often fall short of addressing the underlying causes of the rise of inequitable urbanization and the advance of social and environmental perils. Most notably, the strategies of Landscape Urbanism and Ecological Urbanism—though touted for their far-reaching vision—have

so far fallen short of producing an equitable city, as evidenced by the current state of urbanization. Criticisms have been made that these planning approaches do little to address the underlying causes of the environmental problems they are trying to solve (Hudson & Marvin, 2010). The resulting creation of what Hudson and Marvin (2010) call transposable *eco-enclaves* that only the most affluent can afford, promises a monstrous international habitation style: commodified sustainability sold to the highest bidder. The question is then raised, "But what about the rest of us?" As Landscape Urbanism and Ecological Urbanism fail to address the underlying inequity in the power relations of capitalist political-economic systems, a demand is placed on landscape architects to provide an alternative design process that creates new political possibilities and new landscape imaginaries (Dawson, 2018). Codesign provides a socially just alternative to the proliferation of urbanisms. In doing so, the ability of codesign to affect social change brings relevance to the discipline of landscape architecture, which has traditionally been in service to the affluent and politically influential.

Research Through Codesigning

In addition to the relevancy codesign brings to landscape architecture through its engagements with contemporary social inequities, it lends legitimacy to the discipline in other ways. There is widespread acceptance of the need for discipline-specific research methods for generating new and reliable knowledge among practitioners and scholars of landscape architecture (Deming & Swaffield, 2010). In addition, it has also been recognized that there are knowledge and communication gaps between designers and researchers in the field. Furthermore, landscape architecture as a discipline is being called on to address some of the most daunting social and environmental challenges of our time.

Codesign as a form of research by design (or as research through designing) provides a robust method for addressing these pressing issues facing landscape architecture.

Codesign, as a type of Participatory Action Research (PAR) (Deming & Swaffield, 2010), could function as a discipline-specific research method. However, it has yet to gain widespread acceptance as a legitimate scientific research method in landscape architecture (Hemmings, Crabtree, Rodden, Clarke, & Rouncefield, 1998) despite growing evidence that new and testable knowledge can be created from the act of designing and making artifacts (Lenzholzer, Duchhart, & Koh, 2002). The systematic nature of the codesign framework presented in this thesis could lend legitimacy to this form of research. Though the knowledge gained through codesign as a form of PAR can take—in the eyes of many scientific researchers—unfamiliar forms, when done systematically and with methodological rigor, the results can meet a high scientific standard (Lenzholzer et al., 2013). As applied in the context of this current research, the knowledge created includes oral histories, temporal-geographic context maps, green sanitation infrastructure details, and site-specific landscape designs.

Facilitated codesign activities allow for researchers, designers, and the intended users of the design to all interact and share knowledge. The sharing achieved through this shift in roles bridges the divide between practice and research while breaking down the walls of information silos. Figure 2 on page six depicts the shifting roles and innovative sharing that takes place during codesign. By breaking the divide between researcher and designer, a significant opportunity is created for applied design to be informed by science and vice versa.

Many of the most difficult problems landscape architects face occur in the context of rapid informal urbanizing. In the case of informal settlements, the contribution of local knowledge through PAR can help create context-driven solutions to complex problems that coalesce in informal settlements. By inviting community members to participate in the design process, the likelihood of project success is increased in two ways. First, using contextual knowledge through PAR will improve design suitability, and second, community members will be more likely to take ownership of the design and, thus, use and care for it. In summation, codesign as a form of PAR can provide opportunities for discipline-specific research methods, cross-sectional sharing of information, and increased project sustainability potential.

Empowerment: Codesign as a Form of Transversal Political Action

Codesign, as it is applied in landscape architecture, redraws the boundaries of traditional design roles and fosters direct participation from those who will be most impacted by the results of the design. De la Piña et al. (2017) have described this type of design as a form of democracy—a form of political action. When considering the process of codesign as political engagement, we can begin to understand its ability to empower, to provide agency and control, hope and self-assurance. This type of redrawing fits within a history of transversal political action aimed at destabilizing inequitable power relations through dismantling traditional social roles and hierarchies.

The conceptual development of transversal political action has not been linear; thus, it is difficult to trace its history in a chronological fashion. However, we can identify the research where the concept has emerged and link those efforts through their mutual intent to provide tools for resisting the inequity of established, capitalist,

politico-economic power relations. The concepts of transversality and transversal political action first take the stage in the work of French philosophers Gilles Deleuze, Felix Guattari, and Michel Foucault. With their work beginning in the early 1960s and continuing for almost three decades, these three philosophers developed concepts related to transversal action. One particularly significant concept that emerged during this time is the *diagram*, also referred to as the *abstract machine*. A diagram may seem like a familiar concept; however, in this case, the term refers to a specific mappable condition.

Traditionally, professionals in landscape architecture use diagrams to explain abstract concepts such as systems and time. The term *diagram*, as it is used in the context of transversal political action, refers to the map of all existing polarities of power relations between people. Gilles Deleuze (2016) describes the diagram as "a display of the relations between forces which constitute power in…minutely small relations" (p. 36). As it applies to society as a whole, Deleuze states that "the *diagram* is…a map, a cartography that is coextensive with the whole social field" (p. 34).

Transversal political action operates inside this diagram and recognizes that power relations exist as macro-political structures but are manifest in micro-power relationships between actual individuals. It is by changing the power dynamics between actual individuals, by seeking knowledge in diversity and leveling hierarchies between established social roles--researcher, designer, and community member--that real radical change occurs. Transversal political action is a form of direct democracy that diffuses power concentrations and redistributes forces of power more equitably. As transversal politics is actualized in urban codesign, it invites community members to contribute as equals to a pluralized design for their community's future.

Mark Westmoreland (2013) explains that "Guattari thought of transversality as a strategic tool for breaking through what appeared to be fixed institutional procedures and lines of demarcation." He goes on to say that Guattari "described transversality as a bridge or deterritorialization…"(p. 8).

> To deterritorialize is to rearrange the rules we are given, the roles we are expected to play, and the practices that perpetuate regimes of unjust power relations. This rearrangement allows for new possibilities to emerge. With the idea of deterritorialization, transversality achieves a stronger political bent. To deterritorialize is to take territories (lines, boundaries, and the like) that are unjust and redraw the property lines.
> (Westmoreland, 2013, p. 11)

The power relations manifest in contemporary techniques of administration operate by limiting and simplifying the field of possible social relations and possible democratic engagement in guiding the polis:

> In effect, we live in a legal, social, and institutional world where the only relations possible are extremely few, extremely simplified, and extremely poor. There is, of course, the relation of marriage, and the relation of family, but how many other relations should exist, should be able to find their codes not in institutions but in possible supports, which is not at all the case!…We live in a relational world that institutions have considerably impoverished. Society and the institutions which frame it have limited the possibility of relationships because a rich relational world would be very

> complex to manage [*gérer*]. We should fight against the impoverishment of the relational fabric. (Foucault, 1982, p. 158)

To this end, codesign resists simplifications and enriches social relations through the collaborative activities of saying, making, and doing and thereby provides pathways to shift polarities in the power dynamics imbedded in a community.

## What Is Codesign?

Codesign in landscape architecture fits into the larger domain of participatory design and planning. One of the issues facing participatory design and planning is their ambiguous character. We hear so often that a municipality has undergone a *participatory process* yet there is little or no consistency in what this actually means. Furthermore, many people that claim to be doing participatory design do not follow a systematic program. This has, in part, contributed to a slow adoption of codesign in landscape architecture (Hester, personal interview, April 11, 2019). In order to clarify the position of codesign in landscape architecture within the larger domain of participatory design and planning, and to present a clear explanation of what codesign is, it is important to understand its context. Thus, I present a brief history with two tributaries of practice, one flowing out of participatory planning in the USA, and the other from Scandinavian origins. Both tributaries lead to the nascent practice of codesign in landscape architecture. In order to provide further context, I will also discuss codesign as a type of meta-design (the structuring of the design process). Finally, I will present three types of creativity and the tools codesign uses to elicit them.

### Introducing Design Democracy

Research shows that participatory design has deep roots in western democracy (Sanoff, 2006, 2007, 2008; Sanders & Stappers, 2008). As Henry Sanoff has pointed out in his article *Multiple Views on Participatory Design*, the roots of community participation in design stretch back to the democratic ideals of Plato's Republic (Sanoff, 2008). In 1978, Sanoff published one of the foundational texts addressing community participation in design, and he continues to write on the subject's history. He reminds us that the beginnings of participatory design "lie in the ideals of a participatory democracy where collective decision-making is highly decentralized throughout all sectors of society, so that all individuals learn participatory skills and can effectively participate in various ways in the making of all decisions that affect them" (Sanoff, 1978, p. 213). You see this recognition of democracy and its centrality to the practice of participatory design and planning in other, more recent, publications as well including *Design for Ecological Democracy* (Hester, 2006) and *Design as Democracy: Techniques for Collective Creativity* (de la Piña et al., 2017).

It is indeed the case that during the civil rights movement in the 1960s, many people began to feel that voting was insufficient as the sole tool for democracy. The need for more direct participation in political and planning decision making became a high priority. It was from this desire for more diverse and direct inlets for democratic action that one of the two main tributaries of participatory design developed.

The second branch stems from the desire to improve the suitability of new products for their intended users. Scandinavian research that developed in the 1970s began to include intended product users in the development of new industrial equipment.

A quick glance at the history of participatory design sheds light on how these two tributaries have developed and the state of codesign in its contemporary practice.

Participatory Planning

During the 1960s civil rights movement in the United States, a social movement emerged in which citizens demanded more opportunities for direct participation in the decisions that affected their lives. At the outset, an advocacy model was presented by Paul Davidoff (1965) in which disadvantaged groups received representation through advocates during planning meetings. Davidoff and others recognized that "business elites and other articulate, wealthy, and powerful groups have the skill and resources to shape city plans to serve their interests," but the "poor and powerless" were left out (Davidoff, 1965, p. 333). In order to address this problem, Davidoff argued that planners should act as "*advocates* articulating the interests of these and other groups much as a lawyer represents a client."

> For example, a planner might develop and advocate for a plan which would meet the needs of poor West Indian residents of London's Brixton neighborhood. Another planner might have a different plan representing the point of view of shopkeepers in the same area. And yet another might work with Brixton environmentalists to develop and advocate for a plan based on environmental concerns. A local planning commission could weigh the merits of the competing plans much as a court hears and weighs views from lawyers. (Davidoff, 1965, p. 421)

Though this well-intentioned step toward social justice attempted to provide a voice for those that did not have a seat at the decision-making table, it has ultimately come to be criticized for limiting direct participation (Arnstein, 1969; Sanders, 2008; Sanoff 2007). In 1969, Sherry Arnstein published *A Ladder of Citizen Participation* in which she provides a typology of citizen involvement and arranges the types following their "degree of citizen power" (Arnstein, 1969, p. 217). In Figure 5, she presents the typology graphically, as a ladder, with citizen control at the top and manipulation at the bottom.

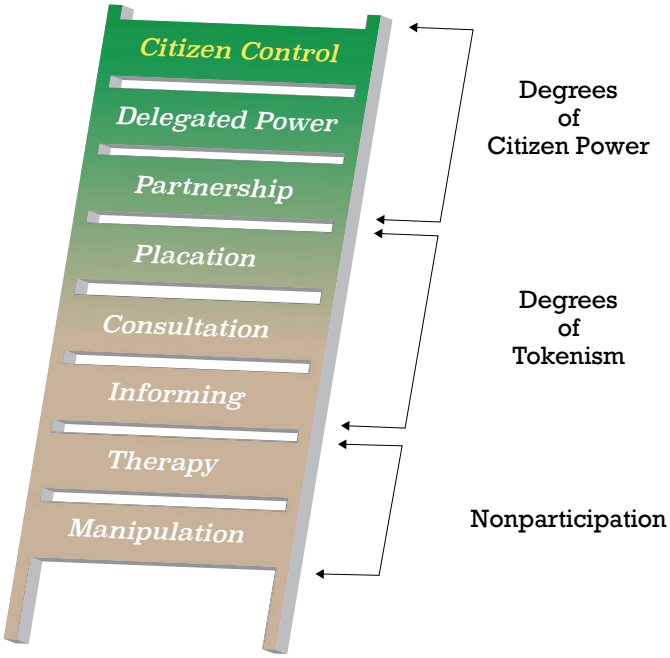



Figure 5. Arnstien's Eight Rungs on a Ladder of Citizen Participation.

Local governments have continued to offer opportunities for citizen participation such as public hearings and requests for feedback on design proposals. However, when

considering Arnstein's ladder, these opportunities for citizen involvement rarely surpass the consultation, informing, and placation of token participatory design events. King, Conely, Latimer, and Ferrari (1989) argue that the system of meetings offered by local governments, in many cases, fall short of democratic and agency building participation:

> Referendums, public hearings, and public meetings leave those who are concerned with community design doubtful that results represent community opinion. Many aspects of these processes limit the individual citizen's ability to participate in planning: the adversarial nature of the proceedings encourages negative opinions; the lack of notice about meetings and of timely access to information limit the depth of understanding of issues; only one person at a time can speak, allowing the most articulate and vociferous to dominate; and the format itself lacks procedure for visualizing creative alternatives. (King, Conely, Latimer, & Ferrari, 1989, p. 4)

Even beyond the internal dynamics of the town-hall-style planning meetings, the limited diversity of opportunities provided favors the affluent and those with abundant free time. This has resulted in some very unfortunate circumstances. "As wealthy citizens have embraced participation, and environmental risks have become clearer, an increasing number of dangerous land uses such as landfills, toxic sites, and polluting industries have been located in poor communities" (Sanoff, 2000, p. 26). Using the influence and opportunities provided by financial security, wealthy citizens have had a greater opportunity to decide how the places in which they live will develop through time. In doing so, they often move the land uses they do not want in their backyards into the

backyards of the disenfranchised. Manifesting itself as a toxic version of the *not in my backyard* ideology, agitators usher in environmental injustice. Sanoff (2006) writes,

> Today, participation has been used to preserve the quality of life for affluent and powerful citizens. Those who already have economic clout are involved in politics in ways that disproportionately increase their influence, making the practice of democracy increasingly biased against the economically disadvantaged. Similarly, citizen input has largely been reduced to reacting to, rather than initiating projects. (Sanoff, 2006, p. 16)

Sanoff (2008) argues something more purposeful is needed to combat this dysfunctional democracy. He suggestions "deliberative democracy" as one possible solution. Though the details of deliberative processes are not yet well defined, Sanoff writes that a deliberative democracy "introduces a different citizen voice than that associated with public opinion and simple voting" (p. 60).

> It seeks a citizen voice capable of recognizing other groups' interests, appreciating the need for trade-offs, and generating a sense of common ownership. The practical question for design and planning professionals is how best to be deliberative within conflictual, adversarial settings. (Sanoff, 2008, p. 60)

This deliberative approach has been described by Sanoff (2006) as "community design" and "community building." He writes,

> Community design stands for an alternative style of practice, based on the idea that professional technical knowledge is often inadequate in the resolution of social problems. It…emphasize[s] the involvement of local people in the social and physical development of the environment in which they live. (Sanoff, 2006, p. 14)

In the broadest sense, community design (or community building) is a movement that explores "how to make it possible for people to be involved in shaping and managing their environment" (Sanoff, 2006, p. 14). The productive process of community building decentralizes power concentrated in the affluent and politically powerful and diffuses it into a larger population, empowering each individual to have a role in the creation of the places they inhabit. Sanoff writes,

> Community building, in contrast to the 1960s federal programs where outside professionals selected priorities, sees resident groups playing a more central role in planning and implementation. It is dedicated to the idea that residents must take control of their own destiny and that of their community. Instead of seeing the old idea of citizen participation in government programs, community-building advocates see government participation in citizen initiatives. (Sanoff, 2006, p. 15)

This process of deliberation and idea exchange has been referred to as a transactive process. Hester (1990) notes that when "community designers design *with* people, not *for* people...they usually employ a...transactive process involving both users and experts, to make decisions on everything from goal-setting to construction and

management" (p. 8). The process is considered transactive because a transaction takes place—a mutual exchange of knowledge, experience, and aspirations. Between 1990 and the present, multiple books and articles on the topic of community building have been published (Hester, 2006; Linn, 2007; de la Piña et al., 2017). Of note are the publications that provide collaborative design activities to be employed during the community building process. It is from these publications that we begin to see the opportunity for the two branches of participatory practice to be braided together.

Product Design

At roughly the same time community building was beginning in the US, the business and product design world was also undergoing a change. Almost in tandem with the citizens' empowerment movement, product and software-interface designers in Northern Europe were recognizing that traditional design processes were not satisfying the needs of the users they were meant to serve. Designers recognized that they could meet users' needs in a more tailored way if the users had greater participation in the design process (Sanders, 2008). They determined that this was nowhere more apparent than in the workplace. Companies needed new technology that would be easy to use and quickly adopted by their workforces. To meet this need, codesign was used for the first time in Norway as an initiative between computer professionals, union leaders, and members of the Iron and Metal Workers Union collaborating together to introduce computer systems in the production process (Sanoff, 2008). In what followed, "several projects in Scandinavia set out to find the most effective ways for computer-system designers to collaborate with worker organizations to develop systems that most effectively promoted the quality of work life" (p. 58). This work was most notably

embodied by the "collective resource approach." Sanders describes the approach as putting together "the expertise of the systems designers/researchers and the situated expertise of the people whose work was to be impacted by the change. Thus, the approach built on the workers' own experiences and provided them with the resources to be able to act in their current situation" (Sanders & Stappers, 2008, p. 7).

The work produced from this approach opened an entirely new design process, one that engaged the user not only as a subject for study to inform market-driven design decisions but as a participant in the design process. This work led to the advent of cultural probes and generative tools used to map the context of those who would be using the products created by the codesign process. Cultural probes and generative tools will be covered in full detail in a later section.

User-Centered Design

Another branch in product design which is worth mentioning is user-centered design. User-centered design runs parallel to the history of codesign. User-centered design (also known as human-centered design) employs a strategy that views the user as a research subject that can provide valuable information for product design. Stopping short of including participants in making artifacts and participating in design, user-centered design applies a thorough research agenda with potential users as research subjects. The strategy was pioneered by Stephen Draper and Don Norman in 1986 and made famous in their book *User Centered System Design: New Perspectives on Human-Computer Interaction.*

User-centered design has had a degree of success in creating products for impoverished and vulnerable communities and has garnered recognition from large institutions. While IDEO.org is perhaps the most recognizable practitioner of user-centered design, the principles of this design approach have been lauded by numerous development and consulting organizations including the Bill and Melinda Gates Foundation, Dahlberg, DAI Global, and USAID.

One of the major differences between user-centered design and codesign is the approach of the designer. Sanders (2002) provides a clear description of the relationships between researcher, designer, and user in a user-centered process:

> In the user-centered design process, we are focused on the thing being designed (e.g., the object, communication, space, interface, service, etc.), looking for ways to ensure that it meets the needs of the user. The social scientist/researcher serves as the interface between the user and the designer. The researcher collects primary data or uses secondary sources to learn about the needs of the user. The researcher interprets this information, often in the form of design criteria. The designer interprets these criteria, typically through concept sketches or scenarios. The focus continues then on the design development of the thing. The researcher and user may or may not come back into the process for usability testing. In user-centered design, the roles of the researcher and the designer are distinct, yet interdependent. The user is not really a part of the team but is spoken for by the researcher. (Sanders, 2002, p. 1)

The usability testing Sanders (2002) refers to is an important step in collaborative design as well; however, when users are not included in the generative phase of design, researchers and designers place intended users "mainly in a reactive role" (Fischer, 2003, p. 89).

In user-centered design, research on the user groups is seen as relevant information for the designer who will do the designing. There is, however, little or no dialogue, deliberation, or transaction of knowledge and ideas between the user and the designer. Codesign, on the other hand, goes beyond just data gathering. Codesign is transactive; whereby, designers engage with user groups directly to solicit creativity while providing design guidance from the expertise they have gained during their professional training.

## Codesign Today

The two branches of participatory design are beginning to overlap. However, knowledge and discourse are still siloed within distinct disciplines. The diagram in Figure 6 shows the current layout of design approaches (Sanders & Stappers, 2008).

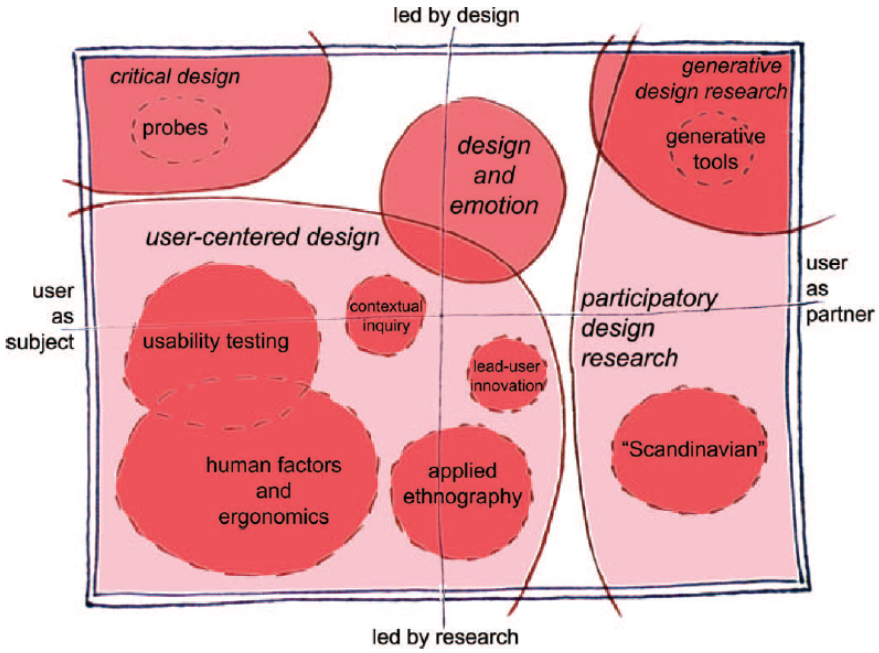



Figure 6. Diagram showing domains of product design and research. *Note*. Domains are organized using spectrums of motivation (research/design) and user participation (subject/partner) (Sanders & Stappers, 2008).

Codesign is the latest trend in the respective design fields and is described by Sanders and Stappers (2008) as *collective creativity*.

> The authors take co-creation to refer to any act of *collective creativity* [emphasis added], i.e., creativity that is shared by two or more people. Co-creation is a very broad term with applications ranging from the physical to the metaphysical and from the material to the spiritual as can be seen by the output of search engines.…co-design is a specific instance of co-creation…By co-design we indicate *collective creativity* [emphasis added] as it is applied across the whole span of a design process. (Sanders & Stappers, 2008, p. 6)

This move from designer-driven product design to user-driven product design has meant many changes for the designer. In fact, the roles of designer and user are both changing. With greater user participation in all aspects of the design process, from idea generation to decision making, the role of the designer is shifting toward that of facilitator, interpreter, and translator. More attention is being given to what Sanders (2008) calls the *fuzzy front end* of design development. This is the point in a design process when brainstorming, goal setting, and concept development occur. Sanders describes this shift:

> People who are not educated in design are designing; the line between product and service is no longer clear; the boundaries between the design disciplines are blurring; the action now is in the fuzzy front end of the design development process with a focus on experiential rather than physical or material concerns; the action in the fuzzy front end is all about new ways to understand and to empathize with the needs and dreams of people. (Sanders, 2006, p. 1)

Sanders (2007) organizes design into stages. The first stage, Sanders's fuzzy front end, is the most abstract. This is typically followed by prototyping and, finally, evaluation. The diagram in Figure 7 depicts Sanders and Stappers' (2007, 2008) stages of design.

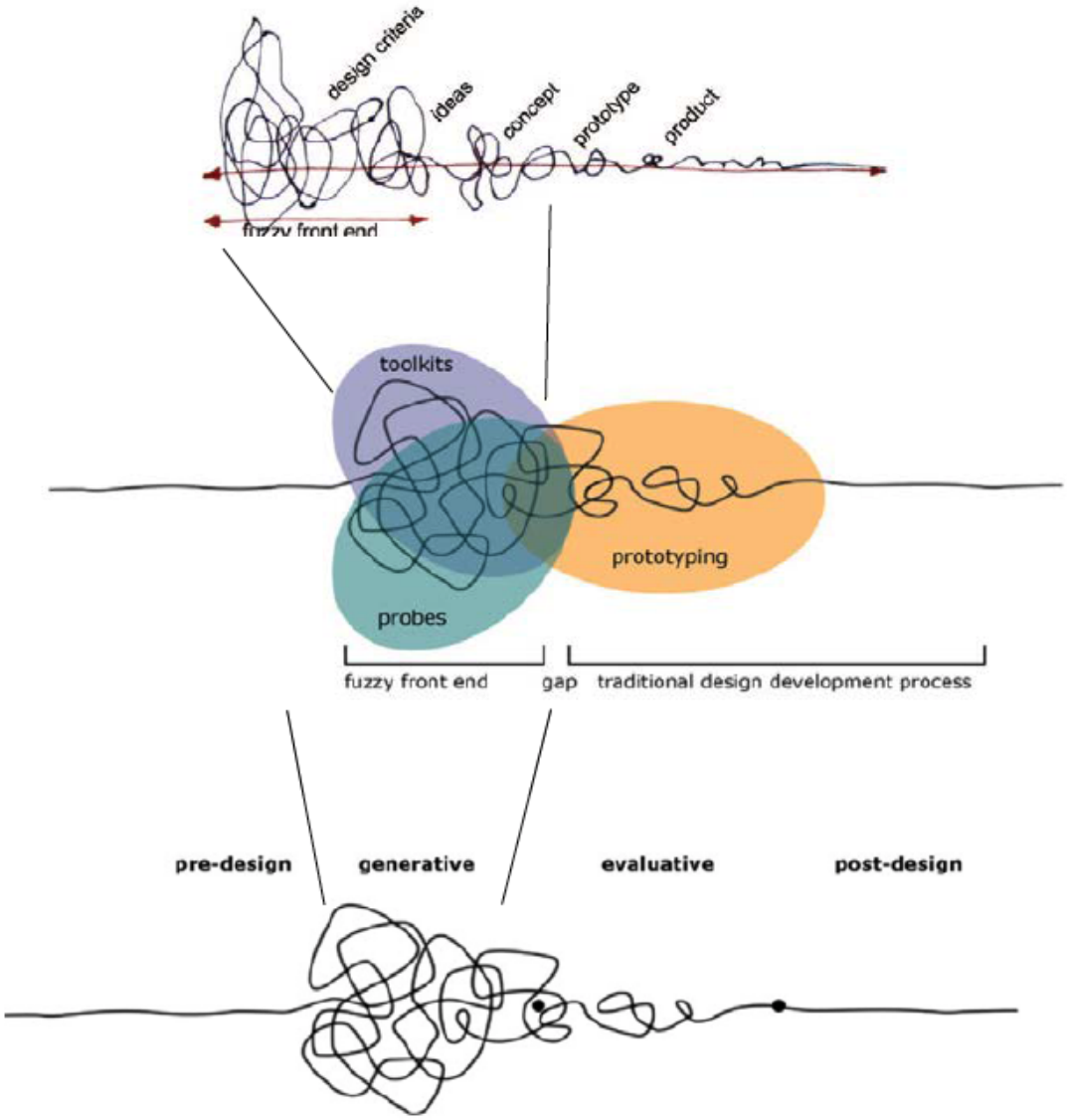



Figure 7. Design stages as presented by Sanders and Stappers.
*Note.* (Sanders, 2007; Sanders & Stappers, 2008).

As one can see from the diagram, the fuzzy front end is followed by the traditional design process where the resulting ideas for product, service, interface, etc. are developed first

into concepts and then into prototypes that are refined on the basis of the feedback from future users (Sanders & Stappers, 2008).

The product design and community building processes share certain commonalities, yet they also diverge. For both practices, goal setting at the beginning of the process is a critical step toward a successful outcome (Hester, 1990; Visser et al., 2005). While the development of codesign techniques in product design is driven by the success of the outcome (the success of the product on the market), community design is more focused on the process and how the effects of the process help to strengthen a community.

### Codesign as Meta-Design

It has been established that a design process itself can have an impact on those taking part in the process (de la Peña et al., 2017; Hester, 1990; Hester 2006; Linn, 2007). As such, the structuring of the process known as meta-design gains in importance. Fischer (2003) claims that "meta-design is a useful perspective for projects where 'designing the design process' is a first-class activity, meaning that creating the technical and social conditions for broad participation in design activities is as important as creating the artifact itself" (p. 3). Meta-design aspects of codesign include the organization, strategies, tactics, and activities that are part of the codesign process but are not considered design in the traditional sense. They are used in the fuzzy front end of the process to help inspire goal setting, concept generation, and testing during a proof of concept process. The details of these activities are described in a subsequent chapter. In meta-design, the breadth of what is typically considered design is expanded and a diverse

group of potential end users is invited to engage in these activities. Fischer and Scharff (2000) write:

> People have incredible capabilities when they adopt a designer role, and, under the right circumstances, people want to be and act as designers. In this context, "design" is a broad notion that involves activities in which a person wishes to act as an active participant and contributor in personally meaningful activities...when people have the need and desire to participate in a design process, we must provide contexts in which they can be designers. (p. 398)

Fischer and Scharff go on to articulate the need for what they describe as "convivial tools."

> Convivial tools allow users to invest the world with their meaning, to enrich the environment with the fruits of their vision, and to use them for the accomplishment of a purpose they have chosen...Convivial systems encourage users to be actively engaged in generating creative extensions to the artifacts given to them and have the potential to break down the strict counterproductive barriers between consumers and designers. (p. 398)

Without some direction, these convivial tools run the risk of being misguided or ineffective at eliciting the participant's creativity. It is for this reason that researchers have identified different types of creativity that can be used to express memories, behaviors, and dreams.

Accessing Experience Through Creativity: Saying, Making, Doing

It has been recognized in the literature regarding product codesign that there is a diverse realm of human experience and multiple types of creativity (Sanders, 2000; Sanders, Brandt, & Binder, 2010). In addition, practitioners of participatory design agree, in Randy Hester's words, that "in good science, you want to have multiple methods of asking the same question" (Hester, personal interview, April 11, 2019). Of particular interest is how time shapes experience. We act in the present moment using memories of the past and dreams for the future to help guide us. This full realm of temporal experience from memories to present thoughts and feelings to hopes and aspirations for the future can all contribute to the collective creativity in a codesign process. Figure 8 illustrates how memories and aspirations feed into the present experience.

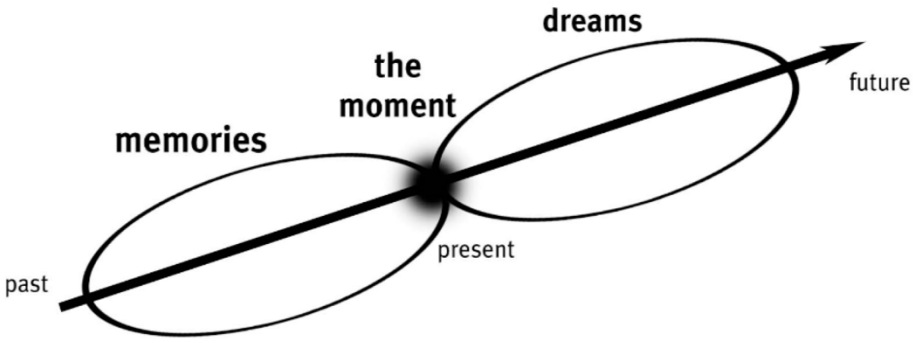



Figure 8. Diagram showing how memories and aspirations feed into present experience. *Note.* (Sanders, 2000).

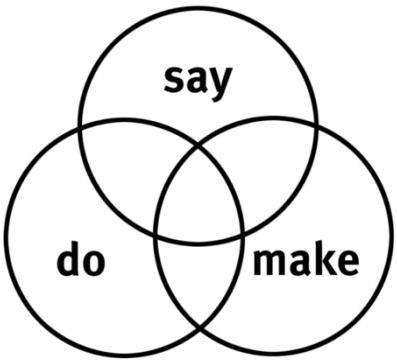



Figure 9. Diagram showing three types of creativity. *Note.* (Sanders, 2000).

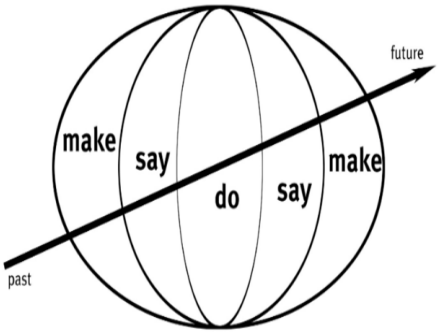



Figure 10. Diagram showing relationship between experience and creativity. *Note.* (Sanders, 2000).

In addition to accessing the diverse realm of human experience, codesign activities can also elicit different types of creativity (see Figures 9 & 10). Sanders (2000) identifies three primary types of creativity: saying, making, and doing (or telling, making, and enacting) (Sanders, 2000, 2001; Sanders, Brandt, & Binder, 2010). It has been recognized that to have a robust sampling of the creative potential of participants they should be allowed to express themselves in all three levels of creativity.

Sanders (2000) reminds readers she has not identified these types of creativity on her own. In fact, they have developed out of well-established fields of research. Sanders (2000) writes:

> Keep in mind that these methods are used together with other methods in a converging perspectives approach (Sanders, 1992) that draws simultaneously from marketing research ("what people say"), applied anthropology ("what people do"), and participatory design ("what people make"). (p. 5)

To gain a rich sampling of a group's creativity it is thus recommended that facilitators use activities that elicit creative expressions from multiple realms of

experience, using tools that allow people to tell, make, and enact creative expressions from the past, present, and desired future. Sanders (2001) describes how this process could unfold:

> For example, we might start in the middle with what people do in their current situation using contextual observations. Then we might move to what people say methods in the form of a dairy as well as one-on-one interviews. Finally, we could engage the participants in what people make sessions using a wide variety of participatory tools. In this type of plan, each research phase can be informed by the previous phase.
> (Sanders, 2001, p. 5)

The Changing Role of the Designer

As new design techniques are developed, the roles of the designer and researcher are changing. Instead of producing knowledge from research and observations, they are beginning to act as cocreators, taking on the role of facilitator, interpreter, and translator. As users and citizens are empowered toward a greater ability to shape their worlds, the designer and researcher act as vehicles for the collective creativity. Sanoff (2006) describes this process:

> Facilitation, which uses participatory methods for both problem definition and design solution generation through design assistance techniques, has emerged. Facilitation is a means of bringing people together to determine what they wish to do and helping them find ways to work together in deciding how to do it. (Sanoff, 2006, p. 14).

While collaborative design is a group activity, it needs an effective facilitator to achieve productive sessions and a successful process. Facilitators should be proficient in the basic skills of listening, analysis, and communication. The analysis of the artifacts produced by participants during codesign can provide the greatest opportunity and greatest challenge to the interpreter. The products of the generative tools are often ambiguous, without clear lines connecting them to design alternatives. However, they provide an exciting new way to inform concept development. Indeed, any process that involves feedback requires interpretation. Gaver (2004) states:

> Researchers express their interest through questionnaires, experimental tasks, or the focus of their ethnographic observations; volunteers interpret researchers' motivations and interests and express themselves in response; and researchers interpret the results. But whereas most research techniques seek to minimize or disguise the subjectivity of this process through controlled procedures or the appearance of impersonality, the probes purposely seek to embrace it. (p. 55)

The final role of the designer and researcher is as a translator of usable information to the participants and of the participant's dreams into designs. All of these roles are new, and the skills training needed to fulfill these roles is generally missing in the education of designers. King (King, Conely, Latimer, & Ferrari, 1989) goes so far as to say:

> Nothing in traditional architectural education, nor in architectural practice, prepares one for designing with the public. Education in schools of

> architecture needs wider focus on social issues, community organization, and strategies and skills in communicating with large groups of people. (p. 4)

Tools and Techniques for Codesign

The following section outlines the types of activities used to elicit creativity during a codesign process. The diagram in Figure 11 shows the most general level of organization the tools fall into.

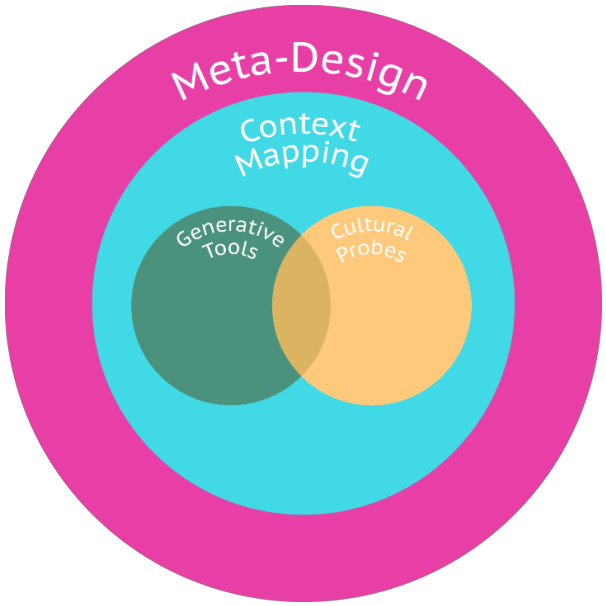



Figure 11. Diagram showing organization of codesign practices within meta-design.

*Context mapping*. In product design, as noted by Sanders and Stappers (2007), the fuzzy front end of design has become a major focus of the design process. Context mapping is just that: using a diverse set of activities to engage participants, facilitators use the material produced by the participants to build a robust understanding of the context in which the design development will occur. Context mapping is also a way of exploring the context in which the design will be used. Thus, context mapping can inform both the design process and the design itself. Visser (2005) writes, "In exploring contexts, users are involved in what is called generative research, which inspires and informs the design team in the early phases of the design process" (p. 1). Two techniques using similar tools have emerged to facilitate this exploration, cultural probes and generative tools (Visser, 2005). Figures 12 and 13 show an example of one such set of cultural probing tools.

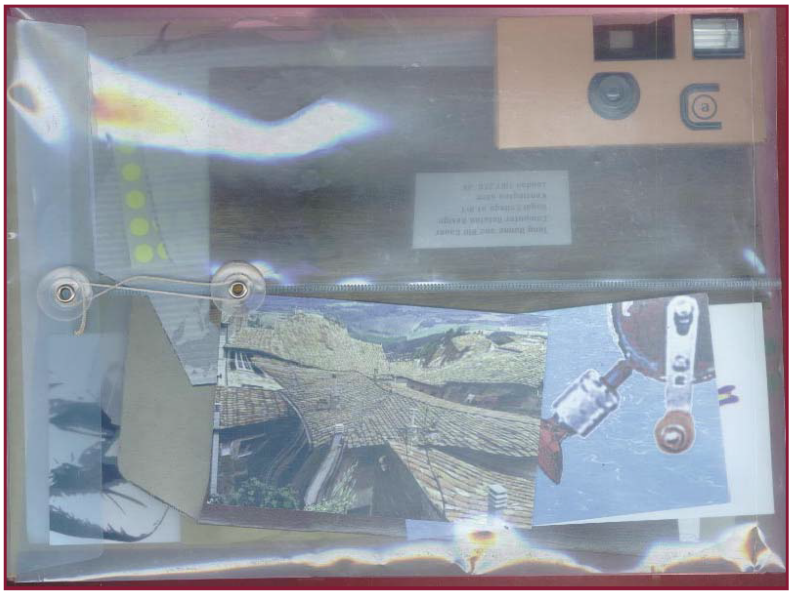


Figure 12. Sensitization package sent to participants before work session. *Note.* Includes a wide range of activities (Gaver et al., 1999).

*Cultural probes*. These probes are used at the earliest stages of a design process. In some cases, collections of activities sometimes referred to as *sensitization packages* are sent to design participants before group sessions begin (Visser et al., 2005). They can be used to prime participants for the sessions and used by designers to begin to build an understanding of the participants. Sensitization is described as a way of getting participants to engage more deeply with the sessions (Visser et al., 2005).

To clarify, this approach does not attempt to create defensible scientific knowledge; the artifacts and stories collected are meant to be used as inspiration. Gaver et al. (2004) write, "Probes are collections of evocative tasks meant to elicit inspirational responses from people—not comprehensive information about them, but

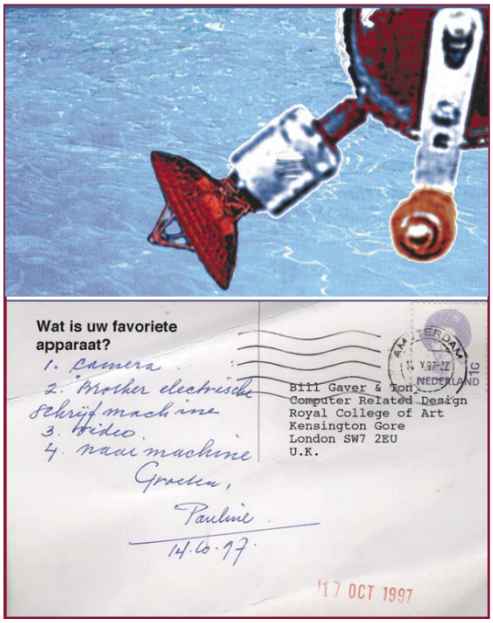



Figure 13. Postcard "What is your favorite device?" *Note.* (Gaver et al., 1999).

fragmentary clues about their lives and thoughts" (p. 53). But what are the actual tools in the probe kits? A typical list of activities a cultural probe package may contain includes

interactive maps for coloring and posting stickers, disposable cameras, postcards with evocative images, and diaries.

This list is expanded and changed according to the group of participants involved in the design process. Gaver et al. (2004) have researched cultural probes extensively; the work they are doing is driving the development of cultural probes and how to use them in the design process. Gaver et al. (2004) write, "If Probes are collections of materials posing tasks to which people respond over time, then 'probology' is an approach that uses probes to encourage subjective engagement, empathetic interpretation, and a pervasive sense of uncertainty as positive values for design" (p. 56). This last statement emphasizes the new role of the designer as an interpreter. The process of interpreting artifacts produced from cultural probes still lacks standardization and the outcomes are largely determined by individual interpreters. "Far from revealing an 'objective' view on the situation, the probes dramatize the difficulties of communicating with strangers" (p. 55). (The development of interpretation techniques provides grounds for further research.) As shown in Figures 14 and 15, some activity outcomes take more interpretation than others. Photos and dream recordings can require particularly skilled analysis to translate into design considerations.


Figure 14. Disposable cameras given to participants. *Note.* Intent was for participants to take pictures associated with a list of subjects included on the camera body (Gaver et al., 2004).


Figure 15. A "Dream Recorder." *Note.* Participants were asked to record dreams they had during the night. Pulling the cord on the device would give participants 10 seconds to record their dreams (Gaver et al., 2004).

From these creative communications, the designer will interpret and translate the artifacts created by participants. The material from the probes and the generative sessions will be used to begin the prototyping process.

*Generative tools*. Similar motivations have inspired the creation of generative tools. These techniques are used in work sessions to engage participants to creatively express themselves in a range of ways. Whereas the cultural probes are used to inform the broader design context, the prompts for these activities focus more closely on the scenarios surrounding the design intervention. There are a wide variety of tools, techniques, and games that can be used during generative sessions (see Figure 16). The techniques include collaging, concept mapping, and using interactive models.

Figure 16. Codesign toolkits used in generative sessions. *Note.* (Sanders & Stappers, 2008).

The following tables are provided by Sanders, Brandt, & Binder (2010) to help organize some typical activities that can be used in generative sessions and, in some cases, probing and priming.

| Tools and Techniques | Probe | Prime | Understand | Generate |
|---|---|---|---|---|
| **Making Tangible Things** | | | | |
| **2-D Collages** using visual and verbal triggers on backgrounds with time lines, circles, etc. | ● | ● | ● | ● |
| **2-D Mapping** using visual and verbal components on patterned backgrounds. | | ● | ● | ● |
| **3-D Mock-ups** using e.g. foam, clay, Legos, or Velcro-modeling. | | | ● | ● |
| **Saying, Telling and Explaining** | | | | |
| **Diaries** and daily logs through writing, drawing, blogs, photos, video, etc. | ● | ● | ● | |
| **Cards** to organize, categorize, and prioritize ideas. The cards may contain video snippets, incidents, signs, traces, moments,photos, domains, technologies templates, and *what if* provocations. | | | ● | ● |
| **Enacting and Playing** | | | | |
| **Game boards** and **game pieces and rules** for playing. | | ● | ● | ● |
| **Props** and **black boxes.** | | | ● | ● |
| **Participatory envisioning and enactment** by setting users in future situations. | | | | ● |
| **Improvisation** | | | | ● |
| **Acting out, skits** and **play acting** | | | ● | ● |

| Current Application of the Tools and Techniques | Individual | Group | Face-to-face | Remote |
|---|---|---|---|---|
| **Making Tangible Things** | | | | |
| **2-D Collages** using visual and verbal triggers on backgrounds with time lines, circles, etc. | ● | ● | ● | ● |
| **2-D Mapping** using visual and verbal components on patterned backgrounds. | ● | ● | ● | |
| **3-D Mock-ups** using e.g. foam, clay, Legos, or Velcro-modeling. | ● | ● | ● | |
| **Saying, Telling and Explaining** | | | | |
| **Stories** and **storyboarding** through writing, drawing, blogs, wikis, photos, video, etc. | ● | ● | ● | ● |
| **Diaries** and daily logs through writing, drawing, blogs, photos, video, etc. | ● | | ● | ● |
| **Cards** to organize, categorize, and prioritize ideas. The cards may contain video snippets, incidents, signs, traces, moments,photos, domains, technologies templates, and *what if* provocations. | ● | ● | ● | |
| **Enacting and Playing** | | | | |
| **Game boards** and **game pieces and rules** for playing. | ● | ● | ● | |
| **Props** and **black boxes.** | ● | ● | ● | |
| **Participatory envisioning and enactment** by setting users in future situations. | ● | ● | ● | |
| **Improvisation** | ● | ● | ● | |

Figure 17. Tables showing codesign activities organized by type of creativity and use. *Note*. Adapted from Sanders, Brant, & Binder (2010).

*Visualizations*. Included in this category are visual communication methods used while working with citizens in planning and design workshops. Typical techniques include the use of Geographic Information Systems (GIS) and professional sketching (see

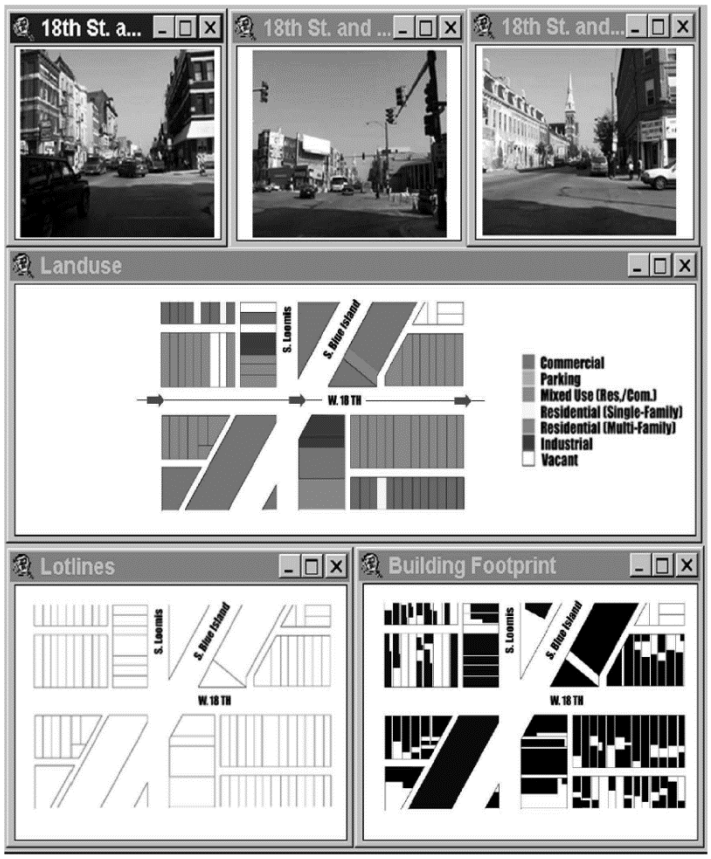



Figure 18. Image showing the use of GIS during a citizen participation. *Note.* (Al-Kodmany, 2001).

Figure 18). In these cases, a professional, such as a sketch artist or GIS operator, translates information from the participants. In the case of GIS, participants can record spatial data that GIS experts are then able to map. It can also be used to link photos taken by participants to maps of existing conditions and aspirations for future changes.

In the case of the professional sketch artist, perspective drawings are created in real time to help participants visualize their ideas (see Figure 19). This type of citizen participation relies on experts to express the ideas and knowledge of the community; however, it falls short of including participants in the creation of artifacts as part of a design process. If we consider Arnstein's Ladder, this form of participation does not achieve the highest rung.

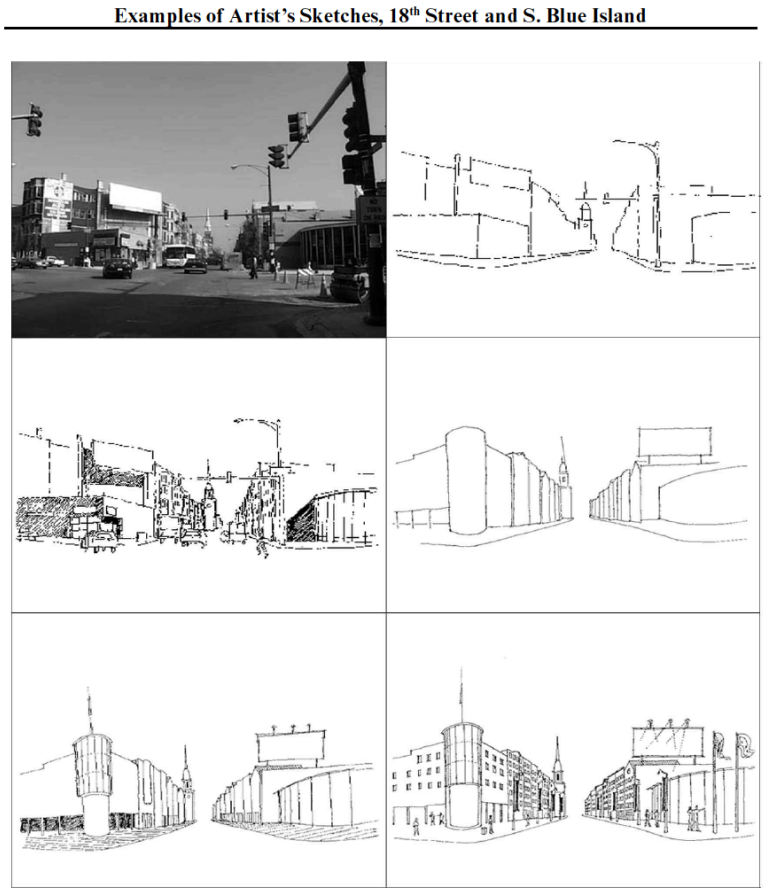



Figure 19. Image showing the use of a professional sketch artist to visualize ideas during a citizen participation workshop. *Note.* (Al-Kodmany, 2001).

Though the techniques used in visualization are not the highest degree of participation, they do offer many benefits. For example, when a sketch artist is used at the

beginning of the design process to render ideas coming from the community, the origin of the design thinking changes spatially and socially. The design process, rather than beginning with a master plan developed by an office, starts with the perspective drawing. King et al. (1989) explains:

> Rather than follow the traditional process of architectural communication, which begins with the plan and ends with the perspective, codesign reverses the process…In the codesign process we draw the perspective first to help the viewer imagine the experience in the scene…After the scene has been designed we draw the plan…to explain the scene and add dimensions. (p. 4)

Kheir Al-Kodmany has been a leading researcher in the techniques used for public participation. He argues that using visualization methods to engage the public helps to bridge a divide so often present between design professionals and university researchers on one side and community members on the other. Al-Kodmany (1999a) describes why visualization can serve the participatory process:

> Engaging a community in a way that empowers its members and effectively elicits their input is a goal of community-based planning, but it is a difficult goal to achieve…However, there is promise in a new approach to community-building…Stanley King and other scholars (see also, McDowell and McClure) suggest that visualization provides this kind of common language to which all participants—technical and nontechnical—can relate. Visualization provides a focus for residents'

discussions of what design should look like in their communities.

(Al-Kodmany, 1999a, p. 39–40)

Using a live sketch artist to render participants' ideas in real time and even allowing participants to draw provides a common language for all that have the ability of sight. Physical models may prove to be the most universal language of all the communication techniques.

# CHAPTER IV

# A CODESIGN FRAMEWORK FOR LANDSCAPE ARCHITECTURE IN INFORMAL SETTLEMENTS

There are multiple reasons codesign is well suited for landscape architecture in informal settlements. Perhaps most significantly, is the reason that residents in informal settlements tend to lack tenure and, thus, lack legal recognition and representation. This means there is typically no formal municipal administration in these territories. As such, there is no *top-down* planning of informal settlements. They are planned, designed, and built by the residents themselves. In addition to codesign being specifically well suited for landscape architecture in informal settlements, there is a robust history of collaborative design, and its contemporary practice is actually beginning to enter the field of landscape architecture on a wider scale (de la Peña et al., 2017). However, the history and practice of codesign is so broad that it can be difficult to know where to look for guidance on how to effectively implement the practice. The following section presents an organizational tool—a framework—designed with the hopes that it will both help those new to codesign in landscape architecture by providing a guide for the practice and make it easier for landscape architects to provide codesign services in informal settlements.

The new codesign framework for landscape architecture has been developed from a synthesis and translation of existing frameworks in the public planning and product design traditions. Figure 20 shows the relation between my framework and the two established collaborative design frameworks, one from public planning provided by Hester (1990; Hester & Kweskin, 1999) and a second from product design from Visser, Stappers, & van der Lugt (2005). This new codesign framework for landscape

architecture organizes the codesign process into three phases: establishing common ground, sharing ideas and cocreating, construction and critique.

Each phase includes a series of steps focused on the particular aim of the phase. There are a total of six steps beginning with facilitator preparations and ending with critique and adaptation. In some cases, the steps have multiple parts (see Figure 21).

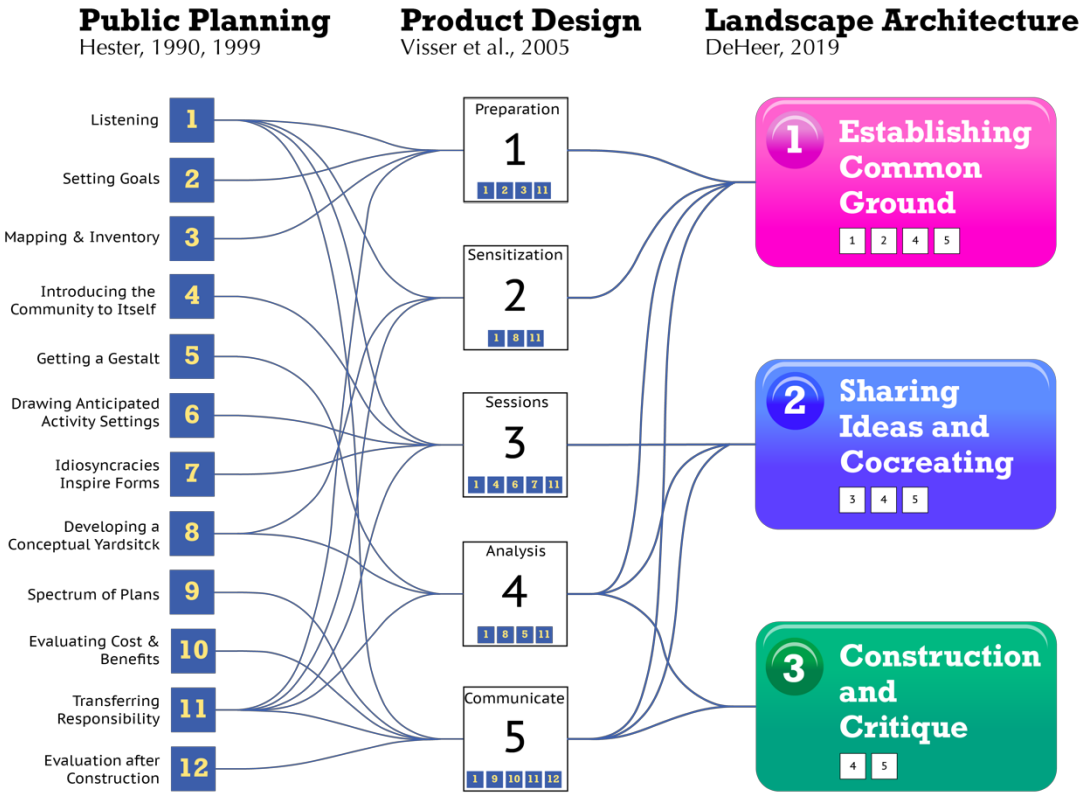



Figure 20. DeHeer codesign framework for landscape architecture synthesized from public planning and product design.


Figure 21. The six steps of the DeHeer codesign framework for landscape architecture.

A third framework from Sanders, Brandt, and Binder (2010) shown in Figure 17 is used to help organize the suite of available activities. Activities in each step are categorized such that the three types of creativity—making, saying, and enacting—are engaged during the entire process. Sanders encourages practitioners to ask participants to: remember, think, map, envision, feel, story tell, and dream (Sanders, 2014). In the next chapter, the fully expanded framework, with its lists of activities, will be discussed step-by-step as it has been applied in a green sanitation infrastructure project in an informal settlement in Lima, Peru.

# CHAPTER V

# USING THE DEHEER CODESIGN FRAMEWORK: GREEN INFRASTRUCTURE DESIGN IN AN INFORMAL SETTLEMENT OF LIMA, PERU.

Between August, 2017, and December, 2018, I made three trips to Lima, Peru where I used an early version of the DeHeer codesign framework (see Figure 21) during a green sanitation infrastructure project in an informal settlement on the outskirts of Lima. In what follows, I will describe the six steps of the framework, detailing the aspects used during this project. Lessons learned and how the lessons were used to improve the framework will also be discussed. The complete framework presented in this research was still under development during my involvement in this project. As such, not every step of the current framework was applied and some steps were completed out of order. For the sake of clarity, I have organized the activities such that they relate to the framework but do not necessarily correlate to the chronological order in which they were actually carried out. This is noted when it is the case.

Figure 22. Water truck fills water tank for home use. *Note*. All household water in this informal settlement is provided in this way.

## Phase 1: Establishing Common Ground

At the outset of the project, a request for design support was made by x-runner, a local container-based sanitation business. There was interest in developing a greywater and urine treatment solution to complete x-runner's sanitation service portfolio. Using urine-diverting, container-based toilets x-runner provides feces pickup for approximately 700 households living in this informal settlement of Lima. X-runner has a very low attrition rate, and their number of service users continues to increase. As such, x-runner is generating increasing volumes of treated feces which are ultimately transformed into compost. Though they are considering alternative treatment options, part of their initial request for assistance was to develop a means for the compost to enter the market as a value-added product. Despite the growing number of new service users, x-runner has had difficulty expanding into adjacent communities. It was speculated that using the compost in the creation of local public green space could provide an incentive for more rapid adoption of the container-based sanitation service.

The activities and analysis accomplished during my first visit reflect the orientation of the relationship client (x-runner), brief (green sanitation infrastructure), and designer (myself). However, through the course of the first visit, it became clear to me that a greater degree of community participation was going to be necessary for the project to be successful. By the end of the visit, I had begun soliciting participation from the community, although it was not until later visits that I began to apply the codesign framework presented in this thesis.

Step 1: Facilitator Preparations

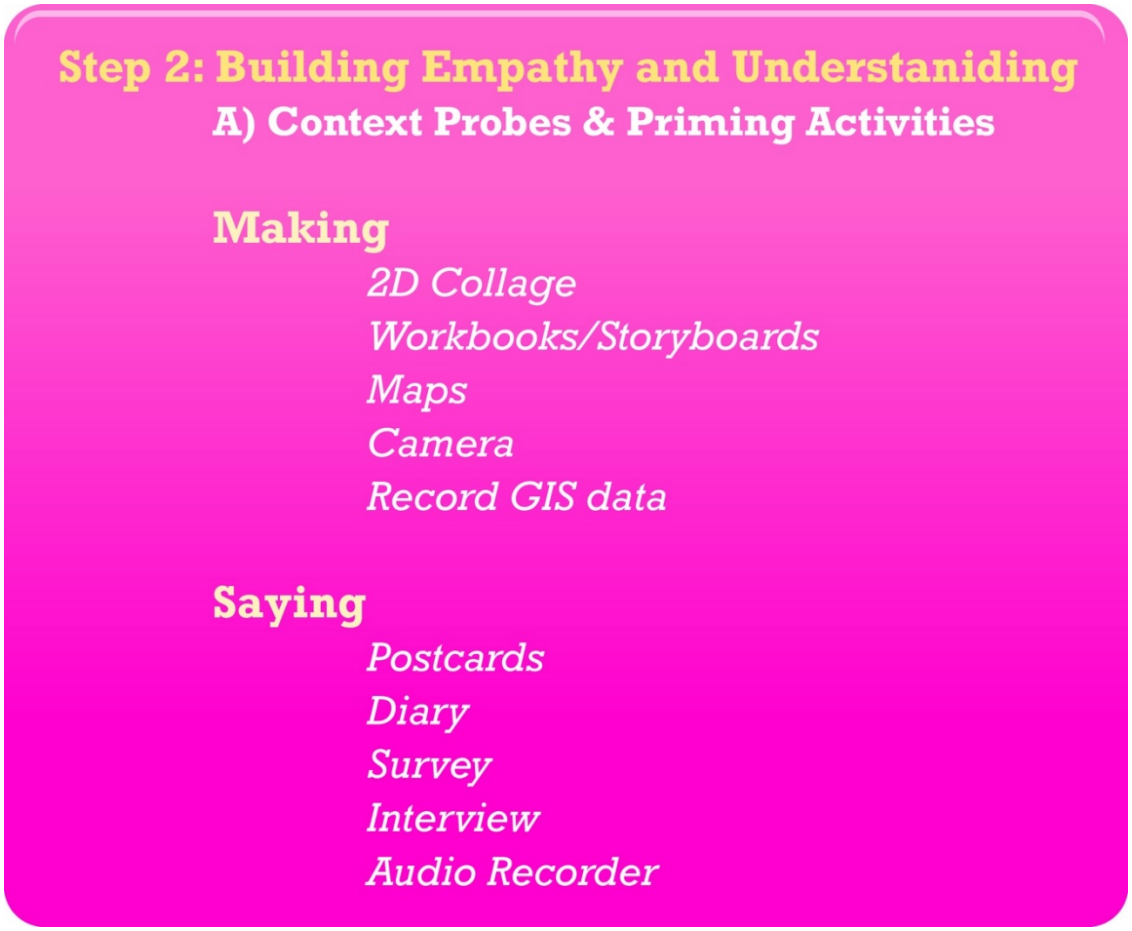

Though essential to the success of codesign, the basic skills acquired for this project will not be discussed in detail. What is important to note is that analysis, listening, and other communication skills (both verbal and visual) are all used during the codesign process. A facilitator should seek the appropriate training to acquire these skills. In addition, I have since established specific activities such as bias mapping and explicit goal setting as important steps in facilitator preparation.

Table 1. Goals for the codesign process.

| **What do I want to learn from the community?** | **What do I want them to learn from me?** |
|---|---|
| The narrative of the community history | Nutrient and water cycles |
| Values, assets, challenges, opportunities | Design principles for landscape architecture |
| Vision statement | Design techniques |
| Neighborhood goals | |

By increasing awareness of individual bias and producing clarity about the goals of the facilitators, these activities help to inform analysis of codesign artifacts and evaluation of process outcomes. For my participation in this project, I established goals in two categories: knowledge I wanted to gain and knowledge I wanted to share (see Table 1).

Step 2: Building Empathy and Understanding




At the time of design initiation, it was still early in my research on codesign; consequently, I did not use the full suite of codesign tools I am now familiar with. There are many ways to engage the collective creativity of a group, and it is best to use multiple activities that elicit different types of creativity. Despite my limited knowledge, I was

able to use two traditional tools during step 2: interviews and mapping. Interviews with community members and the community leader proved exceptionally educational and reassured me that the brief my client had issued was at least, in some cases, concurrent with the aspirations of community members.

*Interviews and community mapping.* As part of my goal to have this work meet community needs and to assure that design interventions were aligned with community goals, current x-runner service users were interviewed. Although the sample size was statistically insignificant, the goal of the interviews was not to produce scientifically defensible data, but to add creative inspiration to the project and to test the aims of the project against community aspirations. The following questions were included in the interview.

Step 2 Interview Questions:

1. What are common community priorities?
2. In general, what is the public opinion of reusing human waste in their communities?
3. Is there an adequate level of expertise personally, and in the community, to be able to take care of the green space?
4. What are the kinds of green space people want? Public or private?
5. Is there a concern that communal green space would be used for delinquent activities?
6. What kinds of food resources would you like to have closer to home?
7. What are the types of plants you find most attractive and most useful?
8. Are there any specific things to avoid or that we may have overlooked in selecting plants for the green space?

Many insights came from initial investigations into the potential for the creation of green spaces in the community. Through site observations, interviews with community members, and discussions with the community leader, important discoveries were made. Two findings are most notable. First, the community leader informed me that the community needed to establish public green spaces in order to receive formal recognition from the local government. Once formally recognized, the community would be able to legalize land tenure and begin receiving funding to provide basic services for the community. He also provided an official map of the community showing land parcels where green space was to be established (see Figure 23).

Unfortunately, the green spaces identified on the map are at the highest elevation in the community, higher than any of the residences. This created numerous problems. At one point in my conversations, it was mentioned that green space previously established in one such place had failed socially. It was uphill from the community, largely out of sight, and not on anyone's route home. With higher elevation green spaces, water needs to be carried uphill to irrigate the plants, and no one can see the green space from their residence. This latter fact not only reduces the benefits of the green space but also turns it into a hazard for the community: it could easily be appropriated by delinquents who would choose the hidden space for drug use. The location likely contributed to the previous green space's failure given the difficult access to the site and the lack of eyes on

the park. There was much to suggest that the current location of designated green spaces within the community was not ideal and presented a risk of dereliction and delinquency.


Figure 23. Site plan of informal settlement community showing the proposed location for public green space.

*Stairway green corridors*. A second outcome from this initial phase was the identification of alternative locations for public green space. Many of the stairways in the community present the greatest potential for the success of green space creation. In addition to being identified by the community members as desired locations, there are many other benefits to stairway sites. Because the stairways are adjacent to many

Figure 24. Images showing alternative areas for green space identified during phase1.

circulation routes, most of the community members would have direct access to the green space on a daily basis. Furthermore, if trees were planted in these areas, their shade would fall directly on the surrounding residences. Also, being so close to the many doors and windows of the residences facing the stairways, eyes would always be on the space, providing surveillance of delinquency and dereliction. In addition, resting places with benches could be created to serve elder community members, who were identified as having difficulty navigating the steep stairways. The location of the corridor along the stairways would also make watering and fertilization easier. For all these reasons, the stairway corridors presented themselves as the ideal location for the green space intervention.

Figure 25. Potted plants at the residence of one interviewee.

*Initial design concepts created during phase 1*. As part of the analysis of the knowledge gained from this first phase, I produced the following design concept sketches (see Figures 26–30). There are five major elements contributing to the concepts: 1) a greywater and urine collection system, 2) a greywater and urine infiltration system, 3) small retaining walls built using locally quarried rock, 4) x-runner compost and (potentially) biochar soil amendments, and 5) plant stock.

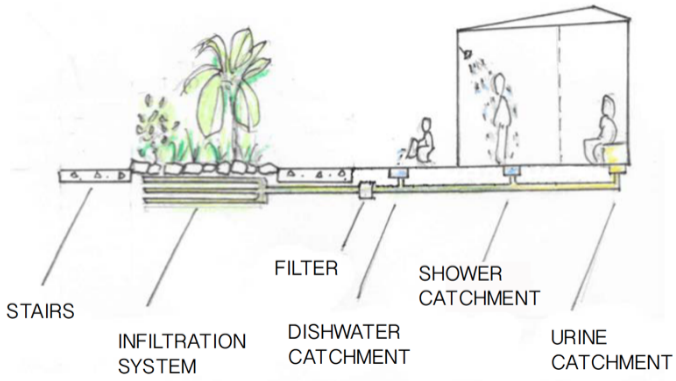



Figure 26. Section showing system parts as imagined during initial design phase.

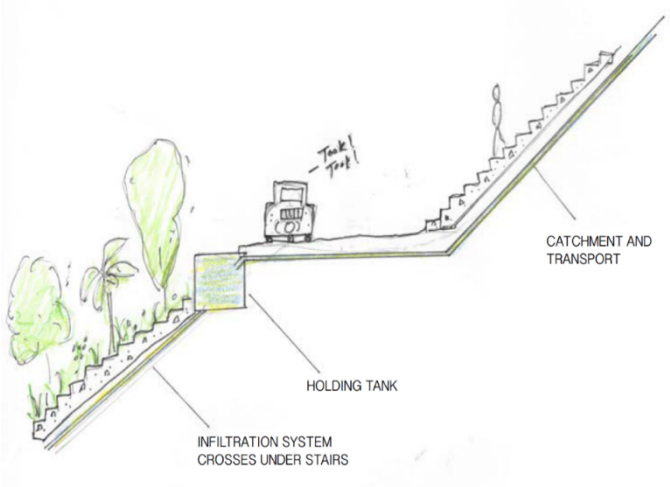



Figure 27. Plan view of planter with irrigation from gray water and urine.

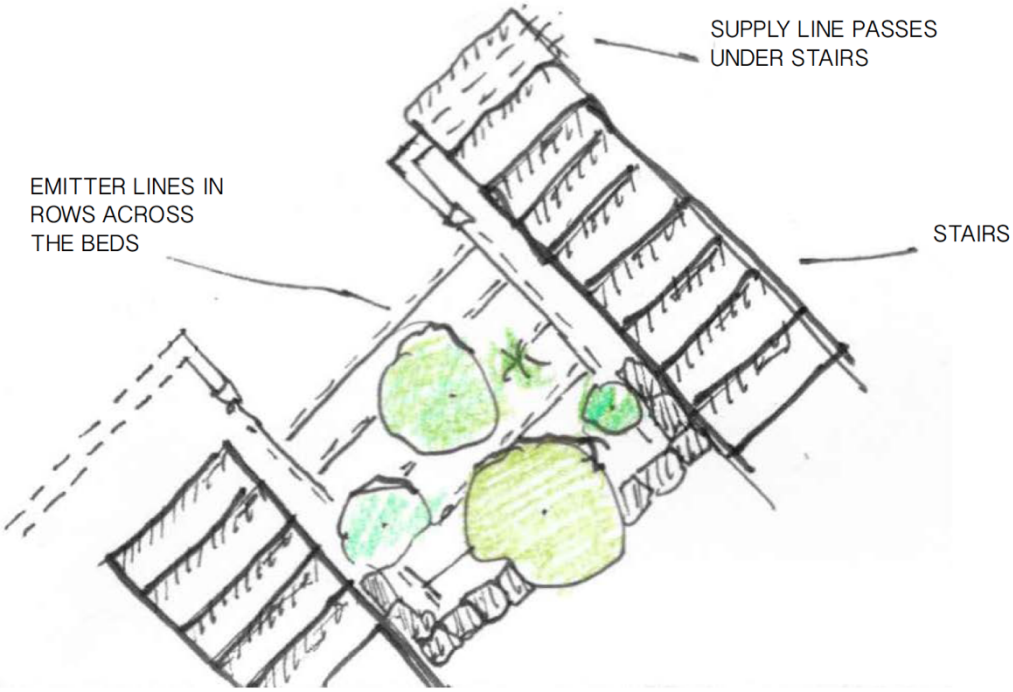



Figure 28. Section showing collection and transport of fluid resources along stairways.

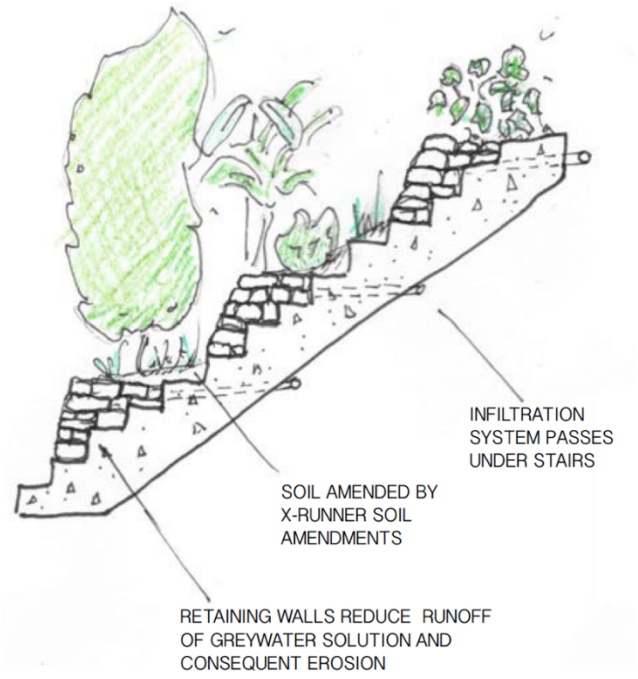



Figure 29. Section showing planter beds with irrigation.

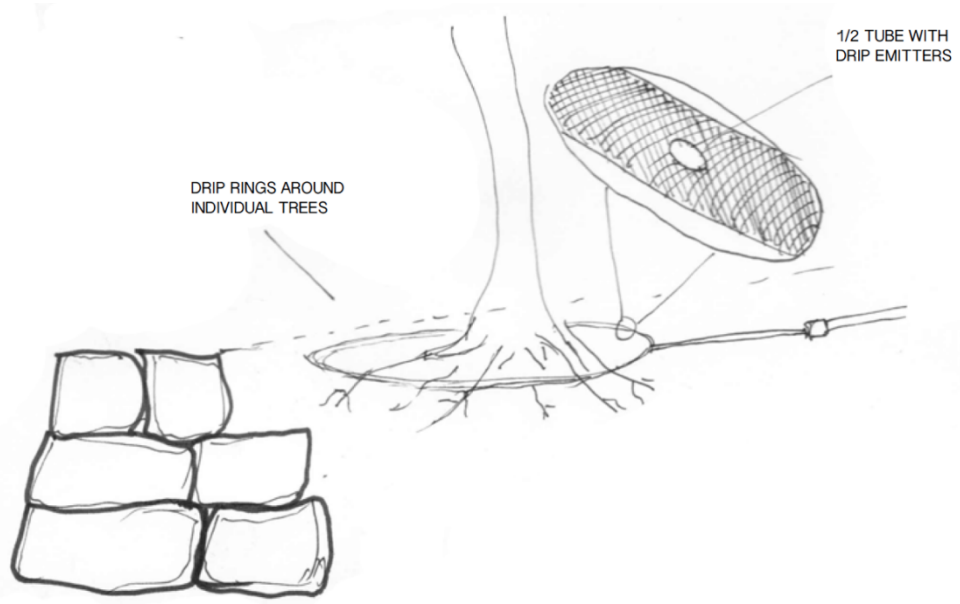
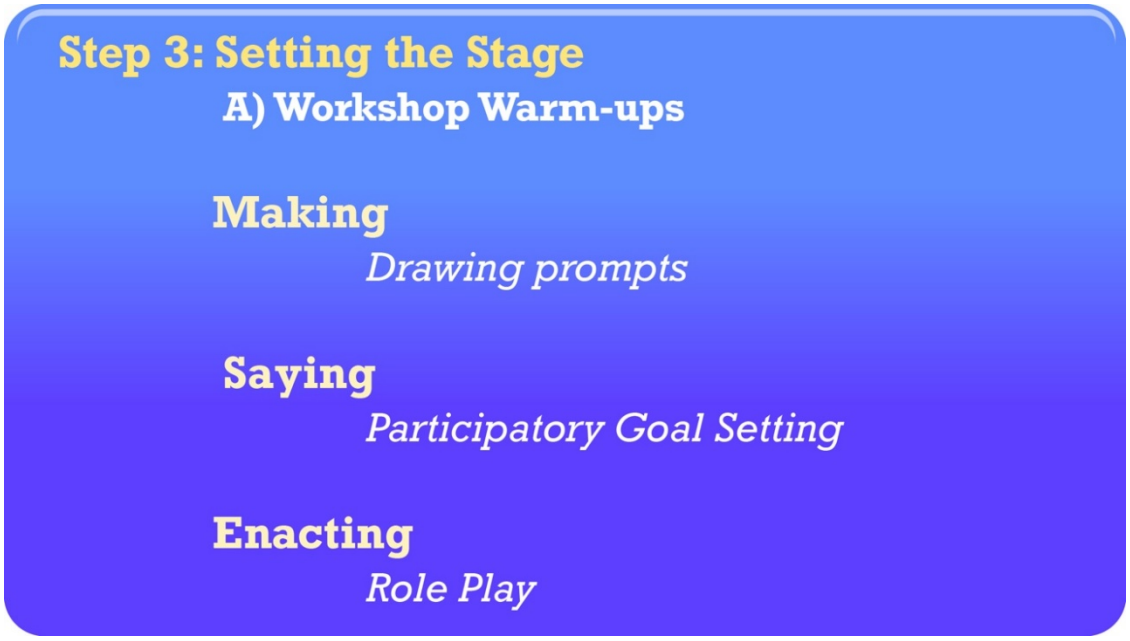



Figure 30. Image showing proposed drip irrigation.

## Phase 2: Sharing Ideas and Cocreating

Between the first and second visits, substantial design development and prototyping occurred. It would have been ideal to include more community participation before I worked independently on design development; however, I was not able to increase community involvement until I returned to Lima with the first version of a green sanitation infrastructure prototype in hand. This was out of step with my current codesign framework in which the community provides additional design development before prototyping. As such, some of the community engagement during phase 2 was directly related to the function of the prototype.

Step 3: Setting the Stage




This step in the process was included in a later version of the framework and was not executed during the green infrastructure project in Lima. In many cases, participants will be new to creative activities like drawing and role playing. For this reason it could be helpful to do some ice-breaking activities so participants become more comfortable using their creativity. In the case of the green sanitation infrastructure project in which the codesign framework was piloted, workshops were successful in soliciting creativity without this added step; however, the opportunity was missed for community members to express explicit goals they had for their community.

Step 4: Mapping Context and Aspirations


This was one of the most successful, exciting, and educational steps in this project's codesign process. Rich inspiration, detailed information, and insightful narratives were all shared during this step's activities. Much of the knowledge gained during this step contributed to design development; most notably, the desire to have a greywater-recycling system in addition to the creation of green space and sanitation services was expressed. This discovery has since dramatically changed the design intervention. These changes will be presented in Step 6: Construction and Critique.

*Codesign exercise 1: How did you get here?* In this activity of making and saying, participants were asked to draw a map of how they got *here* (the workshop was held in a local community center) and then to describe the route to the group. This exercise was presented as open ended—participants could draw the route they took to get from their home to the community center or a longer history of how they arrived in this particular community.

Participants spent approximately 15–20 minutes to create their maps. All participants were very engaged in the activity and were happy to have an opportunity to share their story.

Figure 31. Photos from "How did you get here?" workshop.

It was a good choice to leave this as an open ended exercise, because the interpretation of the instruction was very telling. The general reaction to the question was: "There was nothing here when I arrived! We built it all ourselves!" There was a great sense of pride in the fact that the whole community was *planned* (subdivided using the *manzana* and *lote* system, an improvised grid of alleyways and small lots) and built over the past 20 years by the residents themselves. "How did we get here? We built it ourselves!"

This pride was also reflected in the response to the question of residence before arriving in the informal settlement. Many described the fact that they had been renting somewhere else in the city and that they now owned their home and that this gave them a great sense of pride. The drawings of many individuals depicted how the community came into existence. The stairways were a fundamental and essential part of how the beginning of the community was identified. The stairways were also a fundamental part

Figure 32. Another photo from “How did you get here?” workshop.

of all but one of the drawings of the community’s current conditions at the time. (It is interesting to note that the omission was from one of the youngest participants, who focused mainly on car transportation routes.)

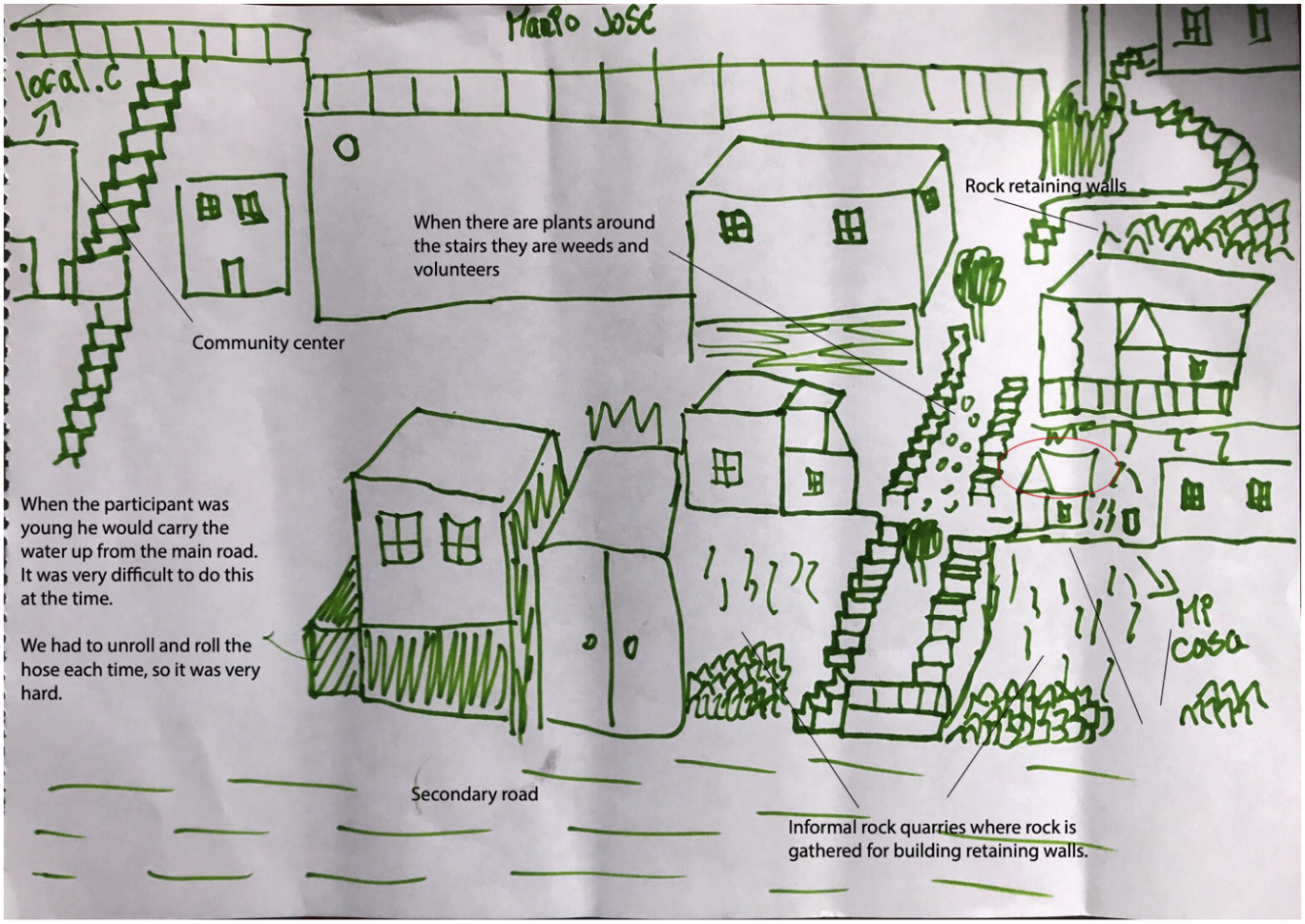



Figure 33. Map created by participant during the "How did you get here?" workshop.

Figure 34. Photos from “How did you get here?” workshop.

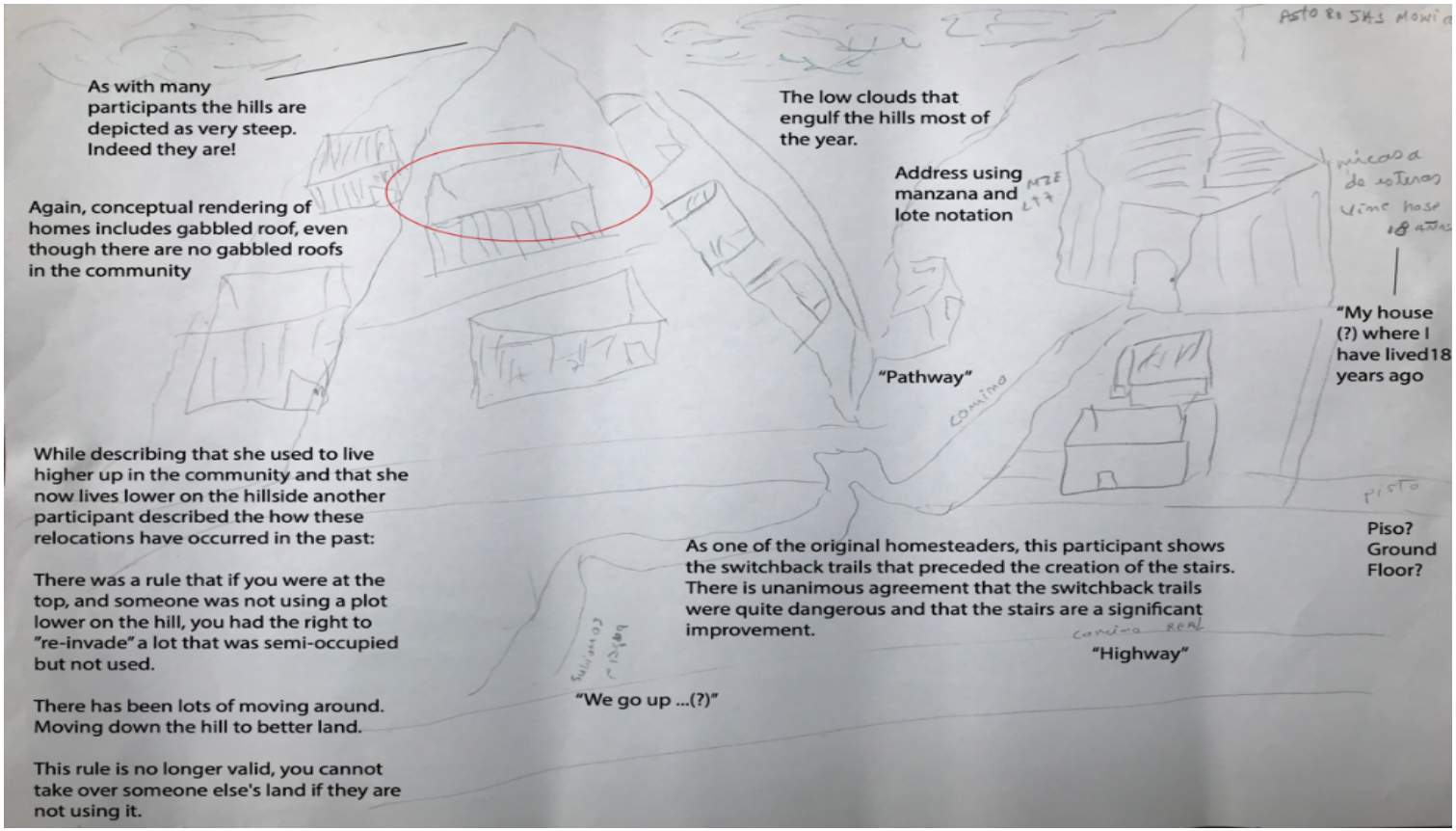



Figure 35. Map created by participant during the "How did you get here?" workshop.

Figure 36 is a drawing I created as a synthesis of the stories told in the community members' context maps. A hand rendering of this quality was appropriate for presenting back to the community the story I had seen in their maps and heard in their descriptions.

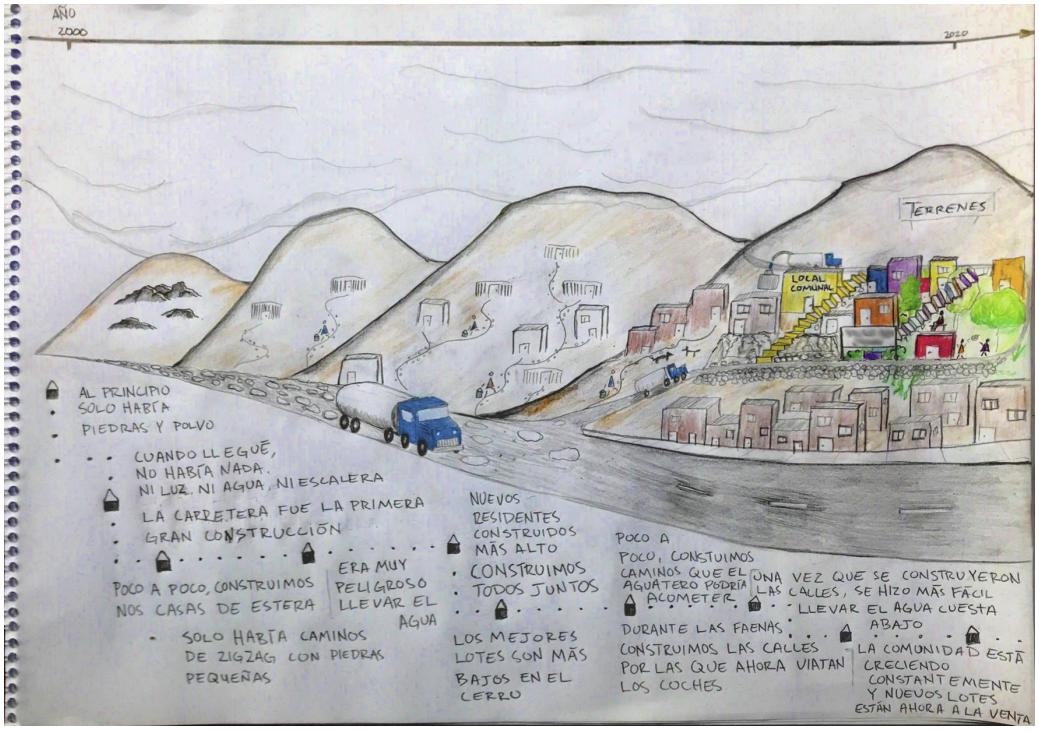



Figure 36. Author's synthesis of participants' context maps.

*Codesign exercises 2 and 3: photo journal and aspirational collage.* Through making and saying activities, these two workshops focused on assessing community aspirations, and aesthetic and programmatic preferences. This was achieved through two activities: a week-long photo journal documenting desirable and undesirable landscape features, and aspirational collages using photos collected during the photo journal exercise.

Each participant was given two disposable cameras. It was explained that one was to be used to take pictures of desirable things—places they liked, found beautiful, or would like to see in their community. The other was to be used to take pictures of things they found undesirable, ugly, or not wanted in their community. ("Like the dogs!" one participant remarked.) It was also explained that I would develop these pictures and bring them back to be used in an additional workshop creating collages of ideal community activities, amenities, and aesthetics. It was made clear that this was an idea-generating process and that there was still no official plan to build yet.

Figure 37. Photo from aspirational collage workshop.

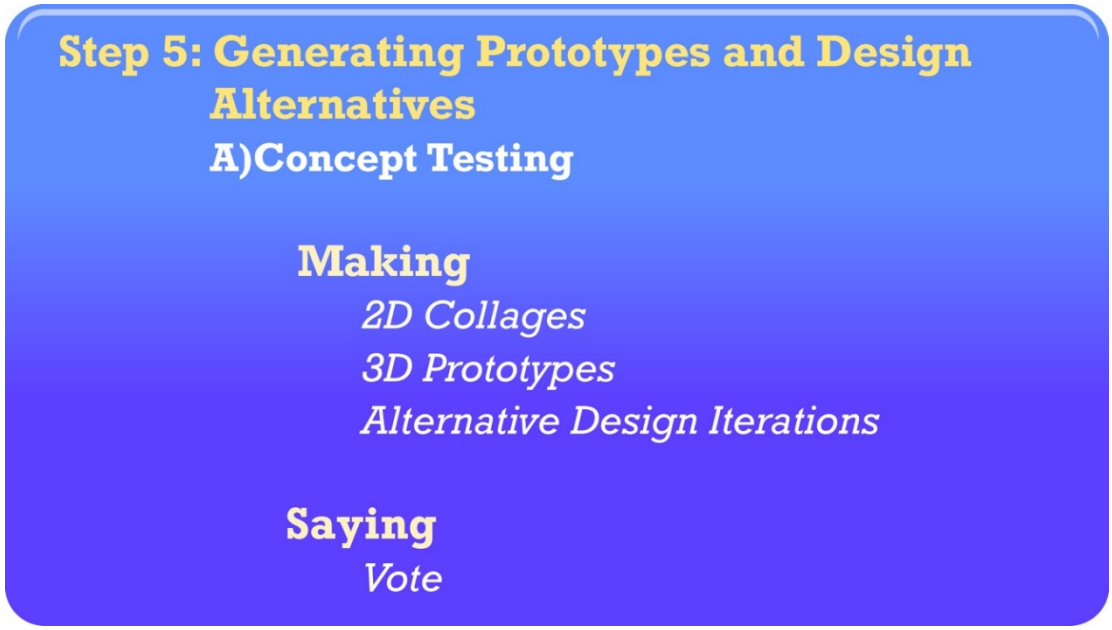

Figure 38. Photos from photo journal and aspirational collage activities.

Through this generative exercise, I was able to identify the following:

Table 2. Important information gained during codesign process.

| Existing Nuisance | Existing Resources | Aesthetic Preferences |
|---|---|---|
| Trash | Stairways | Formalism (French) |
| Wastewater in the street | Quarry rock | Broadleaf and tropical plants |
| | Pallets | |
| | Plastic bottles | |
| | Container planting | |

Step 5: Generating Prototypes and Design Alternatives



Using information gathered from phase 1, a prototype was built and shared with the community. Many of the necessary improvements to the prototype could have been included in the original version had the framework I am presenting now been followed.

Much of the information gathered during the beginning stages of phase 2 could have been integrated into original prototypes, thus saving money and time. Nevertheless,

Figure 39. Photos from prototype analysis workshops.

having a prototype for participants to interact with and evaluate was vital for building an understanding of the project, and its presence spurred radical design improvements.

During step 5, community participants and x-runner technicians provided feedback on the design and suggestions for improvements. In addition to an open-ended filter demonstration and solicitation for feedback, more directed questions were asked during a group interview:

- How is water currently used in the household?
- How do you dispose of your gray water and urine now?
- How might this unit be integrated into the household?
- Are the spaces in front of homes considered private, public, or something different?
- What types of places and activities would be in your ideal community?

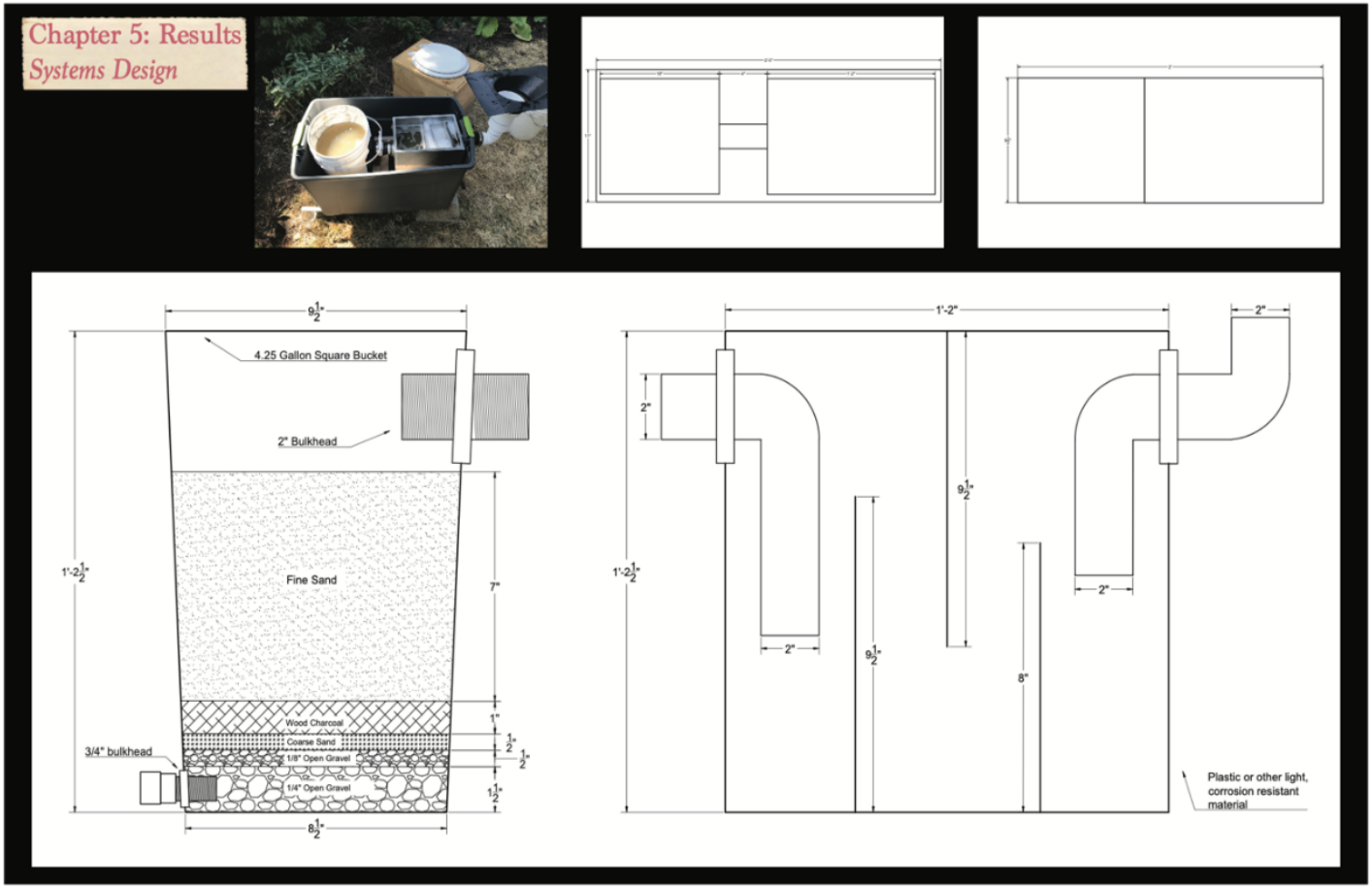



Figure 40. Images showing original prototype and its construction.

Some unexpected and important financial information gained from these interviews is presented in Table 3.

Table 3. Water and sanitation costs and household budget for informal settlement.

| **Water and Sanitation Service** | **Expense** | **Percent of average income--based on 330 USD (1100 PEN) monthly income** |
|---|---|---|
| Size of household water tank: 290 gal. (1100 L) | Single fill: 5 USD (15 PEN) | 1.5% |
| Daily household water consumption: approx. 40 gal. (150 L) daily | Monthly expense: 20 USD (65 PEN) | 6.1% |
| Weekly x-runner collection service | Monthly expense: 12 USD (39 PEN) | 3.6% |

One significant result coming out of the collaborative design process during step five led to major changes in the design of the green sanitation infrastructure intervention. Upon being introduced to the prototype, residents immediately saw the potential to use a similar system to recycle water for household use. Given the high percentage of monthly income residents spend on water, the opportunity to recycle water in the household presented substantial economic benefits. Figures 41 and 42 show an existing water use diagram and an alternative water use diagram, respectively, where filters are employed to create green space and to recycle water for household use.

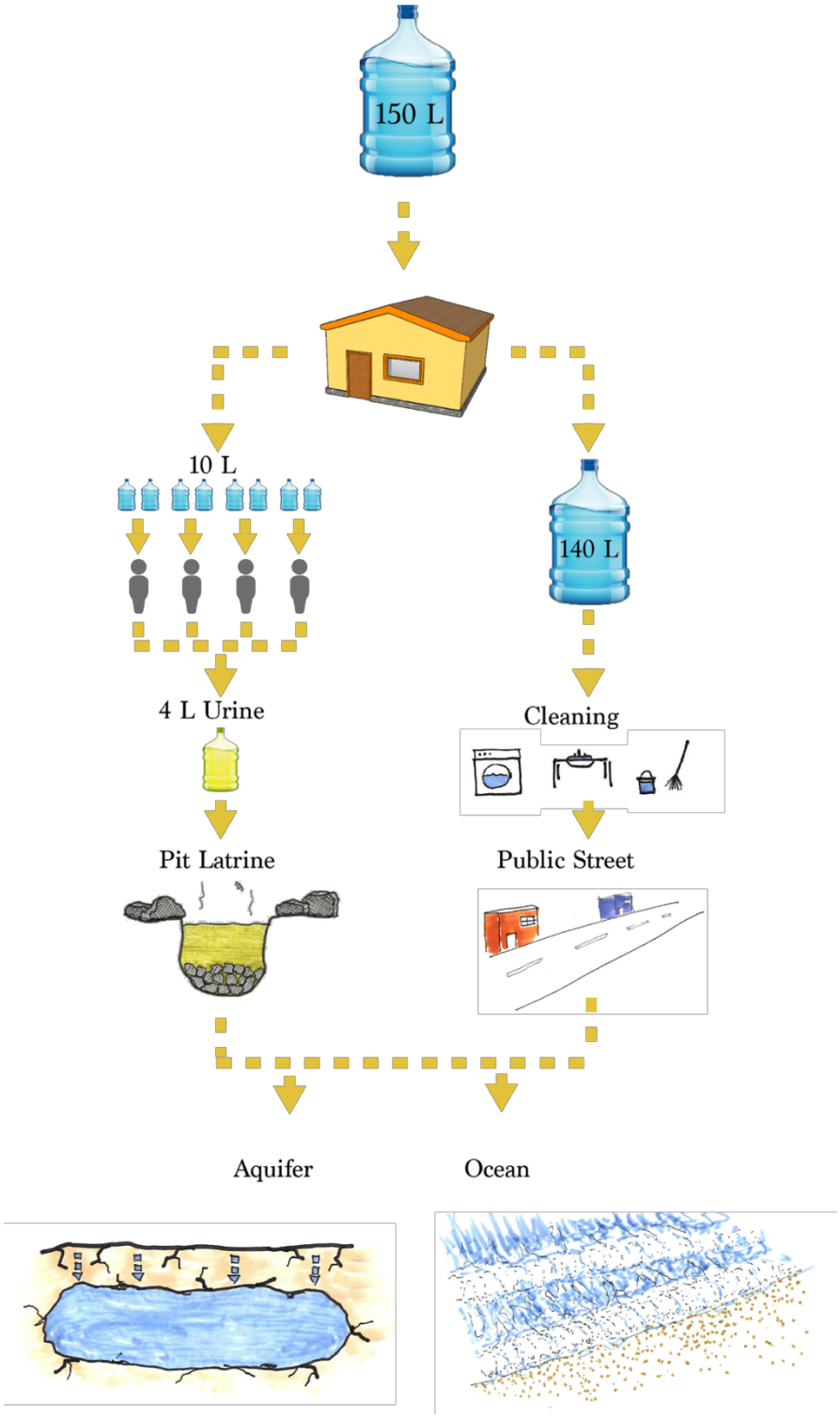



Figure 41. Existing water use and waste stream.

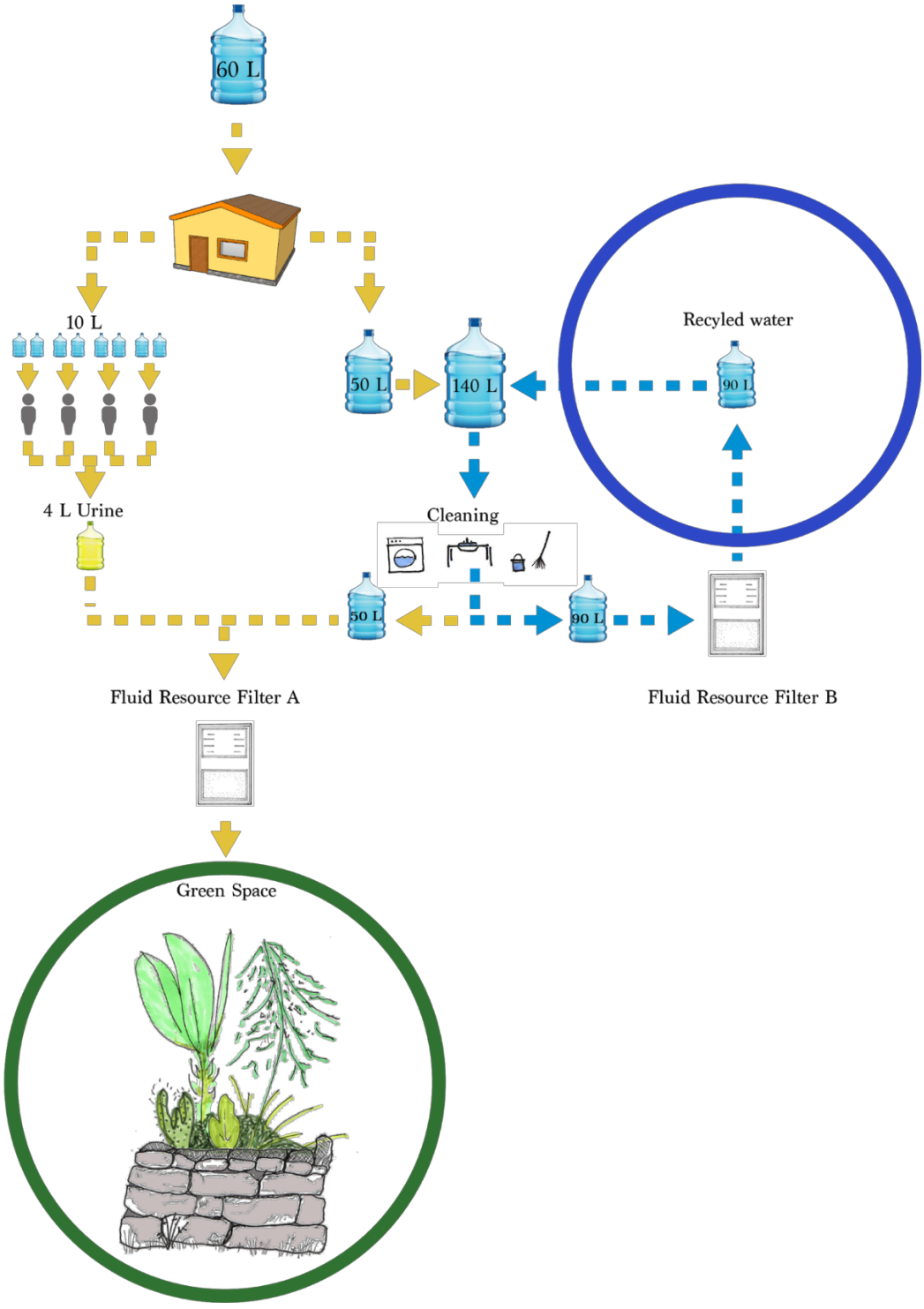



Figure 42. Water reuse and green space creation changes water consumption and waste streams.

Phase 3: Construction and Critique

Step 6: Proof of Concept and Adaptation


Incorporating knowledge gained from phase 1 and 2, I piloted five green sanitation infrastructure units during phase 3. There were many lessons learned from the pilot program. It was critically important to remain flexible at this stage and produce a product or landscape that would remain adaptable.

Critiques of a pilot should be incorporated, relatively easily, into further design development. Certain constraints and design issues only become apparent at the construction phase. Scaling and construction of projects should be phased so lessons learned from earlier phases can inform the development of subsequent phases. Since the first pilot, information gained from this trial and the results of phase 2 have been included in the most recent iteration of the green sanitation infrastructure system. The image in Figure 43 represents the most recent development of the system.

Figure 43. Photos from pilot of first prototypes.


Figure 44. Most recent design of green sanitation infrastructure.

Participatory design approaches (Schuler & Namioka, 1993) seek to involve users more deeply in the design process as collaborators by empowering them to propose and generate

design alternatives themselves.

> Participatory design supports diverse ways of thinking, planning, and acting [sic] making work, technologies, and social institutions more responsive to human needs. It requires the social inclusion and active participation of the users. Participatory design has focused on system development at design time by bringing developers and users together to envision the contexts of use. But despite the best efforts at design time, systems need to be evolvable to fit new needs, account for changing tasks, and incorporate new technologies. (Fischer, 2003, p. 89)

# CHAPTER VI

# DISCUSSION

## Challenges to Practicing Codesign

Though the practice of codesign is growing, it still faces many hurdles on the road to normalization. Many of these hurdles are internal to the practice, while others are created by exterior barriers. Criticism of codesign found in the literature included the inefficiency of the process, lack of control over the outcomes of the process, and an inability to evaluate the outcomes (Blomkamp, 2017; Botterill & Fisher, 2002). Through interviews with leading practitioners of participatory and community building projects, additional issues facing the practice were identified. They included poor facilitation, lack of rigorous scientific evaluation and a deficiency in design pedagogy.

Randy Hester (personal interview, Hester, April 11, 2019) has identified the lack of skilled practitioners as a leading cause of codesign's slow adoption rate, saying, "A lot of people who do it are not very good at it...There are a lot of people who went to city planning school, they took one class in participation, *possibly*. They are just not very skilled at it, and they are terrified of doing something transactively, they are not very competent...It's hard to do well." Practitioners lack training and a clear method for facilitating an effective codesign project. A clear method for codesign developed from the framework presented in this research would help to address these issues; however, the issue of design education would require more substantial change. Lauren Elachi, Design Coordinator at Kounkuey Design Initiative (an organization

which focuses on community participation in their projects), also identified a lack of practitioner education as a major impediment to the broader use of codesign techniques in landscape architecture. Here she addresses participatory design techniques (Elachi, personal interview, April, 2019):

> A lot of students are really interested in this type of work and don't see an outlet for it in their own educations….Design schools don't really address these issues, and don't really teach people about participation, engagement, or even people, in design work...And that trickles up into the [landscape architecture] profession. Yes we can do things to change the profession, but to me, the design schools are the most important part and until that pedagogy starts to shift in a meaningful way...I don't see that shift happening and that is really key for being able to improve the profession.

Leading practitioners agree, to see real change in the way landscape architecture is practiced, academic institutions will need to change the way they teach design.

Another issue acknowledged in the literature and by practitioners is the lack of research showing the benefits of codesign. Codesign has been notoriously hard to evaluate. This is due in part to a lack of standard evaluation metrics. The framework provided here, especially the goal setting and evaluation steps, offer an opportunity to include targeted research that can support the value of codesign. Working with community members to gather baseline data for comparison to post intervention data would be a powerful step toward legitimizing the benefits of codesign. This would involve human subjects research, structured survey work—for which I have applied

for Human Subjects Research approval—to continue to test this framework and its outcomes as the green sanitation infrastructure project in Lima moves toward implementation and evaluation. Selecting appropriate metrics for measurement will be critical to the success of this research.

Codesign has also been criticized for being inefficient, for extending the time and budget needed to complete a design project. Though this may be the case, practitioners have also shown that, though a codesign process may not fit with external time constraints, it can save time and money in the long run. When designs are forced to meet external deadlines, rushing a codesign process, the result can be a design that does not work for its user group and that will need to be redesigned, requiring even more time and money (Drain & McCreery, 2018).

Finally, as Hester (2019) points out, "There are still plenty of professionals that believe that the aesthetic domain is theirs alone, the form making is theirs alone." This institutional norm is certainly related to pedagogy in the field and underscores the claim that there is a need to make changes to the curriculum of academic institutions.

The rise of codesign in product design shows the effectiveness of its approach. Product design is about generating new products for the market; the success of the product is directly related to the adoption of the new products by consumers. Product design most commonly operates on a profit-generating model; thus, the quality of the product and its appreciation by consumers directly affects the success or failure of the product. Though there are critics of codesign, its adoption by the product design field shows that when it comes to generating profit from consumer preferences, codesign is effective at translating those preferences into improvements in the quality and suitability of products. Landscape architects—if we truly wish

to democratize design—can find inspiration from those leading the codesign adoption in the product and technology fields.

## Compensating Codesign Participants

A question is then raised for product designers and all those that professionally profit from soliciting collective creativity: If there are specific individuals participating in the design of products, should they have a stake in the profits generated from their creative efforts? The question becomes even more pertinent in the case of vulnerable and marginalized communities.

As is often the case in poor, vulnerable, and marginalized communities, their opportunity costs for participating in design workshops can be prohibitive. This is similar to issues relating to intellectual property rights of indigenous peoples. When traditional knowledge leads to profitable products on the market, to what extent and how much should the generators of the knowledge be compensated? How does this question of profit apply to landscape architecture? The success of a landscape architecture project can lead to professional success for design firms and the principals responsible for the project. How can this professional success be shared with those participants involved in the codesign process? Should it be? Should the landscapes generate income, jobs, and career training for the participants? The empowerment of participants in codesign is well documented, but what would be the landscape architecture equivalent of a stake in a company or shares in a product's profits? Perhaps we should ask the participants?

In the case of the research I have shared here, I have made my best efforts to ensure the codesign process was transactive, not extractive. To this end, codesign workshops were held

during regularly scheduled community meetings so that community members could substitute time in community meetings for time participating in workshops and thus not lose personal time by being involved. Furthermore, food was provided as a way to compensate for the time participants spent in the workshops. And finally, the design work the project focused on is meant to improve the community the participants are living in.

## Using Existing and Emerging Technology

It is important to mention that the technology available for use in a codesign process is rapidly evolving. Whereas, 20 years ago, disposable cameras were the best choice for photo journals, cellular telephones now provide the same opportunity with many more advantages. It is important to maintain equal access to codesign projects and, indeed, some people living in poor communities still lack access to cellular telephones; however, large segments of populations living in informal settlements either have personal cellular telephones or have access to them. Cellular telephones provide participants the opportunity to collection visual and spatial data that can be used for mapping in Geographic Information Systems (GIS) and sharing on blogs and wiki pages. The opportunity this technology provides for collecting data in areas traditionally lacking demographic and infrastructure data could facilitate research and financial support for informal settlements.

In addition to the data collection opportunities afforded by existing technology, new and emerging technology such as virtual reality can be used to present design alternatives to participants. Again, it is important to maintain equal access to codesign projects. As such, it will be important to evaluate how the use of new technologies either encourages or discourages a

diverse group of community members to participate in codesign workshops using cutting edge technology.

# CHAPTER VII

# CONCLUSION

The interest in and legitimacy of codesign is increasing. This is evidenced by the emergence of journals such as *CoDesign: International Journal of CoCreation in Design and the Arts*, and businesses such as MakeTools and SonicRim. It is even beginning to be referenced in popular culture as seen on the online social media platform Medium (Stratos, 2016).

As the practice of codesign matures, it will be important for it to maintain methodological adaptability and to incorporate feedback from participants and systematic evaluation of codesign process outcomes. It is my hope that the framework I have provided here will help guide a systematic method of codesign that can be more easily evaluated and improved. The full potential for codesign to transform landscape architecture and, in turn, transform the communities in which practitioners are engaged has yet to be seen. An important part of achieving this potential is targeted research.

During the next steps of the green sanitation infrastructure project in Lima, the following research is planned. First, the collection of baseline data for longitudinal evaluation will be critical. Areas of focus in this data would include rates of crime and delinquency, rates of waterborne illness, and levels of well-being, including physical and psychological health metrics. Data regarding financial impacts will also be collected.

Though there are many daunting social and environmental threats facing humanity globally, they provide an opening for people to work together to collaboratively create a more

just and healthful future. One means to facilitating this collaboration is through the practice of codesign. I have tried to provide a means to expand the practice of codesign through clarifying and organizing steps in the process. However, there is more that can be done to advance this practice. In addition to creating sound research outcomes, I see two opportunities of particular note: the creation of a digital codesign commons, and a codesign graphic handbook.

I have tried to provide an exhaustive collection of codesign techniques available in published documents; however, these certainly only represent a fraction of the techniques being used in codesign practice today. As Visser (2005) points out, "The full range of generative toolkits and techniques is infinite and is constantly increasing in variety" (p. 11). With the rise of interest in codesign and the breadth of new techniques being developed, there is a need for a digital codesign commons where established techniques can be archived and new techniques can be added as they are created. The codesign commons could also host the framework I have developed so that it could be improved by users of the website. Additionally, practitioners could post techniques they have developed and discover new techniques developed by other practitioners.

In addition to the digital codesign commons, a clear and easy to follow codesign method would be equally valuable. Presented in a graphic handbook, the method would serve as a practitioner's guide to facilitating codesign processes. Whereas I have provided a framework for organizing the codesign process, the handbook would present step-by-step instructions coupled with examples from an actual project. Illustrating the handbook in the style of a graphic novel would expand the reachable audience. The format's heavy reliance on images and image boxes

to show the passage of time and other abstract concepts would help to make translation less difficult. The ideal form of the handbook would be a document that could be distributed to communities such that they could more easily initiate a codesign project themselves. This would help provide communities agency in identifying and jumpstarting projects.

Landscape architecture is poised to become a leading force in the betterment of people's lives and the creation of healthy, more sustainable living conditions. Projects like the one described in this thesis, and the codesign process used in its fruition, show the potential landscape architecture has to contribute improvements in social and environmental justice. In the codesign framework for landscape architecture, I have clearly laid out next steps for codesign and its broad incorporation into the practice of landscape architecture: It is now a matter of putting these changes into practice more widely.

By providing an alternative to stale and socially corrosive approaches to landscape architecture, codesign has the potential to create innovative concepts through the use of collective creativity. It also has the potential to address unjust power relations by providing agency to community stakeholders. Furthermore, codesign offers opportunities to build discipline-specific knowledge by conducting research through collaborative design work. In all these ways, codesign in landscape architecture presents an exciting way forward for people everywhere to collaboratively engage in the creation of their shared future.

# APPENDIX

## AREAS FOR FURTHER RESEARCH:

### Mapping

Customarily, organizations concerned with landscape architecture identify major research objectives. At the top of the list is the use of new technologies to improve the practice and create new knowledge. The green sanitation infrastructure project described in this research has the opportunity to fulfill this objective by using drones equipped with LIDAR or photogrammetry to map the change in green space cover as the project progresses. Additionally, small sensors could be placed inconspicuously in the invention area to collect real-time data on ground conditions and to monitor additional changes through the duration of the research. Mapping would occur before the intervention and at least two other times at nine-month intervals. This would also be a good opportunity to collaborate with academic institutions located in the project area UTEC during data collection and analysis. Potentially, this mapping could lead to estimates of carbon capture and an analysis of the potential for carbon credits.

### Effects of Green space on community residents

Another significant research opportunity lies in the evaluation of the effects on local residents of increased access to green space. Three principle ways of measuring these effects have been identified. Firstly, self-reported data on physical, mental, and social health could be collected. The self-reporting would be in the form of surveys with questions regarding such things as rates of asthma, levels of depression and anxiety, and senses of safety and general well-being. A simple test could be coupled with this survey to record rate of cortisol reuptake—a

major indicator of stress resilience (Thompson et al., 2012). This could include a minor stressful event and saliva collection that would later be analyzed in a lab. A third way to measure change in behavior in the community as the green space cover increases, could be to collect data on reported crime in the area. Each one of these research methods could be conducted before the intervention and at least two other times at nine-month intervals.

Microbiome

Humans are inhabited by millions of microbes. Research on the relationship between microbiota and human health is an emerging field with the potential to help researchers understand some of the mechanisms by which access to green space can improve human health (Sampson & Mazmanian, 2015). Initial findings suggest that there are strong links between various human health measures and the prevalence of particular species and communities of microbiota (Ruokolainen, 2014). Research also suggests that cover of green space has an impact on the microbial communities present in the environment (Mhuireach et al., 2016). An opportunity exists to collect data on change in airborne microbial communities throughout the duration of the project. By distributing petri dishes, leaving them exposed to collect drifting microbiota for 24- to 48-hour intervals, and sending the samples away for DNA sequencing, researchers could monitor any change in the microbial communities as green space cover increases. Again, this research method would be performed pre-intervention and at least two other times at nine-month intervals.

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