Understanding Power Differentials and Cultural Differences in Co-design with Marginalized Populations

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ABSTRACT

Co-design collects insights from multiple stakeholders collaboratively making it a powerful method to design with marginalized populations. In the latter context, stakeholders have varying levels of power causing asymmetry and possible suppression of one group over another. Such power differentials can hinder co-design's effectiveness. Through thirteen semi-structured interviews with co-design facilitators who have worked with marginalized communities in 43 different countries, we discovered that despite efforts to mitigate power differentials, significant disparities in educational and cultural backgrounds, language barriers, and gender imbalances prevent true collaboration. Tools for prototyping, analysis and evaluation often require literacy, advanced training, and resources. When these are inaccessible, co-design fails to materialize in the design analysis, implementation, and evaluation phases. We found this failure occurred with marginalized groups. We also found that experienced facilitators were aware of their own privilege as well as the power differentials of outside stakeholders such as donors, and they prioritized strategies to address them ahead of time.

CCS CONCEPTS

• **Human-centered computing** → *HCI theory, concepts and models.*

KEYWORDS

Co-design, participatory design, power differentials, HCI4D

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1 INTRODUCTION

Co-design is a commonly used research methodology in product and service development. It is a collaborative effort between two or more individuals [42], utilizing user-centered and participatory design activities [19] to collect insights and solutions directly from stakeholders. Stakeholders offer expertise and experience, while designers act as facilitators who "lead, guide, provide scaffold and offer a clean slate" [42]. Unlike traditional consumer product design, where participants are easily accessible, interested, and relatively homogeneous [28], co-design with underserved users involves working with stakeholders with varied levels of availability, interest, educational backgrounds, social standing, and power [22]. These differences often contribute to power differentials – the presence of asymmetry in socio-structural factors between groups, which leads to "degrees of control one group has over its own fate and that of outgroups" [41].

Past literature has found at least three different power differentials that impact the success of co-design: (a) power differentials within participants, where marginalized users with lower socioeconomic status or levels of education are suppressed by more outspoken participants, (b) power differentials between the facilitators and marginalized participants, and (c) power differentials between facilitators and more powerful stakeholders, e.g., facilitators facing resistance from donors [15]. Power differentials can hinder the co-design benefits for underserved communities. Researchers have explored existing institutional power differentials in co-design for service-based design and identified dimensions of power that negatively impacted the process such as conflicts of interests and hidden omission of possible alternative solutions [15], [6], [15]. Bratteteig & Wagner [4] discussed decision-making powers and their impact on the co-design process. However, the authors recognize that their findings focus on co-design with majority groups and may not apply to co-design with marginalized populations. While Del Gaudio et al. [11], and Lorini et al. [29] explored other power-differentials such as cultural and contextual differences in case studies with marginalized groups, a more detailed analysis on power differentials between the participants themselves, and between facilitators and participants, remains under-explored.

Researchers have explored best practices and strategies to mitigate the impact of power differentials during co-design, such as working with local partner organizations [37], utilizing pictorial practices [42], and hands-on activities [23]. The efficacy of such

mitigation strategies while working with marginalized populations remains unexplored. In order to understand the impact of power differentials on the success of co-design practices with marginalized populations, as well as to identify the efficacy of mitigation strategies, we recruited 13 participants with experience facilitating co-design workshops in 43 countries with marginalized populations.

We found that power differentials between local communities and facilitators are highly contextual and remain influential even after attempts to mitigate their impact. For instance, in male-dominant cultures, even when women successfully challenged gender norms when facilitators were present, the social fabric in stating fixed gender roles limits them from practicing skills and tools learned from the co-design process after the end of the workshop. In these cultures, we found female facilitators faced more resistance and often adapted to a more indirect intervention than their male facilitator counterparts. We also found that institutional power had different impacts depending on past situations. For instance, when engaged in institution-led projects in a large Midwestern city in the U.S., facilitators sensed resistance from marginalized users that could be based on historical distrust and racial dynamics of past interactions of researchers of that institution with that particular community. On the other hand, in international settings, most of the facilitators found it difficult to align the expectations between their initial research goal and the local population, especially when local populations viewed their institutions as having access to significant resources. Lastly, we found our participants evaluated the success of co-design by focusing more on the process than the outcome. We did not find any standardized method to evaluate the process of co-design; meaningful participation by all participants was a crucial indicator of success for most of the co-design facilitators we interviewed. However, from the data, participants held different perspectives on what counts as meaningful participation. Some sought equal contributions, whereas some argued facilitators should approach participation with more flexibility. Lastly, we found that strategies employed by experienced facilitators can mitigate power differential and cultural issues only to an extent, and often don't last beyond the particular co-design interaction.

Our work highlighted cultural and power dynamics issues that can hinder the success of co-design with marginalized populations. We explored strategies that can help mitigate the impact of such factors, and encourage design researchers and practitioners to be aware of such issues ahead of time with a toolkit of mitigation strategies to address them. This work can help novice HCI4D researchers practice co-design with marginalized populations, while also engaging the HCI4D community in conversation on ways to measure the success of the *process* of co-design.

2 RELATED WORK

Co-design as a method shares similarities and different names in the theories of HCI and interactive learning environments. Authors in the past have developed and advocated frameworks to actively involve participants in the design process. Co-Cooperative Inquiry is developed by Druin in 1999, along with a theoretical framework that is grounded in traditional design and HCI research theories. By directly involving end-users in the process through iterative prototyping, the framework uniquely builds partnerships in the technology development process [14]. Authors such as Scaife also used a similar framework called "Informant Design" to illustrate how users can help the design at different stages [43]. Over the years, the collective approaches have evolved beyond child learning and started to take complex stakeholders into account in the complex environments [45]. Co-design has established prominence to implement innovation [15], utilizing user-centered and participatory design approaches [19] to collect solutions directly from stakeholders.

We conducted literature review to explore power differentials in prior literature on co-design, with a specific focus on socially engaged design, HCI4D *and* other ICTD research with a focus on marginalized, vulnerable, or underserved communities. The review focuses on identifying power differentials in co-design literature and recommended mitigation strategies particularly focused on mitigating the impact of cultural issues and power differentials in this process.

2.1 Dimensions of Power in Co-design

Based on reviews by Gregory [19] co-design utilizes subjects' experiences and emotions to draw touchpoints between the users and product or services [15]. To understand power differentials in service work, Farr took a "bridge-building" approach to further analyze [15], reviewing co-design literature with multi-dimensional analysis on power. Farr summarized from Haugaard [21], Lukes [30], and Digeser [12] to form the four dimensions of power in co-design: conflicts of interests, hidden omission of possible alternatives, deceptive and indiscernible characteristics, and duality of power on social life [15]. The first and second dimensions – conflicts of interest and pressure to converge–apply to the context of social innovation. By mapping observed power differentials from case studies to the two dimensions, one can better understand power differentials in co-design for development.

2.2 Power between Institutions, Communities, and Donors

Across literature, various authors have highlighted the institution's role in co-design. Authors like Farr [15] and Carr [6] discussed the role of the institution suppressing the users by favoring the institution's design interest, creating this clear boundary line and the untrusted relationship between institutional researchers and the users. When multiple levels of interest clash in a co-design setting, the process tends to favor the institution's authority. Farr presented the dilemma in co-design for social innovation—seeking to reduce the power differential by challenging the institutional interest, while noting that the "co-design process tends to work with institutions". This collaboration with service institutions may oppress the "observable conflict of interest" between the end-users and the institution [15]. Carr's analysis also echoed Farr's findings. The current Western-centric design practice tends to suppress or devalue the ideas of the service users in co-design, even when the purpose of the workshop is to encourage finding user-centered solutions. In the example of service care design, institutions tend to draw a clear boundary line between design professionals and the service users ("us vs. them") [6]. The baggage that comes with

institutions prevents true and honest conversation. This boundary can also be present in the use of languages. Linguistic styles of institutional researchers and the marginalized users are quite different. The use of language will signal several types of powers, including the static power of identities, which is a form of power between status, and dynamic power differentials based on situational interaction. Participants tend to echo the linguistic style of people with high power, which defeats the collaborative effort [9].

However, some authors argued that the institutions should not be solely blamed. The institutional initiative is driven by funding and deadline pressures, and time and money constraints lead to a biased co-design direction, harming the partnership between the community and the institution [16]. There are conflicts of interest involving the productive tension between the funding institutional body and the participants. The ones in power expect immediate social innovation, or driven by their own deadlines rush the co-design process that creates further power differentials. Such a difference is even more prominent in a marginalized community, where the end-users and facilitators have drastically different starting points within the process [16]. Lorini et al mentions how a successful co-design outcome depends on establishing the partnership, where the researchers' intervention will need to be tested and grow as participants make contributions. However, researchers' motivations are largely driven by time and funding constraints, which often lead to short-term projects. Such projects result in biased design solutions, favoring the interests of researchers because the design process is rushed through [29]. It is worth noting that although funding agencies in the global north may give researchers more autonomy in terms of activities performed through funded projects compared to those in emerging economies, such funding still comes with limitations in supporting co-design projects. For instance, these funding agencies tend to approve proposals with a very specific scope and clear data involvement, whereas co-design often faces ambiguous scope and relies heavily on the activity to guide the process. Therefore, just autonomy in funding may be insufficient to support co-design projects. These constraints often create a dichotomy between institutions and participants because it leaves unethical and empty promises for the communities.

2.3 Power between Users and Design Experts

One prominent power differential discussed in co-design literature is the level of expertise of the participants and the facilitators. Decision power often circles back to the researchers and facilitators who hold the research vision and expertise to realize a solution [4]. Hence it is important for facilitators to recognize their roles as observers and transfer the ownership of the design process to the participants. Bratteteig and Wagner discussed the four stages of the decision-making process: creating, selecting, solidifying, and evaluating choices. Power-differentials are most prominent in the selecting and solidifying phases because they require more technical knowledge. During these phases, participation is less active. It is often the stakeholder who has more understanding in design artifacts that speaks the most [3]. In an international setting, such differences in expertise may pose different challenges. A field study [23] indicates that there may be different challenges in an international setting with physical product development, considering making skills are essential in realizing a solution. Participants value the opinion of the facilitators who have experience in making designs because they can realize the concepts. However, transferring too much agency to the facilitator can be dangerous as it defeats the purpose of co-design. Because selecting and concretizing choices require expert knowledge, user participation is often lacking. The key finding on power concentrated in the hands of individuals with expertise echoes the discussion of empowering users through increasing design expertise [4].

2.4 Contextual and Cultural Factors

The context where the co-design takes place results in subtle differences that can impact the co-design process. Therefore, putting the power differentials and the stakeholder roles in context is crucial to an efficient co-design process [32]. Cultural and contextual factors lead to a more "wicked" problem [7] and such nuances can affect the co-design outcome even when facilitators follow best practices. The contextual and cultural dynamics add another layer of difficulty to the untrusted and tensioned relationships between design professionals and the marginalized users [5]. In a failed case study that took place in a conflicted area, researchers talked about how a kiosk design failed, even when they followed the best practice of immersing the prototype in the environment [11]. In the case study, the power exercised by a local armed group hindered the implementation, which was not related to the obvious design goal. However, these local and contextual dynamics influenced the outcome because participants feared to participate [11].

2.5 Strategies to Mitigate the Impact of Power Differentials

We summarized strategies across participatory design and co-design literature and mapped these strategies to power differentials (Table 1). It is worth noting that in some of the literature cited, participants are not marginalized, and the authors acknowledge that some effective strategies may not apply to marginalized populations.

2.5.1 Institutional Power-Local Partners. One of the principles to follow to overcome institutional power differential is to form a trusted relationship through adapting to the local context. A community-academic partnership is very valuable, and to achieve such a trusted network, facilitators will need to engage in a series of activities that may not directly relate to their core research questions. Embracing such nonlinearity will yield a more stable partnership, hence a more successful outcome [18].

2.5.2 Cultural Differentials-Transfer Ownership. When facilitators practice co-design in a foreign context, establishing rapport and a trusted network with a third-party organization is crucial. Because the local power and experts enable a more efficient local adaptation and help the facilitators understand the context quickly. Therefore, it is vital for designers to gather more insights outside of their professional circle. Firms need to encourage collaborations and allow the participants freedom. By letting go of some of the power the decision-makers have, the users and staff will gain more control, hence a more successful co-creation process [31]. End-users have expertise that is different from technical skills. Strategies from the Uganda field study showcase strength in recognizing non-technical

Table 1: Strategies to Mitigate the Impact of Power Differentials (PD) from Related Work (Work with Marginalized Users*)**

PD	*Strategies*	*Summary*	*Context*
Institutional Power	Non-research activities	Engaging in socially and scientifically robust activities in the context of the application can generate user knowledge[18].	Health Service
	Partnership with locals	Indigenous researchers provide rich insights in the context of the community and challenge the western-centric power structure[37].	Environmental Change Research
Decision-making Power	Prototyping	Prototyping encourages the participants to initiate negotiation, selection, and evaluation[3, 23]. However, the presence of authorities may suppress the efficiency of this practice[2].	Urban Planning[3], Prosthetic Design*[23], Healthcare[2]
	Hands-on activities	Engaging in hands on activities enables users to express in creative model-building[26] and pushes out of individuals comfort zone[20].	Creative Practice[20], Healthcare[26]
	Dynamic role-shifting	Rotating the facilitator role can amplify layman's voice to mitigate tension and conflicts[35].	Healthcare
Knowledge Differentials	Generative toolkit	Generative toolkits are used to facilitate the collaboration and expression among non-designers to uncover their ways of living[42].	Participatory Design
	Sketching	Users heavily participate in the part where they can see and concentrate on solution in their own language of sketching[4].	Urban Planning
	Gamification	When planning layout with residents, a game is used to visualize abstract design concepts to hands-on participation[27].	Urban Planning
	Multi-modal expression	Different ways of expression like installation, pictures and performance can connect different individuals' perspectives[46].	Community-based Design
	Creative capacity building	During a workshop in Cambodia, a process that utilize sessions of coaching on design process to overcome knowledge gap[13].	Technology development with people with disability (PwD)*
	Cross-pollination materials	A process which participants share different and possibly conflicting ideas and make connection and frame the project. This strategy can help overcome hidden boundaries between different social groups[46].	Community-based Design
Cultural Differentials	Cultural informants	Cultural informants and technology probes helps draw crowd and get insider perspective[39], yet this strategy should be used with care by outside researchers[5].	Technology development in Uganda*
General Practice	Offer compensation	Having financial alternative suitable for the community members supports sustainable co-design practice[35].	Healthcare
	Reflection	Co-design requires ongoing reflection and work to overcome power imbalance and leads to implementation[35].	Healthcare

expertise among participants. Local users can contribute to the early stage of design by providing access to cultural informants. The cultural network is also a great resource for researchers to establish social intimacy and decrease power differentials [39].

2.5.3 Decision-making power -Prototype & Hands-on Activities. The use of artifacts and prototypes can serve as a mechanism to mitigate power in the decision-making process [4]. In the case study of working with volunteers in dementia care, the researchers also find the use of prototypes helps them to elicit shared expertise and knowledge from the participants. Because prototypes bridge the gap between volunteer and professional knowledge, thereby translating the research expertise into lay language. In the context of marginalized communities, prototyping methods boost effectiveness and participation [17]. Based on the results of 11 expert interviews with experienced facilitators, engagement in hands-on activities and shared cognitive activities are the two most effective strategies to encourage participation in co-design activities. The transfer of experiential knowledge helps participants in the co-design process to develop a richer understanding of the context and be more comfortable in crossing disciplinary boundaries [20]. When sharing the expertise, facilitators should keep the workshops short and flexible to have participants stay engaged. Recognizing

the capacity of the participants is crucial. Designers may lead in the early stage and dynamically change their roles as the process moves to a later stage [23]. It is worth discussing that participation is not valuable if participants converge too quickly. Critical reflection is more crucial than meaningless participation. These nuances should be considered as an evaluation of the success of a co-design workshop. When facilitators engage strategies that evoke critical conceptualization by using hands-on experience and situated design [2], there is better success in the outcome of the product.

2.5.4 Lack of expertise -Visualization & Gamification. Non-verbal artifacts also visualize the expert knowledge, which is often hard to communicate through words or writing. Especially with marginalized users who are low-literate, tangible activities such as a cultural probe, avatars, and games make the expertise more transparent and accessible [42]. In the Preference-Planning-Processing (3P) Process, collecting visual elements is the first phase to increase the understanding. By proposing different levels of problems and solving them through game-like tools, facilitators can raise awareness and build connections. Through strategies like visualization, pre-campaign, and gamification, Lee noted designers can build a common language and increase contributions among participants for co-design in services [27]. Participants can still contribute spontaneously through sketching when implicit knowledge was translated explicitly by facilitators. However, they acknowledge such a strategy may work differently in the context of a marginalized community. Therefore, the authors recommend more data should be gathered in the context of practicing prototyping with marginalized communities [3, 4].

2.6 Gaps Identified from the Current Practice

The literature work indicates some effective strategies to mitigate power differentials through theoretical frameworks and practical insights with non-marginalized populations. However, there is currently a lack of validation on how effective these strategies are to empower marginalized users or mitigate cultural issues or the impact of power differentials. When co-designing with marginalized populations and in international contexts, these strategies may not be as effective to create an equal partnership. Past research in socio-technical systems suggests that aspects of power differentials such as race are more pervasive and treated with convergence [36]. Analysis suggests that the equal partnership between the participants and facilitators is not a static interaction [44] and should be qualitatively different from traditional teaching relationships [25]. By initiating exploratory research, we aim to understand the current power dynamics between facilitators and participants(co-designers) and within participants, in the co-design process. We also aim to uncover various cultural issues that may hinder the success of the co-design process. The study aims to analyze the efficacy of existing co-design strategies and heuristics while working with marginalized populations and uncover best practices and user-centric design activities that address cultural gaps and power differentials.

3 METHODOLOGY

3.1 Study Design

Between January and June 2021, we conducted semi-structured interviews with 13 practitioners of co-design with marginalized populations. We used convenience and snowball sampling to recruit experienced practitioners (4 women, 9 men) who had facilitated co-design activities in 43 countries in a variety of different marginalized contexts. We decided to interview facilitators due to the rich perspectives they had with implementing co-design. The facilitators background was relevant to provide more contextual information about the power differentials they witnessed and the efficacy of the mitigation strategies they used in various marginalized context.

The first author conducted all of the interviews over Zoom. All interviews were conducted in English and were audio-recorded after participants' consent and lasted 45 minutes on average, ranging from 23 to 63 minutes.

3.2 Participant Recruitment and Demographics

As part of their review, the Institutional Review Board (IRB) determined that the study is no more than minimal risk and exempt from ongoing IRB oversight. Participants were recruited through convenience sampling via the research team's network. The recruitment materials and informed consent document provided general information about the study and made it clear to potential participants that certain conditions must be met to qualify for inclusion in the research study: (a) Participants must identify as professionals who practice co-design and be at least 18 years of age. Demographic information including age range and the disciplinary background was collected as part of an active screening process. We recruited university faculty and staff (n=5), Ph.D. candidates (n=3), and facilitators from private sector and NGOs (n=5). Participants all have experience participating and facilitating co-design in contexts where the stakeholders were from a diverse range of underrepresented populations, such as with ethnic minorities, forced migrants, low-income communities, etc.

Participants' experience in practicing co-design varied from 6 to 22 years. Their co-design projects ranged from 3-week workshops, 2-year research projects, to decades of community engagements. Among the project locations, two participants (P2, P3) primarily led co-design projects with local communities in the U.S., while the rest primarily engaged with global co-design projects largely based in low-income countries. Table 2 participants demographics include gender, country of origin (CoO), language (Lang.), affiliation (Affl.), years of co-design experience (YoC.), project location (Proj Loc.) and protocol version (Ver.).

3.3 Interview Themes and Protocols

We used two sets of protocols when conducting the interviews. We developed the first version of the protocol based on the literature reviews. To remain exploratory at the initial stage, the first protocol focused on broader themes and examples of participants' experiences when practicing co-design. To align with the understanding of terminology, we asked participants to share their definitions of co-design and their respective success metrics. We then asked about a

Table 2: Participant Demographics

ID	*Gender*	*CoO*	*Race*	*Lang.*	*Affl.*	*YoC.*	*Proj Loc.*	*Ver.*
P1	M	USA	Caucasian	English	University, Faculty & Staff	10	USA, Ghana, Indonesia, Ecuador, India, and Bangladesh	V1
P2	M	USA	Caucasian	English	University, Faculty & Staff	12	USA	V1
P3	M	USA	Caucasian	English	University, Faculty & Staff	9	USA: the Great Lake Areas	V1
P4	F	NA	Asian	English	University, Faculty & Staff	NA	South Africa	V1
P5	M	USA	Caucasian	English, Swahili, Spanish	Industry Professional	13	USA, Ghana, Tanzania, Kenya, Zambia, Uganda, Colombia, India, Pakistan, and Denmark	V1
P6	M	USA	Caucasian	English, Dutch, Spanish	University, Faculty & Staff	*NA*	India, Kenya, Malawi, Mali, Nepal, Senegal, South Africa, Togo, Uganda, and Zimbabwe	V1
P7	M	NA	Caucasian	English, German	University, Ph.D. Candidate	NA	Germany, and Pakistan	V1
P8	F	USA	Caucasian	English, Spanish	Industry Professional	22	USA, Germany, China,Japan, Australia, Switzerland, Indonesia, Botswana, Uganda, Mexico, Costa Rica, and Canada	V2
P9	M	Pakistan	Asian	Urdu, English	Industry, Professional	6	Pakistan, Kenya, Sudan, Jordan, Morocco, and Mexico	V2
P10	F	India	Asian	English, Tagalog, Bicol	Industry Professional	11	Philippines, Pakistan, Thailand, Cambodia, Myanmar, China, Zambia, Mozambique, Tanzania, Kenya, and Australia	V2
P11	M	NA	NA	English	University, Ph.D. Candidate	9	Colombia, Perú, El Salvador, USA, Rwanda, Uganda, and Mongolia	V2
P12	M	Korea	Asian	English	University, Ph.D. Candidate	NA	Zambia, Tanzania, and Greece	V2
P13	F	USA	Asian	English	Industry Professional	9	Tanzania, Uganda, Thailand, Pakistan, Kenya, Zambia, Namibia, Botswana	V2

recent co-design experience. If the stakeholders were not marginalized users, we further probed their definition of marginalization and asked them to share a project working with users with similar profiles. Following the examples, we asked about challenges they faced during co-design, and whether power differentials affect the process *or* outcomes. Depending on their responses, we then dived into specific power differentials that emerged, and asked about strategies they would use to empower the users. Finally, we asked whether they had practiced co-design in virtual setting considering the impact of COVID-19 pandemic. After the first 7 interviews, we started to notice patterns on similar definitions, success metrics and consistent types of power differentials that emerged through co-design experience. Once we reached saturation on the initial questions, we adjusted the protocol to dive deeper into empowerment of users within the co-design process, strategies used to mitigate these differentials, and trade-offs when applying these strategies. Questions about co-design in virtual settings were dropped due to insufficient information. We started off by asking what success metrics they used to measure the impact of the co-design work. Then we follow up with examples of how they mitigate the impact of power differentials. If the examples were all successful, we further probed

the participants to share failures and trade-offs when using such practices. In the end, we followed up with a few prominent and frequently used design practices such as brainstorming and team formation strategies to see if the participants had contextualized these strategies to their situations.

3.4 Data Collection, Coding, and Analysis

The first author conducted all 13 interviews and used 2 versions of protocols (54% for V1 and 46% for V2). The interviews were recorded via Zoom recordings and notes were taken during the interviews. All interviews were transcribed using Zoom's transcribing service, and any personally identifiable information was removed from the transcript. Data is only accessible to study team members with password access. Personal laptops used to access data are secured also by individual ID and password protection and use secure connections to communicate with secure cloud services. We conducted qualitative analyses using inductive coding. The first and the third authors first identified preliminary themes separately and collaboratively synthesized the codes into a cohesive codebook that consists of 89 codes, including *Institutional Power & Distrust*, *Strategies to Mitigate*, and *Limitation & Trade-offs*, etc.

4 FINDINGS

4.1 Definitions of Co-design

Although all participants were recruited with an understanding that we would discuss co-designing with marginalized population, they had a range of ideas about what co-design actually involves. Therefore, we asked each participant to give us their definition of co-design, marginalization, and what would success look like in co-design with marginalized populations.

Findings suggest that participants define co-design on a broad spectrum ranging from participatory design which users are consulted to inspire design ideas, to the other end of the spectrum where the users themselves come up with the design and production of the solution. Participants who came with a human-centered design approach associated co-design with the end of the spectrum where stakeholders have a direct impact on a system.

"There are a few different practices and priorities that have often been associated with this idea of a human-centered approach. One of them is attention to human values and priorities. Another is the use of participatory approaches and co-design approaches. And a third is designing systems that advance the autonomy or agency or skills of the end-users. And I think I associated [co-design] with approaches that are more on that end of the spectrum [third] with more participation of users or other stakeholders who are going to be affected by a system." [P6]

Influenced by MIT D-lab's design process, participants with social science backgrounds mentioned the framework of "design *for* users, design *with* users and design *by* users" [1], A few of our participants associate co-design with the concept of "design with" users [P4, 12, 13].

"The design with is kind of like co-design, because you basically are designing alongside with the users. And design for and design by is like providing the capacity for the people to kind of understand design process and have them design by themselves. So the definition of co-design… in my work is… trying to have the end-users or whoever is benefiting - the beneficiaries - involved in the process to create, for my instance, educational materials, or curriculum or programs together, so it's more culturally more acceptable for them [beneficiaries/co-designers] to actually take on further… implemented [implementation] sustainably than other approaches." [P12]

Despite variation on participants' position on the spectrum of the level of participation that defines co-design, they shared a common understanding that co-design projects veer off from the direction that the facilitators may have had in mind. Most of the participants mentioned that co-design often yields a different direction or outcome than what they had initially envisioned. They do not consider the deviation as a failure but expect and embrace it as a feature of co-design. In fact, according to P11, the changing element is the most powerful feature of co-design, it's not an error.

"My ideal co-design is where the solution that you actually end up with is not one of your own ideas… for me, that's kind of like a holy grail, where they [designers/facilitators] kind of tell a story and go, and so we worked with this group, and we got them to think about a problem. And they came up with a brilliant idea that worked for them." [P10]

Participants no longer consider themselves as designers and researchers during the co-design, but "*more of an enabler, or facilitator.*" [P9] By stepping down from the role of solution generators, participants believed they were transferring the decision-making power to the co-designers.

"I really like that kind of literature that is focused on trying to shift decision-making power, even away from designers; designers can kind of become more facilitators or collaborators, and try to give the power into the hands of the people that you work with, and for. And I tried to do this in the work and there's some approaches that really try to put political issues and maybe at disagreements into the design process as a line of work from mostly Scandinavia, but also the US." [P7]

4.2 Success Metrics

4.2.1 Process Evaluation. Since co-design often yields different results than expected, based on participants' definition, it would be unrealistic to measure success of co-design solely on the eventual product or designed solution that comes out of the co-design. Given the nature of co-design projects, facilitators are often dealing with unpredictable factors from several parties of interest. Therefore, we found that our participants evaluated the success based on the co-design *process*, instead of the efficacy of the solutions generated. P8 and P9, both industry professionals, acknowledged that their understandings of success for workshops differ from their regular product design jobs. In co-design workshops, they link the success with interactions with co-designers in the process.

"In those cases, what success looks like is, for me in particular, to not have that much of a visible effect, to be the support structure underneath and around the people who are designing the solution, answering whatever questions I can, pointing them towards resources, helping them feel more confident in their abilities and encouraging interplay between people on the team." [P8]

Therefore, even though facilitators may end the project lacking satisfaction towards a final solution, which may be a failure according to industrial product design standards, they would still consider

the project successful if there were meaningful participation from the co-designers.

4.2.2 Meaningful Participation. When it comes to what would be meaningful participation, participants held different perspectives. Some believed meaningful participation meant equal contribution from different co-designers. If *"some dominant personalities that prevent certain other people from feeling comfortable and engaging as deeply"* [P5], the workshop will be more of a failure to them. However, some participants [P2, P11] believed that equal participation does not translate into "meaningful" outcomes. A common misconception is that there is a need to act as equals in a co-design workshop. P13 pointed out that such "seemingly equality" is more toxic than the differentials themselves, and it is generally a misconception and a Western (especially U.S.) standard to measure participation by taking leadership.

"I used to think that people want to be leaders. I just kind of assumed that. But that's just not true. Not everyone wants to do that. And that's totally okay. The world needs different kinds of people. And to push people into positions of leadership when they're not ready and don't even really want that time with that organization is just not sustainable. It's not regenerative. It's just not nice either." [P13]

P11 advises that *"participation can be expressed in a number of different degrees in a number of different ways in how these initiatives are measured."* Therefore, they believed meaningful participation should be measured fluidly according to the initiatives set before the workshop, not based on standardized metrics. However, we were unable to uncover any formal methods to evaluate meaningful participation in co-design from our participants.

4.2.3 Lack of Interest in Quantitative Measures. Lastly, our findings suggest that there is a lack of quantitative measurement for co-design practice. When asked about quantitative metrics and tools, only 1 out of 13 participants mentioned they would deploy quantitative surveys to measure the satisfaction with the designed artifact or tangible outcome of the co-design process [P9]. Some participants argued for different metrics of success. For example, due to the nature of co-design work and its complexity, they do not believe that scalability of the designed solution or the quantity of products produced would be fair metrics for measuring success in the context of their work [P2, P10]. Instead, they believed that focusing too much on the quantitative metrics can be harmful to the process, as it is counterproductive to the creative process.

"You ask any designer when they were a child, were they interested in efficiency? Or are they interested in the light or joy of building things with their hands and efficiency is never in it... It's not a question of being efficient, but it's a question of being attached." [P2]

4.3 Reflection on the Term "Marginalization"

An individual can be marginalized in multiple respects, so we defined the term "marginalization" broadly throughout the interviews. However, to avoid generalization in respect to contextual information, participants were asked to reflect on the term "marginalization" relative to their work. Participants worked with a diverse range of marginalized groups, and these groups were marginalized through different factors such as race, gender, socio-economic status, and educational level. Participants mentioned being "marginalized" does not mean that the users have no resources and skills. We found a lot of introspection from our participants when it came to how they perceived resources in low-income countries. *"I mean, there are all sorts of problems early on, mostly to do with me. And expectations of, what my role was, what my expertise was, and understanding that even though something looks different than you… like the physical form looks, under resourced or degraded, or whatever it might be, doesn't mean that there are not resources and skills there. And so, one is to try and sort of absolve yourself of judgment and ego that says, 'this doesn't look like the way it looks like where I am–therefore, there must be something wrong with it.'"* [P2]

However, on the other hand, our participants reflected that despite the skills and resources the co-designers possess, these groups still *"exist within a system that puts them at the margins"* [P6] due to deficiency in power. Participants mentioned that marginalization is dynamic and highly dependent on the context of the system. There are different degrees of marginalization within a group of populations. For example, when P5 worked with the refugee populations in Uganda, they noticed even among extremely vulnerable populations, there are different degrees of power within that marginalized group.

"Refugees [in another country] were certainly much more marginalized in that context. Whereas in Uganda, while they [refugees] certainly didn't have all the advantages [of the host population], they would have [as refugees] access to employment, they had access to schools, and that allowed them to, that made them less marginalized [compared to other refugees in different countries where access to work or school is limited]." [P5]

After sharing the definition of co-design, success metrics and reflection on marginalization, participants shared major challenges they faced when leading co-design workshops with marginalized populations.

4.4 Challenge 1: Power Differentials

4.4.1 Institutional Power: Attitudes Towards Institutions. Participants who practice co-design from an academic context or represent their universities find their identities and power privileges are often associated with the institutions. Many participants mentioned that the association indicates underlying power differentials between the co-design facilitators and the communities. However, the attitudes towards institutional projects differ with nuances between communities domestically in the U.S. and overseas. In local U.S. communities, where American university researchers can reach local residents more readily, marginalized users tend to consider facilitators who come from a university to have an intention to exploit the community solely for research purposes due to historical distrust and racial inequality. However, a limitation with respect to this finding is that all of the researchers we spoke to who worked with US communities were affiliated with a large research institution in the Midwest, and this institution has had historical abuses with respect to research conducted with marginalized populations in the past. In a community-based project in the Great Lakes area, where racial difference is distinct, an institution-led co-design session was seen as a "research activity".

"The other was the sort of expectation of the university to get something demonstrably done, to publish it, or to even as you started

at the beginning, to have a research question. People are not research questions, their homes, and their lives aren't research questions, they are their lives. And the way that we [facilitators from universities] talk about something, as a research question, is really, sort of clinical and abstract. And denies emotion in many ways." [P2]

Despite the distrust and other emotions, the communities felt towards the institution, the communities still chose to work with institutions because of the resources the institute has access to, such as incentives for educational opportunities and technology equipment for the local schools. P1, who also led a similar project in a U.S. under-resourced community, mentioned, *"… as soon as you say that you are from [redacted university name]… It's kind of like an elitist label; people know that the University has money."* Such association with institutions damages the collaborative effort between the communities and the institutions, and leads to false expectations.

However, in international co-design work, these expectations can be falsely positive, and deviate from the originally intended project priorities. For example, when the same team [P1] engaged with local communities in rural Ecuador, marginalized users saw "wealthy American engineers associated with the university [P1]", they expected the groups to bring resources and skills to solve local infrastructure problems, which the residents genuinely care about. However, the facilitator team had neither the intention nor the resources to implement a water management system; their intention was to understand the residents' farming routines. Such false initial assumptions caused the team a long time to realign the expectations of the community with the goals of the co-design process.

4.4.2 Outside Stakeholder Power: Education Elitism. Despite the different attitudes towards institutional projects, our participants reflected on education elitism as an issue throughout the stakeholder engagement process, regardless of location. Partner organizations and institutions often brought in stakeholders outside of the community to diversify their expertise. However, many participants mentioned that often in a group co-design session, outside stakeholders who have higher education from a university hold power over less educated stakeholders. Some donor stakeholders with university degrees will dominate discussion, suppressing the other stakeholders from participating. There were examples in both domestic and global settings from interviews. In a co-design session in Botswana, one participant who came from a Western educational background thought *"that they should be respected [by the local community participants] and heard [perhaps more]in the process because they had an [advanced] education"* [P8].

Similarly, in a town hall project in the U.S., more educated stakeholders from the donor side *"present[ed] and talk[ed] intelligently about technical processes that a layman is not going to understand"* [P3]. This differential isn't just externally enforced. Sometimes the marginalized populations' own perceptions of their skills due to a lack of higher education can limit their participation. We uncovered instances where differentials between educational levels [of the co-design participants] will discourage the participation of the marginalized co-designers who may not consider themselves "well-educated" [P3, P4, P8, P12].

Such interaction leads to disengagement of marginalized co-designers and passes the decision-making power to outside stakeholders, which defeats the essence of co-design to gather authentic insights and expertise from the actual users.

4.4.3 Strategy to Mitigate: Select Donors Who Embrace Co-design. When asked about the key to a successful co-design project, most of the participants emphasized the importance of selecting an appropriate donor for funding, and relying on partner organizations to build trust with the local communities and to overcome cultural differences. Although prior literature has stressed this point, a few of our participants mentioned it is vital to align the expectations early on with donors, considering co-design often reveals surprising insights and has the potential to eventually pivot of the project direction. There is a considerable amount of work and effort our participants spent in aligning their goals [researchers'] with a suitable donor who understands the co-design process [P11, P13]. A co-design expert would use criteria to vet the donors and make sure there is a right fit.

"Before we even sign up, contract, or come into a partnership, we let them know that before we do anything, there has to be a relationship-building process, that usually takes time. And it happens at the pace of the community, [and] is not at the pace of what the donor wants." [P11]

According to experienced facilitators such as P11, shifting from the proposed outcome is a normal feature of co-design, not a defect. Donors who understand this co-design feature allow facilitators to allocate resources for marginalized communities.

4.4.4 Strategy to Mitigate: Acknowledge Power & Differences. Facilitators utilize different activities to mitigate power brought by stakeholders outside of the community. P1 emphasized *acknowledging the unearned privileges* with less experienced facilitators before the project. *"What feels salient in this particular situation, is doing reflective work, and anticipatory work ahead of time"* [P1]. This practice helps facilitators to address assumptions they may hold about themselves. P2 referred to this practice as *currency mapping– "understanding of what different people's currency is"* [P2]. During a session working with a low-resourced community in the Great Lake area, P2 noticed a stakeholder with an engineering degree dominated the discussion. By explicitly helping these stakeholders identify their power through a currency mapping activity, they [the stakeholder] discover their shortcomings in creative thinking, hence preventing dominance in future group discussions. P10 mentioned that they would use the *empathy walk* practice, *"a reflective way for a group to concurrently share and learn of each others' vulnerability, experiences and privilege"* [P10], to guide donors through the process in the eyes of the users and be more understanding of the timeline. If needed, the participants also mentioned that they would hold additional sessions with the powerful stakeholders to educate them about power dynamics. For example, during a student-led co-design activity working with Colombian farmers, "we also do have to do a lot of *mediation* with students… there's a certain amount of unlearning that needs to happen for these students to be appreciative of, of the plurality of views" [P11]. Because it is not easy to change facilitation strategies in the moment, knowing the existence of various power differentials ahead of time allows

facilitators to be more aware of potential friction that may occur during the workshop.

4.5 Challenge 2: Cultural Differences

10 out of 13 participants facilitated co-design workshops in international contexts. Therefore, besides power differentials, cultural discomfort is another main challenge they need to address. These differences can seem trivial early on but can negatively impact the co-design process if unaddressed.

4.5.1 Discomfort in Sharing in Group Settings. A common way of sharing or voicing an opinion in one culture may be seen as taboo in a different culture, requiring facilitators' skills and time to adjust into a more appropriate practice according to context. When working with resettled refugees in Greece, P12 mentioned that activities such as brainstorming to showcase ideas among co-designers is common in Western cultures, but *"In Afghanistan or Syrian cultures, having someone [especially women] present an idea to a group is somewhat like a taboo-ish thing."*

The cultural discomfort can also make a historically successful design practice less effective. For example, pictorial activities may be seen as a norm in visual and egalitarian cultures such as the Scandinavian culture, where many such design practices originated from. However, findings show that sketching in front of a group in a less visual cultures may face resistance from co-designers. When working with health workers in rural Uganda, P6 mentioned, drawing in front of the whiteboard or others is seen as "schooling" and many adult health workers feel reluctant to do so, and have the belief that sketching requires expertise.

"In the fieldwork I've done in East Africa, there are just a lot of people who don't feel comfortable doing that [drawing in front of people]. And then there are fewer people who would feel comfortable, but they may not actually want to draw [due to cultural limitations]." [P6]

4.5.2 Discomfort in the Formality of the Workshops. Cultural differences also appear in the perspectives of what people think of as design problems and how to solve them. For example, when working with displaced people in Germany, where local culture values formal attire and settings, P7 mentioned in one city, they noticed such a formal environment can be unwelcoming to forced migrants and therefore implemented a more informal approach workshop in the second city.

"I wanted to create an informal atmosphere and kind of have a feeling of friendship, [but I think I] go too far. But in the first city, we used the informal way, and that was the atmosphere that was trying to create that in the second city. And I learned later that some people stopped attending because they didn't like the informal atmosphere. For them… that was really weird." [P7]

In this case, formality also differs in linguistic styles. It is not solely about whether co-designers can understand each other, but more about formality in a language, even when co-designers speak the same language. P7 shared that marginalized groups such as forced migrants and refugees may learn a second language with different processes and understanding of grammar and formality. For example, in German, there are two ways of addressing people. People use *"Sie"* for an individual, which is a formal way, and *"du"* which is informal.

"Professionals who are German, insisted on using Sie when we were discussing because it has a more professional tone. They wanted a kind of formal structure for a very formal way of dressing for various reasons. Whereas, a Syrian whose German was really good said, why don't we use du because it's more welcoming, and it's more comfortable and less formal. And they [the different participants] couldn't agree." [P7]

The challenge upset other local stakeholders and resulted in a much smaller attendance, leaving less room for rich co-designer interactions amongst each other. With less attendance and past friction, the collaborative nature also decreased. These cultural differences, if not addressed, may hinder the co-design process as well as impact the outcomes, suggesting a substantial amount of prior understanding of different cultures, and pre-adaptation as needed.

4.5.3 Discomfort in Cross-Lingual Workshops. Language barriers also make it harder for marginalized co-designers to express their design opinions in cross-lingual settings. Even with translators present, it would be hard to accurately describe their ideas. P12 mentioned, "In Arabic and Farsi, many words even like the word design just can't be directly translated... So a lot of these terminologies get filtered through." Having to go through translation also marginalized co-designers who don't speak the language of instruction getting surpassed by the rest of the group. In a project in Central America, P5 observed a small group of co-designers who only speak Spanish were subordinated. During the ideation phase, other stakeholders unintentionally try to take over the tasks to save time. Instead of trying to explain the tasks to the member who did not speak the same language, the group said, *"Oh, well, you know, I heard what the instructor said. So I'll just take care of it, you don't need to worry about it."* [P5]

4.5.4 Strategy to Mitigate: Partner with Local Organizations. All participants mentioned reliable local partner organizations will help the facilitators gain trust from the communities faster, allowing for a truly collaborative relationship with the local co-designers. Local volunteers from the organizations often speak the same language and are familiar with the norms and customs, which help bridge the cultural and language barriers [P1, P2, P6, P7, P10]. While these local facilitators will help with the trust building, there are also inevitable trade-offs. When P10 was working with local researchers in Pakistan, who are more used to conducting quantitative research such as surveys, she spent more time helping the partner organization to understand the importance of dialogue within the co-design practice.

"[For facilitation], we kind of just look for local researchers, so people who have a research[locally] spend a lot of time[with the community]. [But] that kind of just means they've done a lot of surveys, like quantitative surveys, where they [local volunteers]'re used to asking that, like four pages of it. We're not doing that. We're doing free flow... let's practice, and then we turn them into [co-design facilitators], and then they have fun." [P10]

While this may not be a cultural issue per se, but one of finding good intermediaries, research norms differ culturally from one

culture to the other, sometimes making it challenging to find good intermediaries.

4.6 Power Differentials are Dynamic and Intersectional: Gender and Power

Most of the participants talked about the concept of power dynamics during our interviews. There is a joint agreement between the co-design facilitators that power relations among stakeholders are not static. As time, context, and other identities change, the power differentials will shift along with these changing factors [P4]. Intersectionality adds complexity and nuance to the degree of marginalization and who is in power versus who is not. There are also several facets of change that contribute to the dynamic nature of power. The first one is the intersectionality of identities someone holds: *"Several identities or backgrounds or skill sets that play in it [intersectionality], that's making it [power] dynamic"* [P4].

The combination of power differentials and identities is not a simple addition or subtraction, which changes the degree of marginalization. For example, among marginalized communities, "certain groups [being elderly and being a man] tend to hold more political power, which can result in other groups [the young, and women] having more limited access to resources" [P5].

4.6.1 Intersectionality and Gender Bias. Gender bias is a case where both power differentials and cultural differences interact and cause additional challenges. Many marginalized communities where our participants worked in were male-dominant cultures, where men are expected to speak first and perform physical activities [P5, P6, P12]. *"It's really difficult for the men, especially the older men to, you know, see a woman, especially a younger woman, as an equal on a team, as a peer, or to recognize that they have just as many rights and abilities to use power tools."* [P8]

In a mixed-gender group, men tend to overpower women in discussions, and the dynamic needs extra attention from the facilitators to make sure all co-designers contribute and engage meaningfully. However, P1 also mentioned that it is considered a standard norm for women and men to have "defined roles" [P1] in some Indian marginalized communities they worked with. Similar constraints were observed when working with Afghanistan and Syrian refugees [P12]. Such gender bias is difficult to change within a three-month co-design project and could potentially bring more harm.

"And having these [intellectual] thoughts and ways of thinking is even more taboo thing for women to have [in that culture]. Imagine them bringing all these thoughts and ideas... like, we basically train them to be more proactive, to share ideas to present, and then I think that sometimes those can be translated back to their family members. Now they will talk about things to their husbands, or their parents and I think some husbands don't like that. So they don't let their wives go back to school [the co-design sessions]." [P12]

Even when men in the community "recognize that they[women] have just as many rights and abilities to use power tools" [P8] during a workshop, there are "social pressures in terms of responsibilities that they are expected to take on and the activities they are expected not to participate in, *"such as women will still rely on "husband making the purchase [of the tools]."* [P5]

4.6.2 Facilitators' Approach with Gender. The different view of genders also influences the interaction between co-designers and facilitators. Facilitators are generally considered as well-educated and having higher power by marginalized communities. Although most facilitators chose to minimize their opinions to avoid shedding power over different participants, we found that the facilitators' position differs when it comes to mitigating gender differences. Male facilitators will purposefully work with men, and if necessary, facilitate the conversations among other quieter participants [P5]. Many women facilitators mentioned they need to adapt to the context when visiting a patriarchal society. When leading a group of male co-designers, female facilitators can also receive more resistance than male facilitators. P10 mentioned, when she was leading a community-based project in rural Pakistan, *"Culturally, they [the men in the community] will respect a woman [who was from outside] but they won't expect them [the women] to be in that position of being the one in their face. So, you kind of have to like, take a chill pill."* [P10]

4.6.3 Strategy to Mitigate: Team Formation. Participants shared many cautionary approaches and heuristics that go into the team formation strategies, including the assignments for the facilitators and co-designers for different teams. 7 out of 13 participants mentioned they would *separate genders in groups* to mitigate the power men have over women in a patriarchal culture. When sharing the same identity with other co-designers, such as an all-women group, co-designers with less power will find the environment more comfortable for them to contribute ideas more openly. If possible, some of these participants mentioned that they would try to match the gender of the facilitators to the group [P1, P5, P8]. Such practice allows less push-back in discussion and more collaboration during facilitation.

If the number of co-designers varies and they could not separate men and women in workshops, some facilitators follow an "*80-20*" [P9] rule, which means they try to balance the power dynamics within a group by assigning approximately twenty percent of the men or those with high power to eighty percent of the women [or other groups] with low power. The reason for the split is *"that power-holders didn't have like [chance to] gang up on somebody or put one authoritative person at a table of five people"* [P3]. When asked about this strategy potentially suppressing input from the twenty percent, our participants were not as concerned. In their perspective, the balance of the team dynamic and empowering the group with less power is more crucial, even if that means some powerful stakeholders contribute less. They argued that such a mitigation could be an important lesson for the twenty percent. For example, the educational benefit for a man to learn by observing a group of women in these areas is more significant than having him work on a project of his preference.

"Trying to make sure that there is a male on the team… we often find that he will grow and benefit quite a bit from that experience." [P5]

Findings, however, do not establish a baseline for an ideal number of co-designers in a group, considering this number largely depends on the project's context. However, some participants mentioned they would try to divide if a group has more than eight co-designers to encourage critical feedback from each member [P6, P10].

4.7 Intersectionality with respect to a Change of Context

A change of context can also lead to a shift in power dynamics. This magnitude of change can reflect at an individual level and among groups in comparison. Individually, facilitators who are considered an ethnic minority in the Global North find the locals associate them with "white" and "western" labels [P4, P13].

"I think it is really strange for me to come from the US where I am a minority and being here, where I'm considered part of the white majority." [P4 - who is an Asian American woman]

This association with *white majority* could either (a) potentially hinder the trust with the local community considering the colonial history, resulting challenges in building rapport, or (b) be associated as a status and power symbol, mis-aligning community expectations with respect to the kind of resources that the facilitators may have access to.

A more extreme example among group power dynamics is when marginalized groups join co-design workshops in a high-income country. When facilitating a workshop in Denmark, P5 noticed that co-designers from South America felt overwhelmed by other local Danish co-designers. When co-designers from low-income countries saw "*people serving lunch in the cafeteria might have more degrees than them* [P5]", they started to lose interest and confidence in solving the problems. P5 argued that finding shared ground when planning a co-design project is crucial. When marginalized co-designers from different communities empathized or related with the participants they were working with, they have more confidence to use their expertise in solving similar problems.

"When someone from Kenya is traveling to an Indian village, there's a lot where [they could] say, Oh, I've seen some of these challenges. Yes, the people look very different from me [in appearances]… But I have a lot to offer [to solve their problems]." [P5]

4.7.1 Strategy to Mitigate: Building Trust through Non-design Activities. Consistently through all interviews, participants emphasized the importance of building trust in order to mitigate the power of the designers and reduce the mistrust inherent in working with marginalized communities. Many participants provided examples of trust-building techniques, such as engaging non-design activities [P1, P2, P11, P12 & P13] with co-designers, such as playing soccer, going to a Turkish cafe to eat pastries, going to church events and inviting them to barbecues, etc. Participants also spoke about committing to the community long term in order to reduce historical skepticism. With a limited time frame to bring success to a given project, making a commitment to the long term is even more essential in building trust.

4.7.2 Strategy to Mitigate: Building Confidence through Visual and Kinesthetic Learning. All participants create tangible workshops that help the marginalized co-designers to build confidence and gain agency. Through visual and physical activities, facilitators help co-designers to unleash the power and confidence that may be hidden due to cultural and language barriers. Strategies such as *engaging in physical tools* from early on in the design process [P5], building a *complete-scale prototype* with real material [P2], engaging in *multiple warm-up activities* before ideation [P13], or *spotlight presentations* to showcase skills from the non-English speaking stakeholders [P5 & P7]. When working with local township residents in the U.S. on technical tax policy, P3 found the use of Lego blocks or paper cards allowed participants to tactically understand the concepts at play - whether that is physically moving the paper cards to show clustering as an analogy to priority or using the Lego blocks to represent chunks of money [P3]. Even the use of some simpler tools, such as tape dispensers, allowed participants to break through the intimidation barrier of participating in such a workshop [P5]. These tactics were used for the purpose of empowering the participants to share their own opinions and feedback in non-confrontational ways.

4.7.3 Strategy to Mitigate: Engage in Multiple Co-design Sessions. Findings indicate that a co-design project that follows the typical design cycle is equipped with appropriate resources. Many participants mentioned they would engage different stakeholders in different spaces through the project [P4, P5, P6, P7, P10]. A co-design project can last from a few weeks to many years, but participants mentioned *"for a design project overall, with a few rounds of a few weeks each, it's feasible to do good design work"* [P6]. Many participants mentioned that through multiple sessions, they could come up with more specific ideation activities tailored towards a particular group [P10], create different space for marginalized co-designers and bridge the gaps between stakeholders [P4] or have sessions "where people will start to see one another's strength" [P5].

For strategies that try to overcome the cultural and trust barrier, time is also a limitation. Building trust and integrating with the community takes time — a special commodity that many participants admitted to lacking. In many instances — either due to funding or the expectation of the research or project outcomes, — our participants have a "tendency as researchers or designers is to move on to the next question, or to talk about scalability very quickly" [P2]. In the same vein, although having multiple sessions would be a more typical and effective co-design process. Some participants also recognize these multiple sessions would lead to trade-offs like exhaustion–*"you have this whole thing where at the beginning of the workshop, you have a lot of energy, and it's all-new, by the time you reach two weeks, you're really exhausted"* [P4].

5 DISCUSSION

5.1 Evaluating the success of co-design with marginalized populations

Building on existing definitions of co-design, our work gathered individual facilitators' definitions of co-design and what constitutes success in co-design when it comes to working with marginalized populations. Based on these definitions from these participants, co-design evaluation is *process-focused* and *qualitative*. Among the success metrics the participants mentioned, meaningful participation consistently appeared as a key metric. However, even among our participants who have years of experience practicing co-design with marginalized users, there was no clear criteria for measuring what meaningful participation could be like. As a result, the projects discussed have used co-design and various other forms of participatory design instead. Western standards for meaningful participation emphasize group sharing and speaking up, which may be non-effective among some marginalized groups in certain cultures.

In such cultures, sitting back and listening is often considered a sign of wisdom. The field of HCI4D has advocated participation by non-western standards, and we suggest the co-design community should also opt for an open discussion on what effective participation in non-western standards could look like.

Furthermore, we also found a lot of defensiveness when it came to using quantitative measures to evaluate the success of co-design. While it is certainly important to have meaningful participation as a success metric to evaluate co-design workshops, there should be a more well-defined evaluation process to measure the success of co-design. What are some other metrics to measure co-design besides meaningful participation? The interview findings present different perspectives on whether the success of co-design should be process or outcome dependent, and whether scalability and quality of the final design output should be secondary measures of success in co-design practices. We argue that quantitative measures can and should be applied to the evaluation of the process itself, for instance, did participants feel heard? Did they feel respected? Did they feel they could meaningfully contribute towards the design of the eventual prototype? Was there a change in their self-perception as designers? These metrics could also be expanded outside of the workshop, such as impact made on the communities after the project ends, or conducting follow-up interviews with stakeholders and co-designers to measure longitudinal impact of participating in the workshop on their confidence, involvement in design, etc. In past literature, we only found one instance in past literature of a rigorous randomized, controlled, impact evaluation of participation in co-design activities with marginalized populations.[10] We argue that the co-design for development (Co-Design4D) community should engage in deeper dialogue to co-create and welcome such evaluation measures, and explore how to remove hurdles towards institutionalizing more robust evaluation of such activities.

5.2 Embracing the messiness that comes with mitigating power differentials and bridging cultural differences

Participants from the interviews shared their effective practices to mitigate the impact of different power differentials (Table 3). These strategies do not always guarantee effective mitigation in every marginalized setting.The findings suggest that despite efforts to mitigate the impact of power differentials in co-design processes, facilitators still encounter significant expressed disparities that prevent a truly collaborative co-design process. While some of these power differentials or cultural differences are reconcilable, others simply are not, especially if the goal is to simultaneously respect all cultures *and* the principles of co-design. For example, if the men in a co-design group think the women should be subservient and quiet, that is fundamentally at odds with the principles of co-design. Therefore, there will be trade-offs, or tricky facilitation coming into play. For instance, we often saw facilitators using their own power, received largely due to being foreigners, educated, or generally more powerful, to thwart gender differences inherent in patriarchal cultures. Facilitators using their own power to mitigate tensions may seem effective in the moment, but can lead to negative consequences for the people affected outside of the co-design settings. In other instances where cultural differences are at odds with the principles of co-design–for example, if a culture resists the public sharing of ideas–we encourage facilitators to embrace the messiness that comes with practicing co-design, and be more explicit in highlighting such issues within the participants of the session and have them openly dialogue creative approaches to circumnavigate such differences. This approach to making differences be more explicit has been successfully used in social justice and social work in the United States. However, as mentioned in our findings, debating such issues within the confines of a co-design session with marginalized populations may be messy – for instance, the conversation may be dominated by more powerful groups, or participants may not feel comfortable speaking up as trust may not have been established between the communities and the facilitators themselves. This is an interesting challenge for the co-design community more broadly – how can equitable participation be encouraged that respects local norms *and* achieves the goals of co-design? Are there asynchronous ways that don't rely on in-person collaboration? Are there ways to approach brainstorming that don't rely on traditional approaches, such as design heuristics.[8] Finally, co-design is not the only effective method when working with marginalized populations, especially in the context of high power differentials that cannot be mitigated easily. Having local participant involved in a project as cultural informants, user-testers and other participatory design stakeholders can be equally as meaningful to engage these populations without reinforcing power norms that hinder participation.

At the very least, we recommend that facilitators practicing co-design with marginalized populations be aware of the existing strategies to mitigate power differentials and cultural differences, be mindful of the differences that may exist in their respective situations, and try to be as prepared ahead of time as possible. Knowing there isn't a silver bullet helps trying various techniques to see what works. We also encourage a wider range of research collaboration and empowering local researchers from these communities to form stronger bonds and a sense of ownership. Such reflection could help identify further strategies going forward, and minimize the negative effects on the communities they serve.

5.3 Lack of use of co-design in later stages of the design process

Our findings showcase a potential lack of use of co-design in the evaluation and implementation phase. Successful co-design should empower participants with ownership throughout the entire design process, including building and testing the solution. However, facilitators in the interviews mentioned due to limited resources and lack of design literacy, tools for prototyping and evaluation are not accessible for marginalized users. Therefore, it is important for facilitators to be more intentional about carrying co-design through the latter stages of the design process. To help push co-design approaches into non front-end stages of design, we recommended a few additional strategies. Prior work has used technology probes [24] as a means to elicit advanced security and privacy features from low-income, low-literate women in Pakistan.[33]. We also recommend facilitators work with communities over the long run, including spending effort on empowering participants to use design tools, as well as becoming familiar with design evaluation methods.

Table 3: Strategies to Mitigate the Impact of Power Differentials from Interviews (Involves Marginalized Co-designers*)**

Power Differentials	*Problems*	*Strategies*
Institutional Power	Donors put pressure on facilitators.	Alignment meeting (4.4.3), Donor vetting (4.4.3), Empathy walk (4.4.4)
	Facilitators and donors are unaware of their privileges.	Acknowledging the unearned privileges (4.4.4), Currency mapping(4.4.4), Meditation(4.4.4)
Cultural Differential	Facilitators are unaware of cultural taboos.	Work with local organization(4.5.4), Local volunteer workshops for facilitators (4.5.4)*
Gender Bias	Men overpower women in patriarchal context.	80-20 Rule(4.6.3)*, Separate men and women(4.6.3)*, Match facilitator's gender(4.6.3)*
Language Barrier	Co-designers and facilitators speak different languages.	Local volunteers who speak the same language((4.5.4)*, Assign interpreters((4.5.4)*, Spotlight presentation(4.7.2)*, Card sorting(4.7.2)*, Prototyping(4.7.2)*
Power Dynamic	Co-designers lack confidence in design expertise.	Hand-tools(4.7.2)*, Complete scale prototype (4.7.2)*, Spotlight presentation (4.7.2)*
	Communities lack trust in outside facilitators.	Non-design activities(4.7.1)*, Work with local organizations(4.5.4)*

This long term approach has been successfully used in Community Based Participatory Research with marginalized communities such as refugees, where refugee communities were intimately involved in the design, implementation and the evaluation of the study.[34] Lastly, we see an opportunity to both design new tools and use existing digital prototyping tools such as Scratch [40] and MIT App Inventor [38] that do not require significant coding literacy.

6 CONCLUSION

As a powerful tool in design for social innovation, co-design is favored by many design and research professionals working with marginalized populations. While its collective nature to gather insights and solutions from multiple stakeholders has been effective in addressing complex problems in the field, co-design practice often deals with cultural differences and power differentials between stakeholders. While some strategies exist to mitigate the impact of such differences and power differentials, co-design facilitators and practitioners are not warned or adequately trained to deal with these power differentials. These power differentials, if not mitigated appropriately, further suppress populations underrepresented in terms of race, socio-economic class, gender, etc. Literature identified power differentials in co-design with marginalized populations from institutional, design expertise, and cultural aspects. Despite a variety of co-design best practices the literature discussed, the efficacy of these strategies to mitigate power differentials in marginalized communities remains underexplored. Building on the existing understanding, the qualitative interviews with co-design facilitators revealed different success metrics in co-design that are process-oriented and possibly length-dependent. We identified some differences in institutional, cultural, gender and language differentials with different marginalized groups. Building on existing heuristics and strategies from literature and interviews, our work included a non-exhaustive summary of strategies that may reduce the impact of power-differentials through the length of co-design.

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