

Co-Design:

Tools, Methods and Techniques for Designing with Users

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Abstract

The field of co-design has grown exponentially in the last 20 years. This is evidenced by an increasing number of non-designers getting involved in design projects. The rationale for the engagement of non-designers in design projects is that the involvement of users ensures their inclusion in knowledge development, idea generation and concept development of products and systems, whose ultimate goal is to serve the interests of the same users. The projects aims of co-design have developed, from being mainly about ICT development to include, for instance, service design, housing development, behavioral change interventions and product development, amongst others. Building on the tenets of participatory design, and being a relatively new approach to designing, a desktop research was carried out that looked at co-design information published in journals, books, reports and internet blogs. The focus of this study was to highlight some of the tools, methods and techniques used to enable co-design. The findings show that three approaches, along which tools are developed, have been used for co-design, namely; telling, making and enacting activities. Telling activities include use of narratives and story telling, gaming and future workshops. Making activities include use of prototypes, probes and generative tools. Enacting activities include use of theater techniques and scenario building. From the exemplars in this study, it was noted that tools are not used in isolation, but are often used in combination. In conclusion, the study proposes a framework for co-design participation that can be used by designers in determining the choice of co-design tools based on intent of use, such as, for probing participants, for priming participants in order to immerse them in the area of interest, to better understand their experiences and lastly, for generating ideas for design concepts.

Keywords: Approaches, Co-design, Framework, Methods, Techniques, Tools.

INTRODUCTION

Co-design is an emerging design practice that involves non-designers in various design activities throughout the design process. 'Non-designers' here refers to stakeholders, users and anyone who has a stake or interest in a design project. The co-design processes usually involve many people from different backgrounds, interests, abilities and roles within the design project (Sanders, 2000). With such a matrix, the common challenge is in finding appropriate ways for engaging and involving different participants in the co-design activities. Although co-design is talked of as a relatively new paradigm in design practice, its approach has been in existence for nearly 40 years (Sanders & Stappers, 2008), having started in the 1970s at the inception of participatory (PD) approaches in Europe.

In an analysis of pioneering applications of PD of the 1980s, reported in Greenbaum & Kyng (1991) and Schuler & Namioka (1993), one can see the level of improvement in terms of the tools and methods of engagement with non-designers presently. The earliest examples of PD approaches, from where co-design originated, were mainly conducted by researchers whose focus was on opening up the design of ICT systems to the participation of users. Reference here is made to the Utopia project, considered the earliest PD project since it involved graphics trade union, a newspaper company and design research institution in Sweden and Denmark, to develop text and image processing (Bødker & Grønbaek, 1991). Today, co-design spans across a broad spectrum of domains and makes use of a myriad of tools and techniques in different contexts, such as research, community development and commercial domains.

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Co-design tools and techniques have different origins, and have been developed for use in different purposes. A review of the Scandinavian system design shows a strong emphasis on what (Ehn, 1988), termed a meeting of language games, with emphasis on prototyping for design engagement. This approach has been expanded further in other co-design projects (Binder & Brandt, 2008; Buur & Bødker, 2002), where there is inclusion of collaborative explorations of everyday lives of people. From these, the main co-design tools and techniques are scenario techniques, making use of such approaches as drama and forum theater, design games and prototype. In recent times, researchers and practitioners have pursued co-design by providing infrastructures and toolkits for supporting users in tailoring their projects. Mattelmäki (2008), observed that designers are facing new design tasks that are beyond their traditional expertise, and this calls for tools and techniques to facilitate design collaborations. Mattelmäki (2008), introduces the probes approach and describes its application in case studies to support collaboration and participation in the context of design research and company collaboration in Finland. Other researchers in this field, like Westerlund et al. (2003), looked at ways of combining probes and prototypes to foster design amongst participants; while Brereton & Buur (2008), modified tools that are traditionally used in workshops in long running co-design projects. More recent is the development of convivial toolkit by Sanders & Stappers (2013), to assist non-designers co-create for their needs. With this brief outline into the origins of co-design, and an introduction into an assortment of tools and techniques, it became imperative that there is a need to make sense and organize what exists, so that it is easier to compare and make choices about tools, methods and techniques of co-design. The objective of the study was, therefore, to identify tools, methods and techniques used in co-design, and to propose a framework for their application in the design process.

THEORY

In the face of complex social, political, environmental, educational and technological issues, in a space where no one person has the knowledge and skills to understand and solve them, and where a different approach is needed to empower people to participate and take control of their own situations and environment, co-design becomes inevitable. It

is about working alongside communities, users and vulnerable people to create interventions, services and programs, which will work in the context of their lives, and is a reflection of their own values and needs (WA Council of Social Service, 2016).

Classical Design versus Co-design

Co-design differs from classical design mainly in the role that the user, the researcher and the designer play in the design process. According to the classical design process (Figure 1), the user is a passive object of study; the researcher brings knowledge from theories, and complements this knowledge through observation and interviews; while the designer passively receives this knowledge, interprets it and uses it to generate ideas and concepts for design solutions (Sanders & Stappers, 2008).

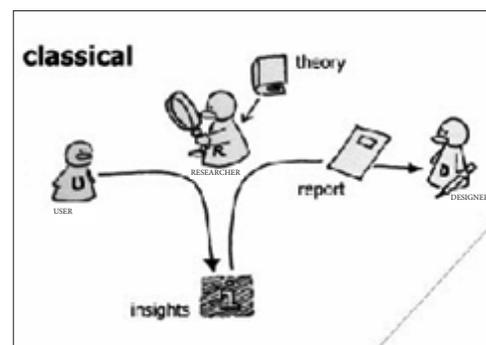


FIGURE 1

Roles of users, researchers and designers in the classical design process

Source: Sanders & Stappers 2008

Sanders & Stappers (2008), explain that in co-design, the 'user' becomes the expert based on his experiences, knowledge and aspirations. The shift is then from 'designing for the user' to 'designing with the user'. The researcher supports the user by providing tools for ideation and expression, while the designer develops the tools for ideation in collaboration with the researcher. In most cases, the designer and the researcher are one and the same person. The interdependent nature of co-design is thus evident, where the designer, researcher and user work collaboratively in order to reach a common goal (Figure 2).

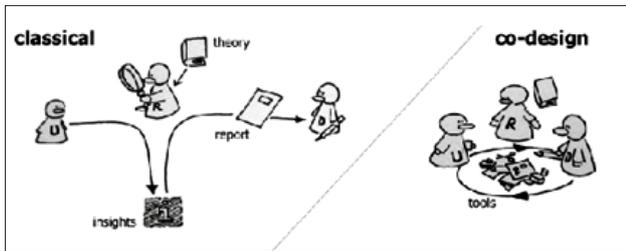


FIGURE 2
Merging the roles of users, researchers and designers in the co-design process
Source: Sanders & Stappers 2008

Design Process

The design development process has changed over the last few years, and with the new challenges designers face, there is an emergence and growth of a very large 'front end', popularly referred to as the 'fuzzy front end'. As shown in **Figure 3**, the front end is made up of many activities that inform and inspire design. In the front end, there is no clarity on what the deliverable may be and approaches to achieve it.

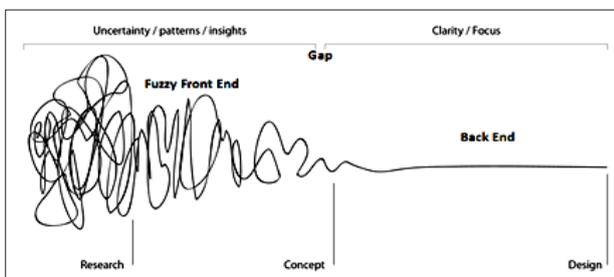


FIGURE 3
Design process
Source: Sanders 2008

In co-design, the move from 'designing for' to 'designing with' requires dramatic changes in the roles played by the designer and non-designers. Designer's role changes to 'facilitator' of the co-designing process, and the non-designers become 'participants' in that process. To participate in the design process, the non-designers are provided with tools, methods and techniques to do this.

a) Participating in the fuzzy front end

At the beginning, most participants may be unsure of their role in the design process. They may have the tacit knowledge, but are unsure on how to express

themselves. The participant will need tools and techniques for probing and priming.

b) Participating in the concept phase

The problem is now well defined and participants can immerse in activities that encourage idea generation.

c) Participating in the back end (design)

At the tail end of the design process, the participants have an opportunity to make their ideas tangible. The tools and methods should enable creation.

RESEARCH METHODS

This was a case study that examined the practice of co-design in a variety of sectors, such as community development, healthcare and education, amongst others. The research approach here can be labeled as phenomenon-oriented, considering that it was mainly based on gathering and analyzing documentary evidence in order to facilitate knowledge creation and advancement (Schwarz & Stensaker, 2016). A desktop study of published literature on co-design, with specific interest on co-design methods and techniques, was conducted for this study. Using search stations, such as Google Scholar, BASE and CORE, the terms co-design, co-create and participatory design were searched. Articles that included two of the three terms were selected for in-depth review. Additional information on co-design from online sources was also included. Researches by Elizabeth B.N. Sanders, Pieter Stappers, Froukje Sleeswijk Visser, Eva Brandt and Thomas Binder, who have engaged extensively in co-design projects, were extensively examined. Thirty publications were reviewed and analyzed to identify the tools, methods and techniques of co-designing. The articles reviewed were mainly those published from 2000 to date. There are few cases of articles published earlier than 2000, and these were considered purely because of the historical context they add to the subject of the study.

RESULTS AND DISCUSSION

Co-design tools and techniques can be broadly categorized into tell-make-enact activities. **Figure 4** is a representation of the tell-make-enact diagram that indicates that tools and techniques do not operate in isolation, and the triad of making-telling-enacting opens a myriad of possibilities for co-design in design projects.

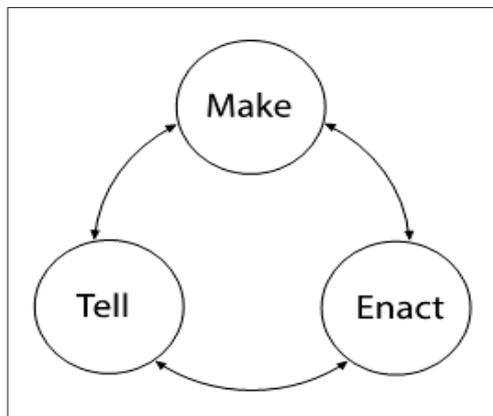


FIGURE 4
Tell-make-enact diagram; arrows going on either direction indicate that the process is interactive, and actions are connected

Source: Brandt et al. 2013

a) Telling activities as drivers for co-design

Telling activities refer to tools and techniques that support verbal expression, such as talking and explaining. Telling tools include diaries, logs and card sorting, used to express ideas. Some commonly used ones are analyzed below.

i. Use of games

Games are visual materials that assist participants in ‘telling’ about experiences and dreams. They are normally tangible representations of design artefacts that make sense to all participants (Ehn & Sjögren, 1991). Games come in a variety of forms and types, and designers can create their own, which are best suited for the activity at hand. **Figure 5** depicts pictures and illustrations of the UTOPIA Project, showing People involved in newspaper production playing the Organizational Kit Game; a simple board game with sketches and text on small pieces of paper illustrating various tools.

Another common game is the use of card sorting. Designers come up with different cards which have photos or illustrations of processes, items or activities. Participants can be asked to arrange the images on the cards in order of preference, organize their daily schedules or organize workflow. In the Nordic graphic workers union and computer scientists PD, workers used card sorting to organize their daily flow of activities in a simplified form, and provide an alternative on how computer systems could be used

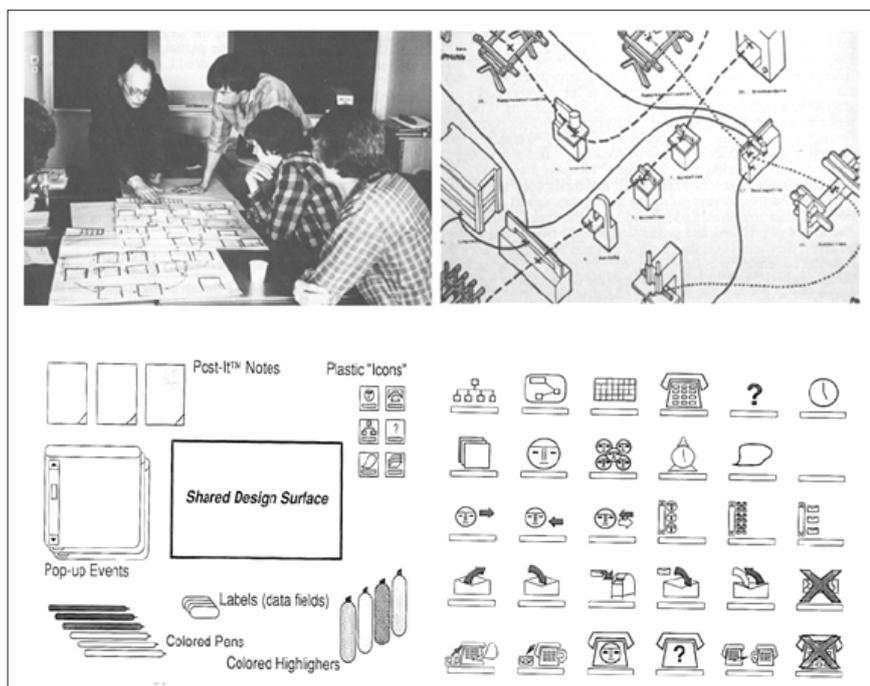


FIGURE 5
Different approaches to ‘telling’ using game activities
Source: Brandt et al. 2013

to make the same flow of activities simpler (Brandt et al., 2013).

ii. Story telling and oral narratives

Kensing & Blomberg (1998), explain how one can capture the 'natives' point of view through observation, story telling, oral narratives and interviews. Julian Orr was, however, the first anthropologist to make ethnography for the sake of design. Orr (1986, 1996), created tools and techniques which were meant to facilitate story telling. One such tool is the use of video camera to capture video snippets of people in their everyday life. Once the video is captured, the same people edit and author the final video as they tell their story.

Another famously used approach to story telling is the use of story boards, which are visual representations of people's stories. These are either illustrations or photos arranged in a sequence so as to tell a story. The pictures are continuously rearranged and illustrations modified by the participants to tell the story.

iii. Future workshops

Future workshops are modelled around Appreciative Inquiry, and are mainly used as a means to effect change in systems and product designs, organizations, communities and cities. They were introduced in the 1970s by Jungk & Müllert (1987). Future workshops start out as a series of brainstorming sessions with a group of people. In the first session, participants list all that they are not happy with in an area on which the future workshop is based, be it a system, product, organization, community or city. The participants come up with this list collaboratively and there is no wrong or right. There is no discussion, endorsements or objections to any point raised. In the second phase of the future workshop, the earlier produced list is open to discussion, and for each item on the list, the participants raise its positive opposite. Further discussions lead to participants developing a utopian perspective, that becomes a basis for a plan of actions to effect change in a product, system, organization, community, city, or any other basis, for the future workshop.

b) Making activities as drivers for co-design

Making activities refer to tools and techniques for making tangible things. They include collages, maps,

models and mock-ups. Making involves coming up with 'things' that embody thoughts and ideas that may describe future objects, or provide views of future scenarios. Three distinct approaches to making activities have been used over time: Prototyping, Probes and Generative tools.

i. Participatory prototypes

Of the three approaches to making activities, participatory prototyping has the longest history, having been introduced in the early 1980s (Bødker & Pedersen, 1991; Ehn & Sjögren, 1991). Prototypes are physical manifestations of ideas or concepts, and can range from rough to finished. They are used to give form to an idea, and also to explore technical and social feasibilities. They usually come in the form of mock-ups and low fidelity models, and can be made from an array of materials such as foam, clay, wood, plastic and electronic elements (Brandt et al., 2013; Sanders & Stappers, 2014).

There are several projects that have made effective use of participatory prototyping, and they show a broad range of application, including designing for computer supported workplaces, interface designs, product design, city planning, health planning and architecture. The tools and techniques each use and apply are also varied, and always suited for the participants and project at hand. One of the first projects to make use of participatory prototyping is the UTOPIA Project (Ehn & Sjögren, 1991), which was a collaboration between Nordic Graphic Workers Union and researchers from Sweden. The aim of the project was to introduce new computer technology into the newspaper industry. They made use of mock-ups; one outcome of this approach is that the skilled workers became actively involved in the design process by actually doing, for instance, the page layouts. Within the Human-Computer Interaction (HCI) discipline, paper prototypes that use annotated sheets of paper to represent the screens are used to visualize user interface design (Benyon et al., 2005).

In working with communities in urban planning and architecture, Henry Sanoff provides participants with small-scale paper-based models, representing physical components of their community, such as buildings, trees, road and railway line, amongst others (Sanoff, 2010). They use these components to explore physical

design options for exterior and interior environments. This same technique has been used by Elizabeth Sanders in hospital planning and architecture. **Figure 6** shows Elizabeth Sanders co-designing with health practitioners to explore future opportunities in patient room design for new hospitals, using small size models representing the various components of a hospital, such as bed, tables and chairs.

Another researcher, Sofia Hussain, in working with children from Cambodia on the development of appropriate prosthetic legs for children with disabilities, provides the children with a set of toolkits that contain paper dolls, clothing and prosthetic options, and the children use these to express their ideas about form and aesthetics of the prosthetic foot they would like to have (Hussain, 2012) (**Figure 7**).

ii. Probes

Probes are materials that have been designed so as to provoke or elicit response from participants. They can take on a wide variety of forms, such as diaries, workbooks, cameras, games, and so on. Probes are design-led approaches to co-designing. Designers create the probes and give them to the end users, often with little guidance. The end users then return the completed probes back to the designer, who, based on the responses, draws inspiration from the users feedback (Sanders & Stappers, 2008, 2014). Use of probes, such as videos, photos and diaries, is a reflection of the participant's point of view, biases and experiences. Both the participant and designer will construct meaning by bringing their personal history, personality and social position into the interpretive act (Loeffler, 2004).



FIGURE 6

Participatory prototyping in action

Source: Brandt, Binder & Sanders 2013



FIGURE 7

Left: The paper doll kits used. Right: A child's presentation for how the prosthetic leg should appear when worn

Source: Hussain & Sanders 2012

In the InterLiving project, Westerlund et al. (2003), designed and produced probe kits that included cameras, video cameras and diaries, for participating family members. Each of the participants took videos and photos of their everyday activities, and also recorded their stories in the diaries. These were then submitted back to Westerlund and his team of researchers, who analyzed the images together with the participants, so as to come up with appropriate home-based computer system. Another researcher, Loeffler (2004), used photos as probes to examine outdoor experience. Working with a group of 14 college students who were outdoor adventure enthusiasts, Loeffler (2004), asked each to record what the outdoor adventures meant to them using pictures. The findings were clustered thematically under headings of friendship, tranquility, peace and togetherness with nature.

iii. Generative tools

The roots of generative tools are trans-disciplinary, emerging from the intersection of design practice, psychology and psycholinguistics theory (Brandt et al., 2013). This approach to co-designing was informed by observing how designers communicate with each other. For instance, graphic designers communicate with each other through 'mood boards' that contain 2D components, such as photographs and illustrations. Industrial designers, on the other hand, communicate with each other through 3D forms that are representations of internal components of a product. Therefore, if designers could communicate with each other through 2D and 3D forms, then it was possible to create 2D and 3D visual elements that non-designers could use to express their ideas, feelings, and dreams, about future design scenarios. Generative tools are thus made of 2D and 3D components, such as pictures, words, phrases, blocks, shapes, buttons, and all sorts, all of which give non-designers a means with which to participate as co-designers in the design process.

Generative tools, like probes, are design-led approaches, and are normally used in the front end design process to help non-designers imagine and express their own ideas about how they want to work, live or play in the future (Brandt et al., 2013). The generative tools can be used to encourage and challenge people to express their tacit and latent needs, aspirations and dreams, further confirming Koestler's

theory of creativity (Sanders & Stappers, 2008). **Figure 8** shows examples of generative processes.

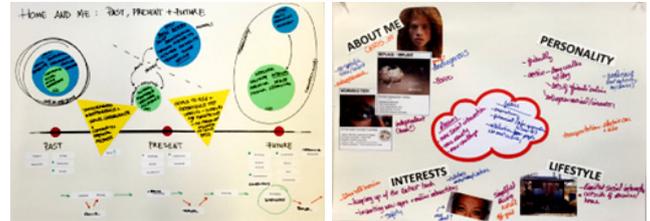


FIGURE 8

Generative activities

Source: Sanders 2000

c) Co-designing through enacting possible futures

Enacting refers to activities where one or more people imagine and act out possible futures by trying things out in settings or in locations that resemble where future activities are likely to take place (Brandt et al., 2013).

i. Theater techniques

Drama techniques, like Forum Theater (Boal, 1974), have been used in enacting co-design sessions for many years. This technique was developed by the Brazilian playwright, director and theoretician Augusto Boal. Boal considered theater as a powerful weapon that could be used for activism. Through forum theater, audiences could transform from being passive members of the society, to becoming active citizens and enablers of social change.

Brandt & Grunnet (2000), suggested a twist in the Forum Theater. Instead of staging a play to the end, and then allowing the audience to make changes, they introduced the use of 'frozen images' (**Figure 9**). In this scenario, as the play is being acted and the audience sees something that needs to be adjusted, action is immediately stopped at that instance. The audience is allowed to analyze, discuss and suggest changes before proceeding. In this way, the 'frozen images' allowed audiences to make realtime changes to the script before proceeding on to completion.

The Russian actor-director-teacher Stanislavsky (2008), invented yet another theater technique, commonly referred to as the 'magic if'. In Stanislavsky's



FIGURE 9
Getting a bodily understanding of the work of refrigeration technicians by performing 'frozen images'
Source: Brandt & Grunnet 2000

approach, the designer builds empathy for the user by asking questions such as, 'what if the user was in this or that situation?' Such questions are used in framing co-design activities that can be easily used to enact and explore future possibilities of a product or a system. The 'magic if' is what brings out reality into a world of art, which is often full of unanswered questions.

ii. Scenarios

The scenario technique has for long been recognized as a powerful means in designing since it provides opportunities for reflection and learning in the design process, and is powerful for envisioning and simulating various future use situations. It has been widely used in HCI designs for many years.

According to Carroll (2000), scenarios are stories about people and their activities. Bødker & Pedersen (1991), state that stories about people and their activities are easier envisioned, and more realistic, when explored and developed through enacting. The said stories will often be built upon a traditional narrative structure with a clear beginning, middle and a definite end. Though scenarios can be written out as text, they can also be told by use of sketches, photographs and videos.

Framework for co-design participation

This study proposes a co-design framework based on the design process. The framework is adapted from the research of Sanders, Brandt & Binder (2010), who,

after conducting co-design sessions with different groups, noted that most co-design practitioners had difficulty in identifying appropriate co-design tools for projects. The proposed framework is not considered an end in itself but is open to further development as the field of co-design grows. The framework provides an overview of discussed co-design tools and techniques for engaging non-designers in specific co-design activities across the design process. It has three main dimensions: form, purpose and context. Form describes the kind of co-design action taking place between participants in a task and is described by telling, making and enacting. Purpose describes why the tools and techniques are being used, and is described along four dimensions namely: for probing participants; for priming participants in order to immerse them in the area of interest; to get a better understanding of their experiences; and the generation of ideas for design concepts, for instance, creating and exploring future scenarios. These are considered in line with the design process. Context describes who, where and how the tools and techniques are used. Context will be described along four main dimensions: group structure, physical or virtual, venue, and stakeholder relationships. The purpose and context of the tools and techniques should be well understood and customized accordingly. **Table 1** lists examples of the tools and techniques that are commonly used today, and that have been discussed in this paper. They are organized by form (making, telling and enacting). The X's indicate where these tools and techniques are commonly applied in relation to their purpose in the design process (probing, priming, understanding or generating).

There are a number of variables that describe the context for use of the co-design tools and techniques. Each of the variables need to be considered carefully when planning for co-design activities.

a) Group structure

Co-design sessions can be conducted with either individuals or groups. The structure of the group can vary based on size, gender, age, literacy levels and financial ability, all of which determine co-design approaches. Within groups, there is always the option of asking participants to work individually or collectively. The purpose, then, determines the choice of group structure.

b) Physical or virtual

It is preferred that co-design sessions be conducted in a face-to-face manner, but there are factors that may necessitate a virtual session, such as costs or restrictions brought about by situations such as the Covid-19 pandemic. Whatever the circumstance, the choices for form in both scenarios should enable the

team achieve purpose. **Table 2** shows how the tools and techniques of co-design are currently being put to use along the dimensions of individual, group, physical and virtual compositions. This composition is, however, anticipated to grow as advances in new communication technology emerge.

TABLE 1: The tools and techniques of co-design organized by form and purpose in the design process

Form of Tools and Techniques	Activities In The Design Process			
	Probe	Prime	Understand	Generate
Telling				
Games	X	X		
Story telling and oral narratives	X	X		
Future workshops			X	X
Making				
Prototypes			X	X
Probes	X	X		
Generative tools	X	X	X	X
Enacting				
Theater			X	X
Scenarios			X	X

Source: Author 2020

TABLE 2: Current applications of co-design tools and techniques as described by context

Tools and Techniques	Context			
	Individual	Group	Physical	Virtual
Telling				
Games	X	X	X	X
Story telling and Oral narratives	X	X	X	X
Future workshops		X	X	X
Making				
Prototypes	X	X	X	X
Probes	X	X	X	X
Generative tools		X	X	
Enacting				
Theater		X	X	X
Scenarios		X	X	

Source: Author 2020

c) Venue

Co-design sessions can be conducted just about anywhere. Some of the most common locations include the participants' own environments (home, school, workplace, community hall, etc), design studio, research lab and/or in a conference room. The venue needs to be considered carefully because, whichever choice poses certain advantages and disadvantages. There is need to consider accessibility of venue to all participants and certain activities, such as enacting, are best done on location. The choice of venue should be cognizant of budget constraints and number of participants.

d) Stakeholder relationship

The relationship between the design/research team and the participants is a variable to consider when planning for co-design activities. The participants need to be chosen carefully, so as to allow a variety of perspectives. Some questions to consider include:

- How will participants be selected?
- Will the participants be prepared ahead of the sessions?
- Will there be compensation for participation or will participants be treated as volunteers?
- How much time will the participants be engaged?

CONCLUSION

Co-design tools and techniques can be broadly categorized into tell-make-enact activities. Telling refers to tools and techniques that support verbal expression, such as talking and explaining. Telling tools include diaries, logs and card sorting. Making refers to tools and techniques for producing tangible things. They include collages, maps, models and mock-ups. Enacting refers to activities where one or more people imagine and act out possible futures by trying things out in settings that resemble, or in locations, where future activities are likely to take place. Mainly used are theater techniques such as drama and scenarios. Within the typical design process, co-design tools can be used for probing and priming participants in order to immerse them in the area of interest. Commonly used co-design forms include games, story telling and generative tools. Another use of co-design tools in the design process is to allow the designer get a

better understanding of participant experiences. Use of drama, scenarios and generative tools can help achieve this aim. Lastly, within the design process, co-design tools and techniques are used for the generation of ideas for design concepts, for instance, creating and exploring future scenarios. Successful co-design sessions require that the purpose and context of the tools and techniques be well understood, and customized accordingly. Context describes who, where and how the tools and techniques are used. Context is described along the dimensions of group structure, physical or virtual contact, venue, and stakeholder relationships. Each of these must be balanced delicately if success is to be achieved.

RECOMMENDATIONS

The tools, methods and techniques of co-design identified in this paper are by no means an end in themselves. As an emerging field, these tools, methods and techniques are continuously being invented, and the database needs to be continuously upgraded as new tools, methods and techniques get documented. That means that the proposed co-design framework needs to be built and developed further. An understanding of the context of co-design application is important in determining success.

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