ABSTRACT

Title of Dissertation: **PERSONAL OBJECTS AS DESIGN MATERIALS**

Salma Elsayed-Ali, Doctor of Philosophy, 2024

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While Participatory Design focuses on inclusion of users, in practice, Participatory Design may often fall short of its inclusive ideals. This is problematic as it could lead to disempowerment, inactive participation, and alienation of users. An important avenue for inclusion is to enable users, particularly those who are marginalized, to enact aspects of their identities and lived experiences in design. Materials, both tangible and intangible, are an important way that this enactment may be accomplished; yet materials are often overlooked and imposed on users in design. This can be problematic as the materials selected may not be relevant or useful to users' situated contexts or goals, or, at worst, could lead to exclusion.

My dissertation seeks to understand how we might support users to enact core aspects of their identities and lived experiences in Participatory Design. To do this, I propose an approach that shifts control of design materials to users by inviting them to bring in personal objects from their lives. Using Research through Design, I developed a sociotechnical system called *Talisman* consisting of techniques to scaffold users' selection and interaction with their personal objects in the design process. Over the course of a year, I collaborated with three distinct communities to

embed Talisman in co-design workshops alongside young adults who are underrepresented in STEM education. These communities included: 1) A STEM education nonprofit based in Chicago focused on creating youth-led “Safe Spaces;” 2) A high school summer internship program based in Baltimore focused on Environmental Justice; and 3) a faculty-led research project at the College of Information Studies focused on redesigning undergraduate programming education to support diverse learners in light of Generative AI. I share direct observations and accounts from young adults into their experiences bringing in and engaging with their personal objects in the design of solutions for their communities. Afterwards, I present a cross-case analysis of the three case studies in which Talisman was deployed and discuss its implications for Participatory and Assets-based design practice within the fields of Human-Computer Interaction (HCI) and Computer-Supported Cooperative Work (CSCW).

PERSONAL OBJECTS AS DESIGN MATERIALS

by

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Dedication

To my dearest husband Amro

And to my parents, Mama and Baba, to whom I owe everything.

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"*Say [O Prophet], 'If the sea were ink for [writing] the words of my Lord, the sea would be exhausted before the words of my Lord were exhausted, even if We brought the like of it as a supplement.*"

[The Holy Quran 18:109]

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Chapter 1: Introduction

Background

Participatory Design is a methodological approach consisting of theories, practices, and studies to designing technology-driven solutions and experiences that reflect and respond to the lived experiences and practices of end users (Greenbaum & Kyng, 1991; Muller & Druin, 2002). The goal of Participatory Design is to support users—through the knowledge and tools—to empower themselves as designers (Buddemeyer et al., 2022), which contrasts the reductionist view of Participatory Design as an "*extractive process to gather new product ideas*" (Costanza-Chock, 2020). Through direct participation of users in project definition and design specification, Participatory Design strives to decentralize traditionally top-down decision-making, and center the voices of those who traditionally wield little influence in organizational and societal power structures (Luck, 2018). In Participatory Design, users do not simply provide "feedback" or data to inform design work. Instead, the aim is for users to actively participate throughout the co-design process from its formative to summative stages (Druin, 2002). While doing so, their values and lived experiences are cornerstones in the co-design and collective imagining of systems and solutions that affect their work practices, communities, and everyday lives, and address the multifarious values of society (Bødker & Buur, 2002; Harrington, Borgos-Rodriguez, et al., 2019; Sanders & Stappers, 2008). The roots of this design approach lie in the Scandinavian workplace democracy movement in the

1970s (Luck, 2018; Spinuzzi, 2005), which continues to shape its long-standing ideal of democratizing design by expanding the boundaries of who gets to design.

While Participatory design strives to be inclusive of users and their lived experiences, it may sometimes fall short of this in practice (Elsayed-Ali et al., 2023a; Erete et al., 2018; Harrington, Erete, et al., 2019; Holone & Herstad, 2013; Spiel et al., 2018). Previous work has described some of the pitfalls of exclusionary Participatory Design practices. For example, in their work with Namibian youth, Charlotte Smith et al. observed that Participatory Design's lack of consideration of cultural situatedness and overreliance on generalized and well-known methods and tools for engagement are not sufficient for decolonizing and democratizing design (Charlotte Smith et al., 2020). Harrington et al. shed light on how the design workshop, an instantiation of Participatory Design, can oftentimes misalign with the lived experiences of marginalized users, which could potentially further marginalize, frustrate, and undermine individuals' participation (Harrington, Borgos-Rodriguez, et al., 2019). This misalignment can also been seen in work by Gautam et al., where Nepalese trafficking survivors reported pain when asked to write down stories of abuse and violence, preferring instead to participate in a photo-elicitation exercise (Gautam et al., 2018; Wong-Villacres et al., 2021). These examples illustrate how users may not feel fully supported or empowered in Participatory Design to design according to their identities, values, assets, knowledge, and situated contexts. These exclusionary dynamics counteract Participatory Design's goal of empowering users and democratizing design, and could paradoxically lead to harm and the exacerbation, rather than dismantling, of inequities (Harrington, Erete, et al., 2019; Thinyane et al.,

2018). Given the delicateness of this "wicked" problem, ***how might we then better empower users, particularly those who are marginalized, to enact aspects of their identities and lived experiences in Participatory Design?***

In this dissertation, I explore how shifting control of design materials to users might be a key mechanism of empowering users, particularly those who are marginalized, to enact aspects of their identities and lived experiences in Participatory Design. Materials are touchstones of the human experience and play a vital role in design. Examples of design materials typically include low-tech, office materials like markers and Post-it notes, or materials prepared by facilitators relating to the design context (Muller, 1991). Materials are not just given to be a part of users' calculations and decision-making, but exert great influence on the design problem and process (Doordan, 2003; Jung & Stolterman, 2010). Through a material lens, design can be understood as a process of meaning-making through exploratory practice with the materials (Jung & Stolterman, 2010). Despite being an integral component of the design process (Muller, 1991) and human experience (Darzentas et al., 2019; Turkle, 2007), the selection and use of design materials is not only often overlooked, but can also adversely affect or exacerbate exclusivity.

Material selection in Participatory Design is often done with little to no input from users. Materials are often ascribed to users in Participatory Design despite being imbued with sociocultural associations (Harrington, Erete, et al., 2019), values, assumptions, and ideas (Charlotte Smith et al., 2020) that may undermine what users can contribute. For example, design materials (e.g., sticky notes, crayons, microcontrollers, tablets) are often ascribed to users despite not being relevant or

useful to users' goals or contexts (A. Lazar et al., 2018). These materials are often value-laden and overlook users' situated contexts (Charlotte Smith et al., 2020; Giglitto et al., 2018). Users may also prefer to draw on their own tangible or intangible artifacts, such as oral narratives (Charlotte Smith et al., 2020), metaphors and symbols (Asthana & Havandjian, 2014), and skills and wisdom (Wong-Villacres et al., 2020). In the liberatory spirit of Participatory Design, there is an opportunity for users to have more control and flexibility over the materials they design with. ***What if, instead of facilitators imposing materials on users, we shift control by inviting users to bring in objects from their lives to use as design materials?***

In this dissertation, I explore the proposition that users may be able to better enact aspects of their identities and lived experiences in Participatory Design by bringing in objects from their lives to co-design with. This proposed approach is in large part a response to the dominant practice of materials being imposed on users, but is also inspired by approaches that encourage users to draw on multifarious aspects of their lives, such as Assets-Based Community Development (ABCD) and Assets-based design (Cho et al., 2019; Kretzmann & McKnight, 1993).

At face value, inviting users to bring in and utilize materials of their choosing in co-design seems relatively straightforward. However, Assets-based design researchers have argued that there is a lack of systematic design knowledge on how to do this within HCI and CSCW research (Karusala et al., 2019; Wong-Villacres et al., 2021). As summarized by Wong-Villacres and Gautam,

> "*PD's specific articulation of a commitment towards engaging local knowledge for pursuing emancipatory goals, however, does not clarify the methodological particularities that can allow these approaches to identify, explore, leverage, and amplify such knowledge, or assets*" (Wong-Villacres et al., 2021).

To support communities to identify and leverage their personal objects as assets in Participatory Design, ***what are some mechanisms to support this process, as well as the myriad of possible (tangible and intangible) objects users may want to bring in?***

In an effort to provide more clarity and definition to this process, I conducted pilot studies in Chapter 3: Preliminary Work to generate possible system designs that could potentially support users to identify, bring in, and engage with their own materials in design. I learned that mechanisms must be set in place that guide users through the design process and support both tangible and intangible materials. The outcome of these pilots was a stable version of a sociotechnical system I call *Talisman*. Talisman aims to scaffold the process of users bringing design objects from their lives, and then using these materials to collaboratively refine the design topic and co-design solutions. Talisman consists of a repertoire of techniques including design activities, prompt, Padlet template, and toolkit. Further evaluation was needed in order to gauge the impact and effectiveness of Talisman in applied, real-world settings. ***How does Talisman support users to identify, bring in, and engage with their own materials in Participatory Design?***

To help me answer this question, I conducted three case studies alongside communities focused on STEM education who were interested in embedding Talisman into their design practice. These communities were focused on co-designing solutions alongside underrepresented young adults relating to 1) "Safe Spaces;" 2) Environmental Justice; and 3) Programming Education. Through extended engagement with the communities and facilitators, I observed how the young adults engaged with their own materials and the ways in which the communities incorporated Talisman into their co-design workshops. Using thematic analysis, I then analyzed the outcomes from the individual workshops and compared my findings across the three case studies through cross-case analysis. Synthesizing across the case studies, I describe the ways in which Talisman helped to shift control, expand the range, and scaffold users' interaction with their personal objects in Participatory Design. These findings have implications for broader Participatory and Assets-based approaches in HCI and CSCW.

Methodological Approach

My dissertation utilizes a Research through Design approach, which is a type of research practice and paradigm in Human-Computer Interaction focused on making things that improve or transform the current state of the world (Olson & Kellogg, 2014). The knowledge produced through a Research through Design approach functions as a proposal, instead of a prediction (J. Zimmerman et al., 2010), and the chief element in the production of this knowledge is the designed artifact (Axelsson et al., 2022). In this dissertation, Talisman is the introduced tool for

Participatory Design (Axelsson et al., 2022). Below, I map my doctoral research to the five-phase Research through Design process. See Figure 1.

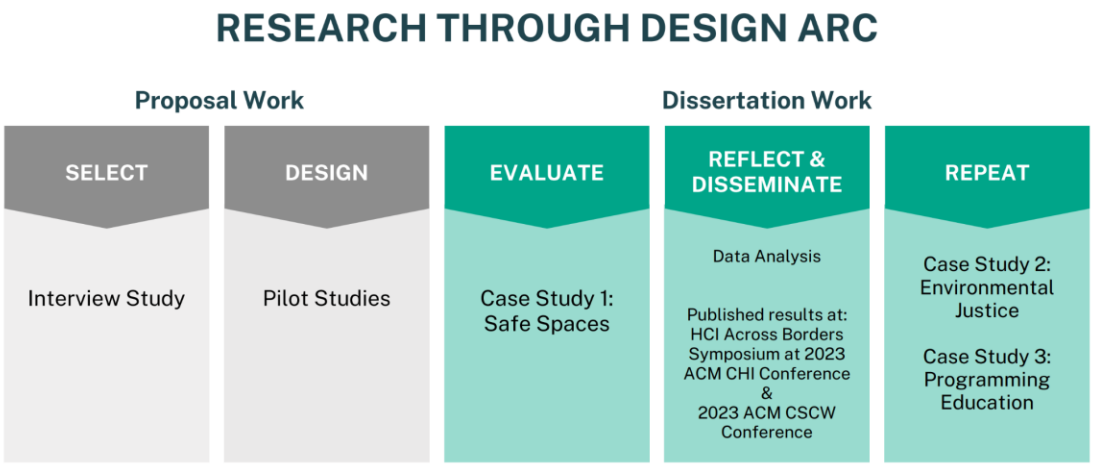


Figure 1: Preliminary work and dissertation work mapped to the five-phase Research through Design process (Olson & Kellogg, 2014).

Within the Research through Design arc, the preliminary work I had conducted for my Dissertation Proposal in September 2022 represents the first of five phases, *Select*. This involves choosing a research problem worthy of investigation (Olson & Kellogg, 2014). I had also completed several cycles of formative pilot studies to converge on an initial prototype and a set of design requirements for my system, Talisman. This second strand of preliminary work lends itself to the second Research through Design phase, *Design*, which entails creating and critiquing an artifact to a stable form.

My dissertation research picks up from the third phase of the Research through Design arc, *Evaluate*. The *Evaluate* phase integrates concerns of Participatory Design and involves deploying Talisman and assessing whether it produced the intended behaviors and outcomes of my research (Olson & Kellogg, 2014). I deployed Talisman in my first case study alongside a STEM education

nonprofit focused on creating youth-led "Safe Spaces." Following the first evaluation, Research through Design encourages researchers to *Reflect* and *Disseminate* what they learned. I presented and received feedback on my preliminary findings from Case Study 1: Safe Spaces at two of the leading conferences in the fields of HCI and CSCW. These included a peer-reviewed position paper at the HCI Across Borders (HCIxB) Symposium taking place at the 2023 ACM Conference on Human Factors in Computing Systems (CHI) (Elsayed-Ali, 2023), as well as a peer-reviewed short paper at the 2023 ACM Conference on Computer Supported Cooperative Work (CSCW) (Elsayed-Ali et al., 2023b).

Lastly, the final phase in Research through Design, *Repeat*, is to repeatedly investigate the same situation so as to produce more robust research findings (Olson & Kellogg, 2014). I collaborated with two additional communities who were interested in embedding Talisman into their design practice. Through these additional deployments, I was able to gauge how Talisman plays out across different communities, contexts, design topics, and modes of engagement. Along with gauging reproducibility and adaptability, repeated deployment helps to refine Talisman and strengthen the empirical contributions of my dissertation.

Summary

The end goal of this dissertation is to advance inclusion of users in co-design. To do this, I explore the use of personal objects as design materials in Participatory Design. Previous work has documented instances where Participatory design has fallen short of its inclusive ideals. A recurring problem is that design materials are often imposed on users, despite not being relevant or useful. I propose an approach

that shifts control of design materials to users by inviting them to bring in personal objects from their lives. The central design speculation of this dissertation is that by users having more control and flexibility over the materials they design with, which are typically ascribed to them, they may feel more included and empowered in the design process. Using a Research through Design approach, I developed a system called Talisman to support users to bring in personal objects to use throughout their design of solutions for their communities. I then deployed Talisman in a series of co-design workshops alongside three separate communities working with young adults. The case studies were focused on 1) Safe Spaces, 2) Environmental Justice, and 3) Programming Education. I observed how users engaged with their objects and constructed their experiences. My dissertation culminates in a sociotechnical system called Talisman and presents implications for Participatory and Assets-based design.

Contributions

My dissertation research aims to expand the ways that users can enact core aspects of their identity and lived experiences in the design process; emerge with a sense of power over the design process; situate themselves better with respect to the design context; and recognize the viability of personal objects, whether tangible or intangible, as design material. This aim is advanced through my **empirical** and **constructive** contributions to the fields of HCI and CSCW. First, this dissertation makes empirical contributions through reported observations of how underrepresented young adults engage with their own materials in co-design. Second, this dissertation makes constructive design contributions, as in it produces "*understanding about the construction of an interactive artefact for some purpose in*

human use of computing" (Oulasvirta & Hornbæk, 2016). Using a Research through Design approach (J. Zimmerman et al., 2007), this dissertation puts forth an approach and repertoire of techniques called Talisman to support users to enact aspects of their identities and lived experiences in Participatory Design. This dissertation pushes Participatory Design to move from a model where materials are imposed on users, to a model where users have greater control over the materials they use. Lastly, this dissertation builds on Assets-based design efforts by conducting a focused methodological reflection on how to do this and by adding a layer of materiality and physical grounding to the growing body of Assets-based design research.

Structure of Dissertation

The main body of this dissertation is divided into eight chapters. Below, I give a breakdown of each chapter and describe the role it plays in presenting my work.

Chapter 1: Introduction

I begin my dissertation by providing a background of the problems I aim to address relating to inclusion in Participatory Design and design materials. Next, I delve into the overarching research paradigm that guides my dissertation work, Research through Design. Then, I summarize the research conducted and give a preview of the contributions it makes to the fields of HCI and CSCW.

Chapter 2: Literature Review

After laying the groundwork of my dissertation, I provide an overview of existing work in HCI and CSCW relating to inclusion, Assets-based design, and

design materials. This literature review is focused primarily on the current theoretical and methodological discourse that frames my research problem.

Chapter 3: Preliminary Work

Next, I summarize two strands of preliminary empirical work I undertook for my dissertation proposal. These include an interview study with practitioners on their challenges to inclusion in Participatory Design, as well as formative pilot studies of early system prototypes aimed at supporting users to enact aspects of their identities and lived experiences in Participatory Design.

Chapter 4: System Chapter

The result of my preliminary work was a stable probe called *Talisman*, which I introduce in this chapter. I describe Talisman's repertoire of techniques aimed at scaffolding users' interactions with their personal objects in co-design across different contexts and modes of engagement. These include a series of design activities, prompt, Padlet template, and toolkit prototype.

Chapter 5: Methods

I then explain the case study approach and methods I used to implement and evaluate Talisman in the field. This includes the types of data that were collected and the qualitative methods used to analyze and compare findings across case studies. Additionally, I give a brief introduction to the communities and participants who took part in my case studies.

Chapter 6: Case Studies

This chapter is divided into three sections corresponding to the different case studies where Talisman was embedded relating to 1) Safe Spaces, 2) Environmental Justice, and 3) Programming Education. Within each case study, I present findings from the individual co-design workshops with young adults.

Chapter 7: Cross-Case Analysis

After presenting the findings from each individual case study, I then synthesize the findings across case studies using a comparative approach to cross-case analysis. I explain how Talisman builds on previous literature and the implications of my findings on design research and practice.

Chapter 8: Conclusion

Lastly, I summarize key takeaways from my dissertation and end with the limitations and suggestions for future inquiry.

Chapter 2: Literature Review

My dissertation is informed by a growing body of literature in Human-Computer Interaction (HCI) and social computing on inclusion, place-making, and design materials. Below, I give an overview of discourse that relates to these areas.

Inclusive Participatory Design

Contextualizing Marginalization in HCI

My dissertation aims to support users, particularly those who are marginalized, to enact aspects of their identities and lived experiences in co-design. This requires having a shared understanding and working definition of marginalization. Drawing on the wider Human-Computer Interaction literature, I first explore existing definitions of marginalization.

While there is no singular definition of marginalization, Human-Computer Interaction researchers have offered their own interpretations. Liang et al. define marginalization as "*how a person experiences the world around them based on their identity and how others perceive them*" (Liang et al., 2021). They note that terms often associated with marginalized people like "underserved," "under-represented," "under-resourced," and "minoritized" denote the failing of society, whereas terms like "vulnerable" denote the failing of individuals and frame marginalized people as weak, in need of help, or burdensome (Liang et al., 2021; Pei et al., 2022). I align with Liang et al., in the former view of marginalization. Marginalization emphasizes systematic discrimination due to unfair policies and/or social practices (Erete et al., 2018), as well as an unequal distribution of power and resources (Pei et al., 2022). Marginalization can be overlapping (Spiel et al., 2018), intersectional (Erete et al.,

2018), conscious or unconscious (Smyth & Dimond, 2014), visible or invisible, and can change over time (Liang et al., 2021). Additionally, marginalization can change depending on the context and situation. Each type of marginalization can exist on individual, institutional, and cultural levels (Smyth & Dimond, 2014).

In its continual effort to evolve from a technology-oriented to a human-centered view, Human-Computer Interaction research strives to acknowledge and include a diversity of communities who are marginalized (Bannon, 2011; Himmelsbach et al., 2019). Galleguillos and Coşkun reviewed 46 Participatory Design projects involving marginalized participants and identified the diversity of participants involved in those projects (Galleguillos & Coşkun, 2020). The projects involved people who are excluded or disadvantaged due to not having access to resources, unable to exercise their voice, and are discriminated against on the basis of their age, sex, disability, race, ethnicity, socioeconomic status, or migration status (Galleguillos & Coşkun, 2020). Harrington et al. focus on marginalized people in a developed context including economically disadvantaged, gender-non-conforming, ethnic, disabled, and/or racialized populations (Harrington, Borgos-Rodriguez, et al., 2019). Spiel et al. give examples of marginalization for children, including children who seek asylum, are disabled, live in low-income households, grow up with adoptive or foster parents, are obese, or are a person of color (Spiel et al., 2018). In their overview of intersectionality, Erete et al. enumerate additional axes to marginalization including androcentrism, eurocentrism, educationalism, politics of appearance, classism, language bias, colorism, religion, and natalism (Erete et al., 2018).

Marginalization in Participatory Design

I now turn to the discourse on marginalization within Participatory Design research, specifically. A few scholars have discussed marginalization in general terms that cut across populations. For example, in their CSCW 2017 workshop titled "Reflection on Design Methods for Underserved Communities," Erete et al. underscored how marginalized communities were not supported in the co-design process (Erete et al., 2018). Le Dantec et al. observed how certain user communities, even in relatively wealthy and privileged societies, were hard to reach (C. Le Dantec, 2012), and thus could not physically access Participatory Design engagements. Galleguillos and Coşkun observed how marginalized participants faced more barriers to participation and engagement in Participatory Design than others, such as not having access to material resources, not being able to exercise their voices, and a lack of literacy on certain topics (Galleguillos & Coşkun, 2020).

Other researchers have discussed ways that marginalization in Participatory Design plays out with specific populations. For example, Gautam et al. observed how Nepalese trafficking survivors were unable to fully engage with the design process due to having to recall their traumatic experiences (Gautam et al., 2018). In a series of case studies, Sabiescu et al. observed that the Roma minority in rural Romania and community members in different Mozambican provinces were unable to assert their views on the nature of participation in Participatory Design (Sabiescu et al., 2014). Hussain et al. found that Cambodian children who use prosthetic legs were unable to have high levels of user participation (Hussain, 2012). Holone and Herstad observed how children with severe disabilities were unable to engage in "true" Participatory

Design (Holone & Herstad, 2013). In a series of case studies, Spiel et al. similarly observed how autistic children and visually impaired children were unable to exercise a level of participation that was expected (Spiel et al., 2018). Based on four years of Participatory Design in an economically depressed city in the U.S., Walsh et al. observed how racially marginalized youth were often unable to participate as much as they wished (Walsh, 2018).

The results of these studies are important for highlighting the pervasiveness and multifacetedness of marginalization, both within the context of society and within the context of Participatory Design research. Considering its various characteristics and contexts, I converge on a working definition of marginalization as the **structural and systematic denial of a group or individual to actively participate as equals in certain facets of society and processes**. Echoing calls by Erete et al., in this dissertation I aim to contribute towards adapting design methods in order to attend to the complexities "*that impact participants' ability to engage as equal partners in inclusive technology design*" (Erete et al., 2018).

Defining Inclusion in HCI

In order to work towards promoting inclusion of marginalized voices in Participatory Design, we must first grapple with what we mean by 'inclusion.' Within Participatory Design, I believe this goes beyond just physical access to the sessions. It involves ensuring that the right conditions are set in place for each individual to achieve their full potential. In their Participatory Design with children with ADHD, Cibrian et al. argue that one aspect of inclusion is creating processes and environments for children who process the world differently to be successful (Cibrian

et al., 2020). Supporting users to engage on their own terms and to share narratives they deem important may push us closer to design engagements where users feel more included and empowered rather than further marginalized (Harrington, Erete, et al., 2019). An additional aspect of inclusion is empowerment, which places power transfer and power-sharing at its core (Bratteteig & Wagner, 2012; Buddemeyer et al., 2022). Zimmerman describes empowerment as enabling people to gain understanding and control over personal, social, economic, and political aspects in order to better their lives (M. A. Zimmerman, 1995).

Inclusion additionally involves faithful representation of an individuals' intersectional, lived experience. In their co-design of a mobile game "*by Black women and for Black women*," Rankin and Irish point to a dearth of research on Black women as producers and consumers of games as a cause for the continued marginalization of Black women within the gaming community (Rankin & Irish, 2020). By ethically and responsibly engaging Black women as intellectuals and equal partners in the co-creation of knowledge and the co-design process, they were able to design a game that reflects the intersectional experiences of Black women (Rankin & Irish, 2020). Based on these readings, I converge on a working definition of inclusion as **the practice of developing and implementing intentional and attentive methods, processes, and environments through which individuals feel empowered to fully explore and enact their identities and lived experiences**.

In my dissertation, I aim to contribute to broadened capacity to advance inclusion of marginalized populations in Participatory Design across various manifestations. I acknowledge that some of these capacities may be enabled by

population-specific interventions and design, but also recognize the possibility of fruitful transfer and joining together of issues and solutions across intersectionalities, which can contribute to larger frameworks that can have broader impacts, such as Design Justice (Costanza-Chock, 2020), Critical Participatory Design (Thinyane et al., 2018), social justice-oriented interaction design (Dombrowski et al., 2016), and anti-oppressive design (Smyth & Dimond, 2014).

On Instantiating Inclusive Design Environments

Place and Space

A key aspect of inclusion in Participatory Design deals with the environment or space within which design activities take place. I summarize previous work that has touched on the role of the design environment.

One example that has been used previously within the context of Participatory Design is Muller and Druin's notion of "third space," described as an "in between" region taking place neither in users' domain or developers' that allows participants to combine their knowledge into new insights and plans for action (Muller, 2008; Muller & Druin, 2002). "Third space" has underpinned other concepts such as Liaqat et al.'s "shared third space" for helping equalize immigrant grandparent and grandchildren contributions in storytelling and intergenerational Participatory Design (Liaqat et al., 2021); and Bustamante Duarte et al.'s articulation of "safe spaces" as environments promoting open communication, knowledge exchange, and beneficial engagements among all participants (Bustamante Duarte et al., 2021), developed in their Participatory Design work with young forced migrants. Similarly, Gautam et al. underlined the need for activities to foster a familiar and trusting space for sister-

survivors to reflect on assets in their everyday lives and to open up and share their personal experiences (Gautam et al., 2018). Harrison and Dourish define "place" as space with added value and meaning (Harrison & Dourish, 1996). Place-making then is the conscious arrangement of elements to create a space that accommodates activity and gives expression to the values of the occupants and their wider community. A lesser used, but also powerful concept is that of Donald Schön, known as "design worlds" (Schön, 1988). Design worlds are holding environments for design knowledge whereby things, relations, and qualities reside. They are built, entered, and inhabited environments by and for designers while designing (Collen & Gasparski, 1995). Designers bring their own knowledge and ideas to a particular design situation, engage in dialogue with that situation, and construct their own design world (Schön, 1988). However, a sense of place and shared "design world" cannot be forged by marginalized people when they do not feel included.

Assets-Based Design

Part of inclusion entails being able to freely enact aspects of one's identity and lived experience. One potentially fruitful approach for accomplishing this may be using Assets-based design. The underlying principle behind Assets-based design (Cho et al., 2019; Dickinson et al., 2019; Wong-Villacres et al., 2020) is for design to move past a deficit-based view to one that instead leverages the assets and strengths of members of marginalized communities (i.e., *assets-as-insights*) (Cho et al., 2019). Assets-based design is an approach in Human-Computer Interaction borrowing from Assets-based community development (ABCD) (Kretzmann & McKnight, 1993), which involves the acknowledgement, recognition, and mobilization of communities'

assets, capacities, and abilities (Kretzmann & McKnight, 1993). Assets-based approaches involve identifying or mapping available local assets (e.g., skills, relationships, and capacities of community residents; local associations and institutions; and physical characteristics upon which a community rests) and drawing connections between them to multiply their power and effectiveness (Kretzmann & McKnight, 1993).

Although assets-based approaches encourage a process of identifying and using assets, there is less systematic understanding of how to actually use assets in technology design (Karusala et al., 2019). To advance understandings of how to operationalize assets in technology design, this dissertation presents a system that helps scaffold users' interactions with their objects and assets in co-design. Additionally, research into the personal, material objects of users as a type of "asset" is an under-explored area of inquiry. My dissertation aims to add depth to current understandings by focusing on a particular type of asset—personal objects. Through empirical and constructive contributions, my dissertation builds on work relating to Assets-based design in these two ways.

Design Materials

On Material Objects and Artifacts in HCI

Objects are touchstones of memory and meaning, closely interwoven into the fabric of human experience (Turkle, 2007). Their acquisition and appropriation are essential in the construction and negotiation of identities and social worlds (Miller, 2003). Through material objects, we can gain an increased understanding of social and systemic structures such as inequality, as well as human action and emotion

(Woodward, 2007). For example, owning and using particular objects can assert our belonging or dissimilarity to certain communities (Brulé & Spiel, 2019). Material objects can also provide deep insight into the immaterial, as when Alan Turing turned to materials to understand mathematics (Wiberg, 2016). Not only can objects be physical, but they can also be intangible such as knowledge, skills, wisdom (Wong-Villacres et al., 2020), memories, and oral narratives (Charlotte Smith et al., 2020). Wiberg details categorical distinctions between materials including physical vs. digital, analogue vs. digital, virtual vs. real, atoms vs. bits, etc. (Wiberg, 2016). Others, such as Miller, argue that the endless types and varieties within which the changing object world may be categorized cannot be enumerated (Miller, 2003). Materiality can be interpreted as the relationship between users, the material artifact, and other artifacts (Jung & Stolterman, 2012). An artifact-oriented perspective in Human-Computer Interaction involves reflecting on the personal, cultural, and social values of artifacts throughout its various phases of design and use (Jung & Stolterman, 2012). By foregrounding material objects and artifacts, we may be able to surface new insights into people and other social phenomena.

The Materials Used and Co-Constructed in Design

In design, materials are design objects employed by users in a project (Muller, 1991). As discussed in early work on the PICTIVE Participatory Design technique, materials were categorized as two types, the first of which included simple office materials like pens, highlighters, paper, and Post-it notes. These low-tech materials were thought to give equal footing between designers and users, especially in the case of intergenerational Participatory Design (Druin, 2002). Second were the materials

prepared by developers, which could be generic for multiple design exercises, or specific for the project being designed (Muller, 1991).

Recently, social computing researchers have called for further investigation into the roles of the materials and artifacts used and co-constructed in Participatory Design (Brulé & Spiel, 2019; Harrington, Erete, et al., 2019). One recurring problem is that generalized materials, which are typically selected or prepared by developers, are frequently imposed on users despite being imbued with sociocultural associations (Harrington, Erete, et al., 2019), values, assumptions, and ideas (Charlotte Smith et al., 2020) that may undermine user's lived experiences, expertise, and situated contexts. For instance, previous work with marginalized communities has found that ideation materials such as colored sticky notes and markers can raise skepticism and make users—particularly those who are marginalized—feel as though their ideas and concerns are not being taken seriously (Giglitto et al., 2018; Harrington, Erete, et al., 2019; A. Lazar et al., 2018). This is problematic as it could lead to further alienation of users. While these ideation materials may be inexpensive and easily accessible to some (Druin, 2002), other users may prefer to draw on materials they already have. For example, DesPortes et al. observed how members of a community of color converted an abandoned lot into a skate park using materials accessible to them (DesPortes et al., 2021). Clarke et al. invited Indigenous youth activists in Palestine to fill jars with precious fragments from their villages, which prompted expressions of excitement and delight from the youth activists (Clarke et al., 2022). Frauenberger et al. observed that neurodiverse youth preferred to bring in their own materials over tinkering with materials researchers provided (Frauenberger et al., 2019).

Alternatively, some users may prefer to draw on intangible artifacts such as personal narratives and memories over tangible objects in their designs (Charlotte Smith et al., 2020; Wong-Villacres et al., 2020). These examples suggest it might be useful to give users more control and flexibility over the materials they design with.

Current Design Techniques Foregrounding Materials

Some common co-design techniques foregrounding materials include Cultural probes (Gaver et al., 1999), Bags of stuff (Druin, 1999), Toolkits (Jarusriboonchai et al., 2018; Vyas et al., 2023), and Contestational artifacts (DiSalvo, 2014; Lupetti et al., 2023). Importantly, facilitators typically decide the materials in these techniques. My approach differs as it aims to shift control of materials to users, thus enabling users to have more say over design.

Other techniques encourage users to bring in artifacts from their lives, such as different types of End-user photography (Muller & Druin, 2007) including Photo-elicitation (Gautam et al., 2018; C. A. Le Dantec, 2009), Photovoice (Harrington, Borgos-Rodriguez, et al., 2019), and Photo collaging (Kam et al., 2006), as well as Journaling (Fails et al., 2012; Pradhan et al., 2020). To support users to share *what they want in the format they want*, I extend the range of objects of which users can bring in and design. This may include objects that are found, personally meaningful (e.g., mementos), tangible, intangible, analog, or digital. This way, my approach may also be used in more contexts and more frequently.

Two previous approaches focus on material-based prototyping using physical, locally-embedded objects (Hansson, 2015): Small change (Hamdi, 2013) focuses on "real" objects as prototypes drawing on and implemented into local practice, such as a

bus stop prototype that engenders a marketplace and activates a local community (Hansson, 2015). A related, broader approach is Frugal innovation, which draws on renewable materials that are "*affordable, sustainable, lightweight, and rugged*" (Bansal, 2014).

My approach differs in that it is more expansive in scope, aiming to be adaptable to other parts of the design process beyond prototyping. Additionally, my research is focused on promoting contributions at both the community level as well as the individual level by supporting each participant to bring in something representative of their identities and lived experiences.

Chapter 3: Preliminary Work

My dissertation research is informed by and builds on two strands of preliminary work I completed. First, my focus on design materials is motivated by a set of findings from an interview study with Participatory Design practitioners, where they provided insight into how inclusion of users is about more than just physical access—it is also about instantiating a design environment where users feel empowered to enact aspects of their identities and lived experiences. These findings were the initial impetus that, in conversation with the literature reviewed in Chapter 2, prompted me to frame the problem in terms of materials. This preliminary work is mapped to the first two phases of the Research through Design process (*Select* and *Design*), as displayed in Figure 1 in Chapter 1: Introduction.

Note: The results from the interview study have been published open access in the 2023 Companion of Computer Supported Cooperative Work and Social Computing (CSCW) and were presented at the conference in October 2023. Please find the citation for this article below:

Salma Elsayed-Ali, Elizabeth Bonsignore, and Joel Chan. 2023. Exploring Challenges to Inclusion in Participatory Design From the Perspectives of Global North Practitioners. *Proc. ACM Hum.-Comput. Interact, 7, CSCW1, Article 130 (April 2023)*, 25 pages, https://doi.org/10.1145/3579606

From Location to Shared Spaces: Formative Interview Study

In the first phase of my preliminary work, I wanted to gain a first-hand perspective of how challenges to inclusion of marginalized people may arise and manifest themselves in Participatory Design. I conducted semi-structured interviews with ten Participatory Design practitioners (researchers and designers) with significant experience in Participatory Design and a substantial focus on marginalized people (including children, individuals with disabilities, lower income groups, and ethnically diverse populations), from academia, government, and industry across four international regions. I then used informed grounded theory (Charmaz, 2014; Thornberg, 2012) to analyze my data and synthesize practitioners' descriptions of the challenges they face to inclusive Participatory Design. A key challenge that emerged from this interview study shapes my dissertation: the current locations, or settings, where users and practitioners meet to co-design may raise challenges for users to participate fully.

Interview participants provided insights into the complexities of where Participatory Design occurs and its impact on inclusion of marginalized users. Participants discussed the inclusionary tradeoffs of holding Participatory Design in three distinct locations: 1) practitioners' settings that necessitate users to go to, 2) users' settings that necessitate practitioners to go to, and 3) remote settings, or Distributed Participatory Design (DPD) (Constantin et al., 2021; Fails et al., 2022). I summarize practitioners' first-hand accounts of some of these tradeoffs below.

While holding Participatory Design sessions in practitioners' locations may erect barriers to physical access for users, practitioners' settings may enable users, who otherwise might not have the opportunity, to access and become familiarized

with sophisticated design materials and equipment. This was articulated by Chen, an academic based in Continental Europe who has led Participatory Design projects with children and adults with disabilities: "*we have children visiting our lab for a reason. We wanted to introduce them to laser cutters and 3D printing and we did a few sessions where we soldered bits together*."

On the other hand, users' locations may require engaging with additional stakeholders, which can sometimes complicate power dynamics, but may offer better grounding in users' concrete lived experiences. For example, Musa, who has organized large-scale Participatory Design projects with youth, government, and local industry in Scandinavia, recounted a Participatory Design project that was "*very locally embedded ... it was very relatable for all the partners involved, for the kids who live close by, because they knew the hospital and the area around it, and for the kids in the hospital*." Musa described how children who lived in or close to the hospital were the "experts" of their environment, which helped make design more tangible and relevant to their experiences. This extends reflections by Muller, who argued collaboration with users in their work contexts made for conversations grounded in concrete work experiences (Muller, 2008).

Traditionally, Participatory Design has been conducted in physical locations. Remote Participatory Design has been proposed as one solution to the difficulties of users and practitioners moving into each other's physical locations, opening access to more people like individuals with disabilities or those who are not co-located (Constantin et al., 2021; Fails et al., 2022; Maestre et al., 2018). Yet, as my participants recounted, remote Participatory Design in its current forms brings its own

sets of complexities and challenges to inclusion. Participants reflected on the acute lack of grounding presence in remote Participatory Design, which seemed necessary for grappling with difficult emotions that might arise. For example, Kofi, an academic based in Continental Europe who has worked with children and adults with disabilities, stated how in certain situations Participatory Design should not be conducted remotely due to the sensitivity of the subject matter, associated trauma, and the lack of access to embodiment and presence to navigate difficult topics:

> "*I can't really do [a specific Participatory Design project] right now because it's also about bodies and intimacy and I don't want to do that online either because it's such a disembodied way…I don't want to be there sitting like kilometers away and then the person just shuts down the Zoom conversation, and I do nothing, I cannot take up any kind of care or responsibility that I have other than by invading their private space potentially, and that is so horrendous to me as a thought*."

This finding complements the in-depth case study observation of Harrington and Dillahunt in their co-design of tech futures with Black youth (Harrington & Dillahunt, 2021), who documented how users were hesitant to share their personal experiences and unfinished ideas. Perhaps one reason why current implementations of remote Participatory Design fall short is because they lack the grounded, embodied, material, and clearly delineated qualities of user or practitioner physical spaces.

It seems that neither practitioners' nor users' physical locations, nor a remote setting, are ideal settings for fully including marginalized users in Participatory Design. How then might we navigate this complex trilemma? Drawing on powerful concepts in Human-Computer Interaction and social computing such as design worlds (Schön, 1988), third space (Muller & Druin, 2002), and place-making (Harrison & Dourish, 1996), I posit that location is about more than just access—it is about instantiating a shared design environment where users feel empowered and enabled to fully design. Where Participatory Design is situated is not simply a question of choosing the setting most accessible to users, which may be physical (e.g., school, hospital, community center) or remote by default. Rather, a shared design environment with empowered users promotes their ability to enact their identities and articulate or communicate their lived experiences. This echoes calls by Benton et al., who argue that Participatory Design must "*support a design environment in which individuals feel comfortable and confident generating and sharing creative ideas alongside designers*" (Benton et al., 2014). Similarly, Harrington et al., call for supporting marginalized people to engage on their own terms in a comfortable environment where individuals feel empowered rather than further marginalized (Harrington, Borgos-Rodriguez, et al., 2019). Distributed Participatory Design might be framed not just as a method to counter problems of physical access, but as a new opportunity to co-construct a shared space that could integrate the best aspects of practitioners' and users' spaces and worlds.

Formative Pilot Studies

After obtaining a more expansive view of "location" in my first strand of preliminary work, I wrestled with how to tackle the problem of constructing a shared, inclusive design environment. I discovered that a recurring problem in Participatory Design was that users were often ascribed their design materials, which often led to users feeling disempowered and skeptical (Giglitto et al., 2018; Harrington, Borgos-Rodriguez, et al., 2019; A. Lazar et al., 2018). I speculated that one way to support users to enact aspects of their identities and lives experiences in design might be for users to have more control over their design materials. I began to brainstorm techniques that may support this in practice.

In this second strand of preliminary work, I engaged in critical design work to explore opportunities to support users to enact aspects of their identities and lived experiences in Participatory Design. I conducted five pilot studies to explore and refine potential system designs supporting users to bring in and use their own materials in co-design. At this point in time, I was specifically focused on Distributed Participatory Design given that this was the onset of the Covid-19 pandemic and in-person co-design would have been a challenge. Stemming from one of my overarching goals of maximizing access, initial constraints for the system included the need to support Distributed Participatory Design; be freely and easily accessible to users (desktop, tablet, and mobile); enable collaborative real-time editing; and support multimodal media types to accommodate the range of materials users may wish to bring in. While Distributed Participatory Design has shown to address issues relating to access (Constantin et al., 2021; Fails et al., 2022), I acknowledge that in certain instances Distributed Participatory Design may not be appropriate.

Across the five pilot studies, I created three separate iterations for the system. These iterations revealed emergent design goals and resulted in a stable probe. All the pilot studies were conducted remotely via Zoom. While recruiting historically marginalized or underrepresented participants was not a focus of the pilot studies, 11 of 14 total pilot participants were racially marginalized people. I provide more information about participants and individual pilot tests below.

Iteration 1: Uploading and Collaging in Google Slides

My initial prototype (at the time called *CollageCollab*) was instantiated in Google Slides (Figure 2, Figure 3), where users were invited to upload ten items relating to their lives into a shared repository and then used their materials and other participants' materials to create collaborative collages (see Appendix A: Supplementary Materials for Preliminary Work), inspired by Lévi-Strauss' idea of bricolage (Lévi-Strauss, 2000). The goal of the session was for participants to use their collaborative collages as inspiration to design technology-driven solutions. Participants would create their collages individually on a Google Slide, then come up with ideas for technologies inspired by their collages. Participants then went around in the Zoom sharing their collages and ideas. I conducted two pilot studies using this initial prototype and method.

The first pilot study (Figure 2) using the *CollageCollab* prototype was conducted with three members of my family, each of whom had a different familiarity with Google Slides and none with experience in co-design. In the first pilot, I collated all the materials participants uploaded into a single Google Drive folder. The second pilot study (Figure 3) was conducted with three undergraduate students recruited from

a single course focused on user-centered design, and thus were all familiar with co-design and Google Slides to an extent. Based on the challenges participants encountered in the first pilot relating to importing images from Google Drive to Google Slides, in the second pilot I imported all of the objects into a single slide in advance of the session. Otherwise, the techniques used in both pilots remained the same.

The two pilots with the *CollageCollab* prototype yielded four key insights. First, despite its ubiquity, some users found importing and manipulating media in Google Slides challenging, and the static slide format constricted them from designing uninhibitedly; using individual slides also stifled dialogue amongst participants. This suggested that users preferred a more 1) open-ended shared space for manipulating materials. Second, users thought bringing in ten items was excessive, often struggling to think of or find time to upload them. This suggested that 2) scaffolding the number of objects participants bring in could be a system constraint through which users feel more comfort and confidence about being able to participate fully. Third, in terms of the activities, users often lost sight of the goal of designing using their materials and instead focused on the quality of their collages. This motivated me to explore a more 3) goal-oriented, discussion-based process for productively engaging with the materials. Lastly, participants often found the open-endedness of prompts confusing ("design new technology inspired by your collages"), which motivated me to make the design topic 4) more specific, such as to design tools for cultural heritage preservation.

Figure 2: Iteration 1. Screenshot from first pilot study where a participant created a collage using the system prototype instantiated in Google Slides.

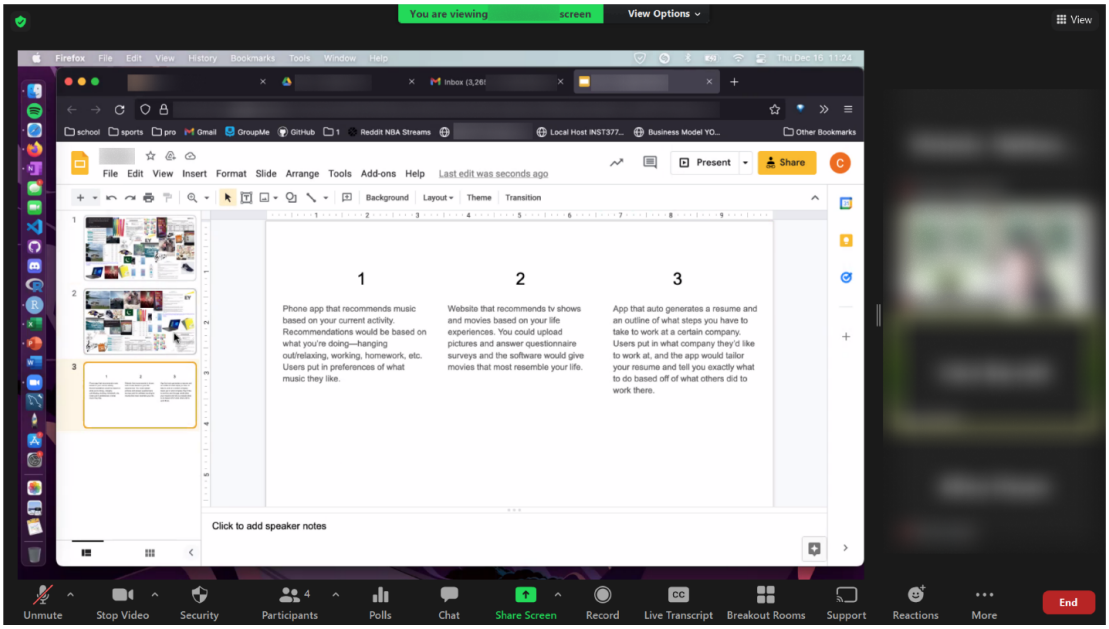


Figure 3: Iteration 1. Screenshot of participant's design ideas from the second pilot study using the system prototype instantiated in Google Slides.

Iteration 2: Uploading in Padlet and Designing in Google Slides

Building on these insights, I then explored a new set of prototypes using Padlet's canvas[1] as an alternative testbed (Figure 4). After exploring other existing systems including Google Slides, Miro, Lucidchart, and Figma, I decided to use Padlet for its relevant affordances including the following: 1) To accommodate a range of materials users may wish to bring in, the Padlet shared canvas supports various multimedia types including GIFs, drawing, live video, and audio recording. 2) In terms of accessibility, Padlet is freely accessible via web and mobile, and supports screen readers as well as over 40 world languages. 3) Posts can only be deleted by the poster or the canvas owner, preventing participants from deleting each other's work, which is a common issue in other systems for DPD (Walsh et al., 2016). 4) Padlet contains settings to prevent participants from seeing their peers' objects beforehand until facilitators approve them. This way, the objects other participants have uploaded earlier can be hidden from view so as to not bias participants.

I conducted one pilot study using this prototype. The third pilot study (Figure 4) was conducted with my two dissertation advisors, Dr. Chan and Dr. Bonsignore. The focus of this pilot study was to explore and co-design ways of preserving and representing cultural heritage. The participants were invited to upload only one item to Padlet prior to the session representing their cultural heritage, and then completed a set of discussion-based activities on Google Slides during the session (see Appendix A: Supplementary Materials for Preliminary Work). The design activities included a

[1] Padlet canvas: "*A freeform surface where posts can be created, connected, dragged, and dropped with no restrictions*" (Definition obtained from https://padlet.com)

"Show and Tell" where participants shared what they brought in; a "Tagging Speed Round" activity where participants would share keywords or tags that relate to what everyone brought in; a "Preservation Requirements" activity where participants would think of types of information that needed to be captured and made available when preserving cultural heritage; and a "Tools for Preservation" activity where participants would brainstorm technology-based solutions.

Participants responded more favorably to bringing in one object than ten, but also found the constraint of one object restrictive and wished they could have brought in more. Thus, the system needed to allow for freedom of expression without being burdensome or time-consuming for participants. This encouraged me to consider a range instead of a hard number on how many objects users can bring in. Lastly, users wanted everything visible in one window so they could reference materials and activities in tandem. In the third iteration, I moved all activities into Padlet which could support the design process from start to finish.

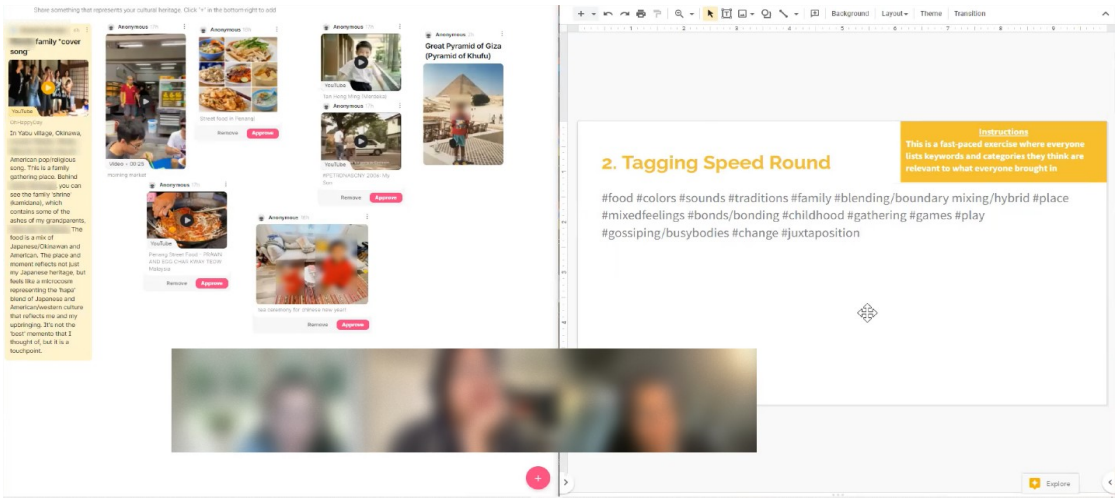


Figure 4: Iteration 2. Screenshot from the third pilot study with system prototype instantiated in Padlet on the left, and early versions of the design activities taking place in Google Slides on the right.

Iteration 3: Uploading and Designing in Padlet

My final prototype was instantiated entirely using Padlet (Figure 6, Figure 7). Users were invited to upload a range of 2–3 personal objects to Padlet beforehand using a prompt (Figure 5). I iteratively developed a prompt that can lend itself to the design topic at hand and support participants to choose the personal objects to bring in (see Appendix A: Supplementary Materials for Preliminary Work). Like in the previous iteration, I chose cultural heritage preservation as the topic of choice.

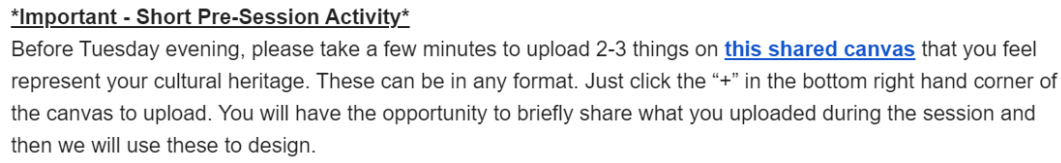


Figure 5: Pre-session activity "prompt" that can be altered depending on the design topic.

I conducted two pilot studies using the final prototype in Padlet. The fourth pilot study (Figure 6) was conducted with two graduate students in my department whose focus was on Human-Computer Interaction and who knew each other. In this pilot, participants completed all of the design activities in one session. The fifth pilot study (Figure 7) was conducted alongside four undergraduate students recruited from a single course focused on user-centered design, and thus were all familiar with co-design. In the fifth and final pilot study, the design activities were conducted across two sessions. The first session was focused on problem refinement and the second session was focused on designing solutions for cultural heritage preservation.

Users responded favorably to bringing a range of 2–3 objects representing their cultural heritage. The Padlet shared canvas was divided into sections corresponding to different inductive participatory activities aiming to identify opportunity spaces, structure the design topic, and facilitate co-design using the objects users contribute. These activities were refined versions of the activities introduced in the second iteration. These included:

1) *Sharing*: Before the first session, participants individually add their selected materials into a dedicated space. During the session, participants go around one-by-one, if they are comfortable doing so, and share what they brought in with the group. This activity also aims to increase rapport among participants.
2) *Tagging*: Participants share tags (words or phrases) relating to what everyone brought in. These tags should strive to find commonalities and draw connections amongst all objects. The facilitator will scribe the tags onto the Padlet canvas.
3) *Specifying* (Design Requirements): Participants share some of the key things they might need to consider when creating solutions to address the design topic (e.g., when trying to preserve cultural heritage). The facilitator will scribe the design requirements onto the Padlet shared canvas.
4) *Designing*: Participants will individually brainstorm systems or technologies to address the design topic. Participants can create one idea or multiple ideas. Participants can use the materials they brought in as inspiration, but are not limited to them. Once all participants have finished, they will have the

opportunity to share their ideas with the group and exchange feedback and ideas with one another.

On the Padlet canvas, I organized activities into a left to right sequence to scaffold co-design and to allow everything to be visible in one window. Users responded favorably, as the sequential activities enabled them to comment on, revisit, and draw connections between materials and earlier activities. Inviting participants to comment on all of the shared materials and contributions has previously helped to engender an atmosphere of ease and to support different amounts and kinds of participation, such as in Gautam et al., where Nepalese sister-survivors could add to someone else's story or share their own story through photographs they had taken (Gautam et al., 2018).

The fourth pilot study initially took place in one session, which resulted in activities being rushed. Thus, the fifth pilot was spread across two sessions, where participants had the opportunity to bring in materials each time and adequate time to complete design activities. Users also responded favorably when reassured that there were no right or wrong answers.

Overall, the pilot studies illuminated the opportunity for creating specific system design features, activities, and instructions that help to scaffold users identifying, bringing in, and engaging with personal objects in the design process. Each iteration revealed design goals and changes that needed to be made to the system in order to improve it (summarized in Table 1). The result of these pilots is a stable probe called *Talisman* that I evaluated in my dissertation research.

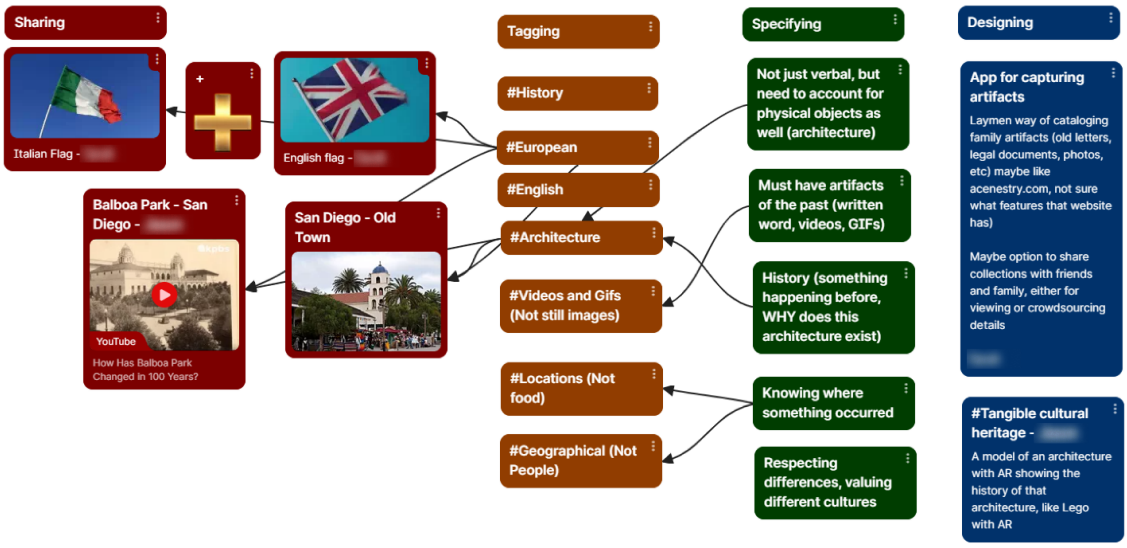


Figure 6: Iteration 3. Screenshot from the fourth pilot study with system prototype fully instantiated in Padlet.

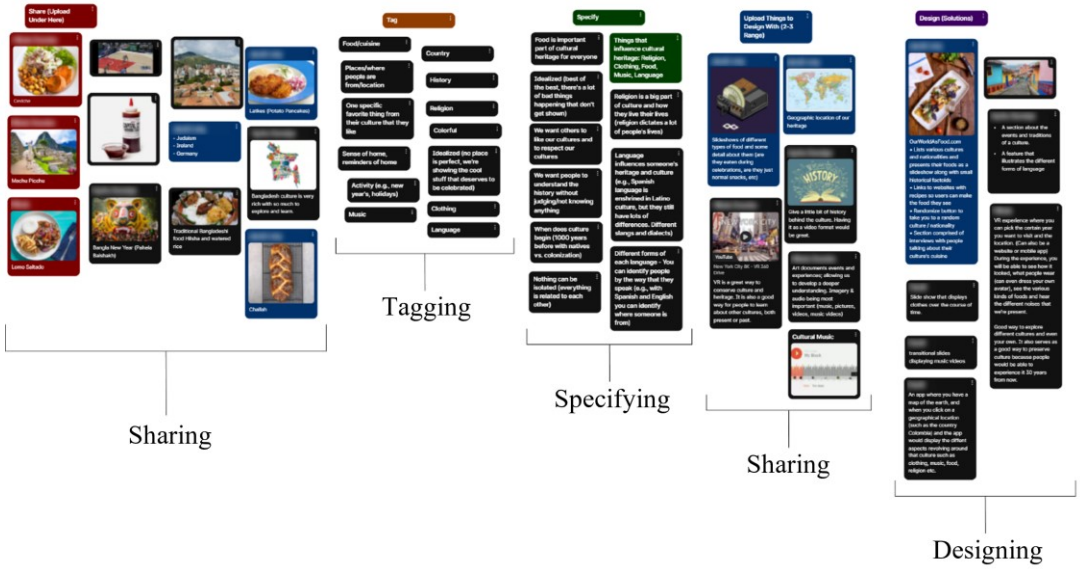


Figure 7: Iteration 3. Screenshot from the fifth pilot study with system prototype instantiated fully in Padlet.

Iteration	Emergent Design Goals
1	● Initiate an open-ended shared space for manipulating materials (e.g., shared canvas) ● Scaffold the number of objects participants bring in ● Facilitate a discussion-based process for productively engaging with the materials ● Constrain the design goal so as not to be overwhelming or unclear to participants
2	● Support freedom of expression through materials without making activities burdensome or time-consuming on participants ● Hold design activities from start to finish in one dedicated space
3	● Spread the design activities across multiple sessions if time allows ● Reassure participants that there are no right or wrong answers

Table 1: Emergent design goals from pilot studies.

Chapter 4: System Chapter

Talisman: Integrating Personal Objects Into Co-Design

In order to shift control of design materials to users, systems must be set in place to guide users on what they can bring in and how to use what they brought in for design. Here, I present the stable version of the sociotechnical system I developed for this dissertation called *Talisman*. Talisman consists of a repertoire of techniques and design activities to scaffold users' selection and interaction with their personal objects in co-design. Talisman includes a series of suggested design activities, prompt, Padlet template, and toolkit.

To share a little bit of background on the name of the system, I decided to name it after the word *talisman*, which refers to an object with "magical" powers. This was, in part, inspired by a finding from the system deployment where a participant brought in an object to which she attributed having magical properties (Leire, Case Study 1). As seen in Figure 8 below, I chose the spiral symbol to embody Talisman, as objects can possess qualities that evoke a sense of spirituality and timeless essence. Additionally, I thought that the spiral symbol conveyed the iterative nature of the techniques presented in Talisman.

Figure 8: Talisman logo

Design Activities

To scaffold co-design and support participants' bringing in and engaging with their objects, I suggest a series of pre-workshop and in-workshop design activities. These activities have been iteratively developed and tested in pilots. With the exception of modifying the descriptions and names of the design activities, these are essentially the same activities from Iteration 3 of the pilot studies. They were created with the intention of integrating into communities' existing practice, as well as being self-directed (i.e., without supervision from me or a research team). I structured design activities to build on one another so that participants' objects were interwoven throughout the process. I was intentional in my design of the sequence of activities, but also wanted to allow for the flexibility of communities to pick and choose which activities to incorporate, when, how often, and for how long. Depending on the goals of the community, it may be helpful to repeat or omit certain design activities. Thus, while these design activities are suggested, they are open to modification depending on the contexts and preferences of communities. At a high level, the design activities include (using the "4 C's" mnemonic, see Figure 9):

1. ***Choose*:** Participants select object(s) to bring in before session (see prompt below); during the session, participants go around and share what they brought in and why.
2. ***Connect*:** Participants draw connections between the objects they shared.
3. ***Consider*:** Participants think of key considerations when creating solutions to their topic.
4. ***Create*:** Participants brainstorm or design solutions to their topic.

Figure 9: Talisman design activities, called the "4 C's"

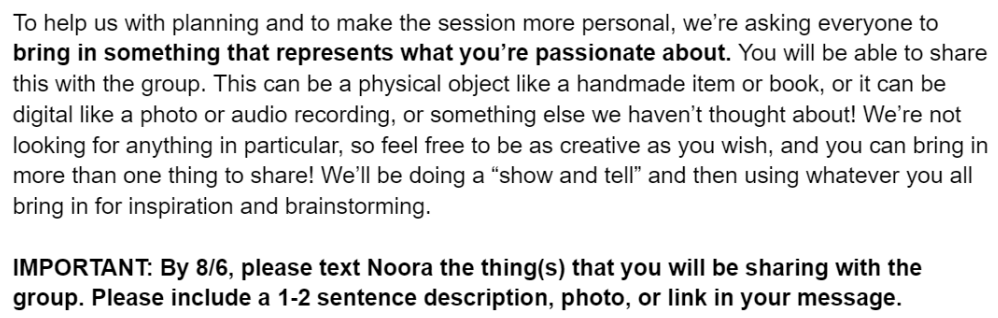
Prompt

The Talisman prompt is a customizable brief that lends itself to the design topic at hand and supports participants to choose the personal objects they want to bring in.

In my preliminary work, I had converged on a set of emergent design goals that laid the foundation for Talisman: I found that users wanted guidance and constraints on the number of objects they could bring in; examples of what may constitute a design material; and a clearly defined design topic to help frame their material selection. In Distributed Participatory Design, users also wanted guidance on how to bring in their objects in a virtual environment. Based on findings from these early pilot studies, I iteratively developed a stable version of the prompt to help scaffold material selection. The stable version of the prompt (Figure 10) was slightly

modified to address the design goals from preliminary work. I also provide fillable copies of the prompt template in Appendix B: Supplementary Materials for Dissertation Research, which can be altered depending on the goals of the community and whether the co-design workshop is held in-person or online.

I wanted to allow for flexibility and openness in the types of materials participants could bring in, while simultaneously grounding the design topic so as to prevent the problem from being too open-ended, as observed in preliminary work. I designed the prompt to accommodate a range of design topics; for example, instead of asking users to bring in objects representing their cultural heritage, users could also bring in objects they envision could be smart devices, objects they use to learn, or objects for designing assistive technologies. The prompt enables participants to think about and engage with the project outside of workshop time (DiSalvo et al., 2008), as well as encourages forethought, reminds participants to bring in their objects, and is an opportunity to articulate what it is they are bringing in before sharing with the group.


To help us with planning and to make the session more personal, we're asking everyone to **bring in something that represents what you're passionate about.** You will be able to share this with the group. This can be a physical object like a handmade item or book, or it can be digital like a photo or audio recording, or something else we haven't thought about! We're not looking for anything in particular, so feel free to be as creative as you wish, and you can bring in more than one thing to share! We'll be doing a "show and tell" and then using whatever you all bring in for inspiration and brainstorming.

IMPORTANT: By 8/6, please text Noora the thing(s) that you will be sharing with the group. Please include a 1-2 sentence description, photo, or link in your message.

Figure 10: Example of a stable version of the prompt used in Case Study 1, Workshop 2.

Talisman Padlet

The Talisman Padlet aims to support users to bring in and utilize their objects in Distributed Participatory Design (DPD), as opposed to Participatory Design held in-person. The Padlet is meant to be used in tandem with video conferencing software such as Zoom or Google Meet.

Other than changing the names of the design activities, the Talisman Padlet has stayed the same since Iteration 3 of my preliminary work. As touched on previously, I selected Padlet because it has the following affordances: 1) accommodates a range of multimedia types; 2) is freely accessible via web and mobile, and supports screen readers and over 40 world languages; 3) provides safeguards to prevent modification or erasure of users' content; and 4) contains settings to prevent users from seeing what others uploaded to the canvas prior to the session, so as to not bias them.

Prior to the design session, facilitators can send their participants the prompt as well as a link to the Talisman Padlet. Here, participants can choose any file type to share, and are instructed to click a "+" button in the bottom right-hand corner of the shared canvas to upload their materials. While optional for facilitators, I created a video recording demonstrating how users can upload their objects to the Talisman Padlet, as well as examples of different types of media they could upload.

Talisman Toolkit

This toolkit is a resource to support co-design facilitators and communities to deploy Talisman on their own and in their current infrastructures and practices (Ledo et al., 2018). The Talisman Toolkit is a repository of the previously described

techniques and design activities to scaffold users' selection and interaction with their personal objects in co-design. I instantiated the current version of this toolkit in Notion, which offers a no-code website builder and inline comments for exchanging feedback easily. The current version of the toolkit includes a summary of Talisman, overview of the design activities and prompt, links to the Talisman Padlet, sample use cases, tips for facilitators, and possible outcomes for participants (Figure 11).

For the purposes of my dissertation research, this toolkit was not as helpful since I worked directly with the communities to embed Talisman in their design practice prior to the co-design sessions. However, in future deployments where members of the research team are not present, this toolkit is essential for communities interested in embedding Talisman into their practice independently. Similar to how Gonzalez et al. "designed themselves out," I tried to design Talisman as well as the toolkit in a way "*such as that it is owned by the communities who use it, where community members could confidently lead effective community conversations about local assets without assistance*" (Gonzalez et al., 2022).

In Future Work, I spec out possible changes to the current version of the toolkit informed by my deployment of Talisman (Chapter 6). For example, one idea is to include more video demonstrations to communicate the functionality of Talisman (Ledo et al., 2018). In the future, the Talisman Toolkit should be publicly available at https://www.TalismanToolkit.com.

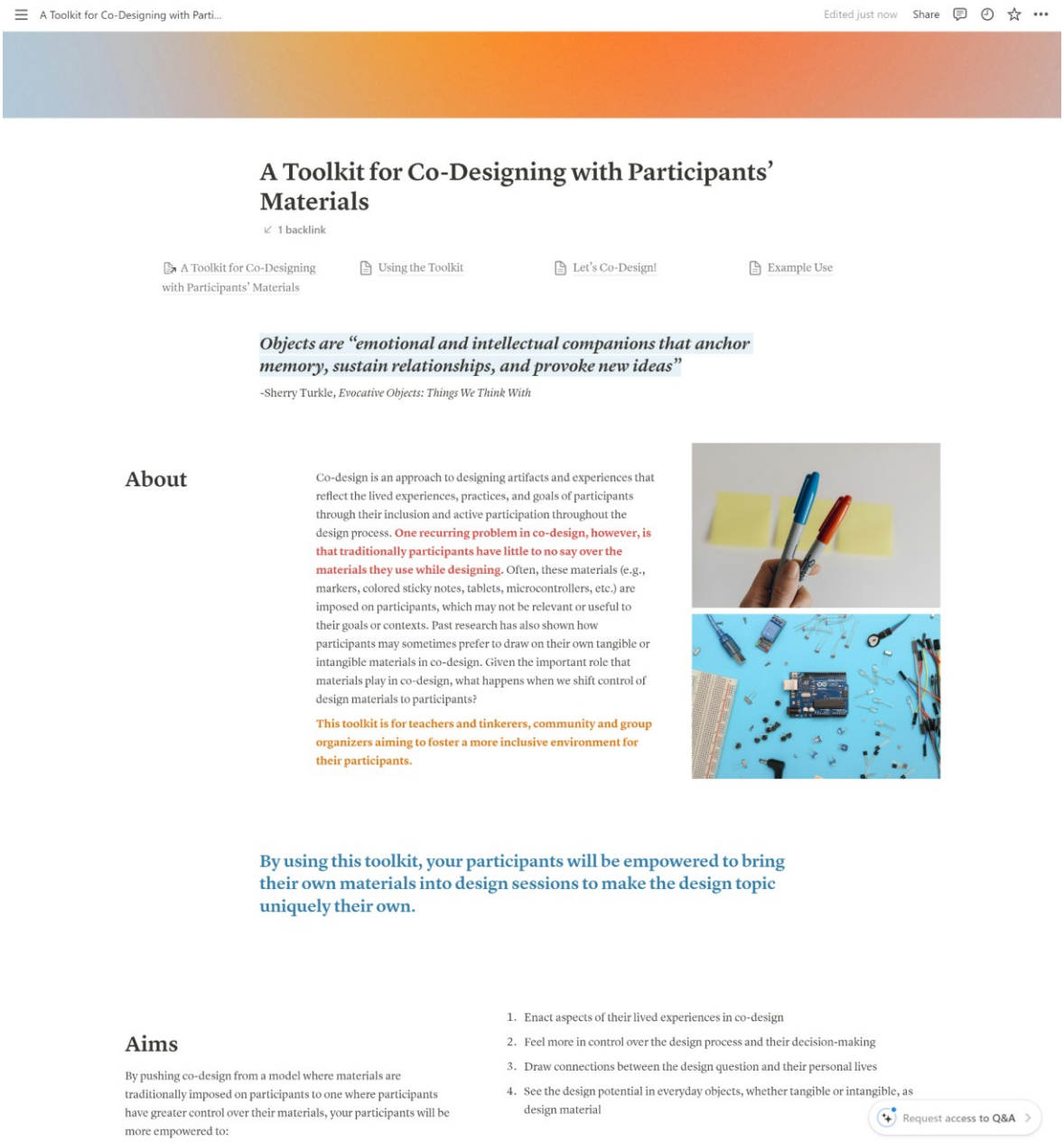


Figure 11: Screenshot of the current version of the Talisman Toolkit. This is a screenshot of the front page.

Chapter 5: Methods

In this chapter, I describe my case study approach and methods used to implement and evaluate Talisman. I give an overview of the communities and participants whom I collaborated with throughout this process.

Case Study Approach

To evaluate whether Talisman produced the intended behaviors and outcomes of my research (Olson & Kellogg, 2014), I conducted a series of case studies alongside three different communities. Through extended engagement over the course of a year, I worked directly with three communities focused on designing solutions relating to 1) Safe Spaces, 2) Environmental Justice, and 3) Programming Education. There are a few reasons why I was motivated to use a case study approach in my research. I delve into these reasons below.

As described by Lazar et al., there are four key aspects that can be used to describe case studies (J. Lazar et al., 2017). 1) First, case studies involve an in-depth examination of a small number of cases (J. Lazar et al., 2017). The number of cases is normally on the lower end but no less than two, and a researcher is advised to continue finding new cases to compare until theoretical saturation is reached in relation to the goals of the research (Khan & VanWynsberghe, 2007). In my deployment, I aimed for a minimum of two case studies to allow for comparison of Talisman across different contexts and to increase robustness of my findings and analysis.

2) Second, a case study approach involves examination in context (Lazar et al., 2017). This means evaluating the intervention in a natural, real-world setting as

opposed to usability testing in a controlled, lab environment. So, instead of me (the investigator) selecting the design topics (e.g., cultural heritage preservation and Internet of Things, as proposed in earlier work), I decided instead to collaborate with communities who had a genuine interest in embedding Talisman into the existing design practices. This way, the design topic would be relevant and situated directly in the community's context.

Lastly, 3) case studies typically involve multiple data sources as a means of corroborating evidence through triangulation, and 4) case studies emphasize qualitative data and analysis. While I delve into these further in the subsections below, typical types of case study data include artifacts, observations, and interviews (J. Lazar et al., 2017). These types of data allow for a rich understanding of participants' behaviors and attitudes, which are essential to understanding ways that Talisman may have played a role in the inclusion of users. Additionally, I suspected that integrating Talisman across different contexts would allow me to gauge its reproducibility, adaptability, and expansiveness. I imagined that Talisman could accommodate a range of design topics, which could be altered depending on the goals of the team.

Participants and Recruitment

A recurring problem in community-based design research relates to the development of trust and healthy relationships between communities and researchers (Harrington, Erete, et al., 2019). When working with marginalized participants—especially as a researcher affiliated with an academic institution—extra time and care is needed to acknowledge local histories and address potential historical harms. Thus,

I recruited from communities with pre-existing relationships and trust established with University of Maryland faculty, staff, or students. These communities already had experience or a vested interest in conducting co-design. In all three case studies, members of my dissertation committee facilitated my connection to community champions.

I worked alongside the community champions over the course of a year to embed Talisman into their existing design practice. In the early stages of our collaboration, I engaged in rapport-building to get to know the community better such as by attending community meetings virtually prior to research engagement (Harrington, Erete, et al., 2019). The community champions (also referred to in this dissertation as "facilitators") led all design sessions and facilitated my access to participants. This meant that the number of participants was largely predetermined by the community. In Participatory Design, the number of participants is usually limited in order to give each user sufficient time and attention. The limited group size is especially important when using Talisman where time must be dedicated for each participant to share their materials and ideas to other group members. More information about participants and their relations to community champions are provided in Table 2.

While the communities and design contexts across each case study were distinct, the population and age range of participants remained relatively consistent throughout. While not intended at the onset of my dissertation research, I noticed that the participants in the first two case studies were underrepresented young adults. Thus, I intentionally sought to work with a third community of underrepresented

young adults in order to complement the prior two case studies. I use the term "underrepresented" to refer to groups of people who have been historically excluded from various institutions in society. I decided to adopt the word "underrepresented" in lieu of "marginalized" primarily since this was the language used by the STEM education nonprofits I partnered with to describe participants. I use the term "young adults" to describe participants, all of whom were between the ages of 16-22 years old. In specific contexts, however, I sometimes refer to the young adults by their roles as "interns," "students," "high schoolers," or "undergraduates."

When working with marginalized people, it is important to be cognizant that their time may be scarcer. All of the co-design workshops conducted with Talisman lasted between 1-2 hours. Getting involved in research should not come at the expense of participants (Liang et al., 2021), and thus participants should be compensated equitably for their time and for lending their expertise. In this study, participants received a $30 USD gift certificate of their choosing for completing all aspects of the study including a short, post-session survey. There were additional non-monetary benefits to participating such as exposure to new design methods. This follows suggestions by Liang et al. who underline how researchers should consider both short-term and long-term ways of giving back to participants (Liang et al., 2021).

	Case Study 1: Safe Spaces	**Case Study 2: Environmental Justice**	**Case Study 3: Programming Education**
# of Participants total	12	6	7
Ages	16-21	~17	18-22
Gender	8 females, 4 males	4 females, 2 males	4 females, 3 males
Context	Year-round, extracurricular workforce development program for youth	Formal summer internship for high school students focused on environmental justice	Past undergraduate students volunteering to contribute to the revision of a course
Relationship between community champion or facilitator and young adults	Facilitator was more of a near peer mentor (smallest power imbalance)	Facilitator was a faculty member and supervisor for the internship (biggest power imbalance)	Facilitator was previous instructor for participants, with the exception of 1 (intermediate power imbalance)
Rapport between facilitator and participants	Knew each other very well, had met on weekly basis for a year	Third time facilitator and participants met	Some knew facilitator more than others, but all were at least familiar
Rapport among participants	Knew each other well, some more than others	Only met twice before, were familiar but did not know each other on a personal level	Some knew each other more than others, but all were at least familiar

Comfort towards outsiders or researchers	Were generally very comfortable with researcher presence	Were generally not comfortable to researcher presence	Were very comfortable with researcher presence

Table 2: Summary Table of case study participants and facilitators

IRB Approval

All aspects of this dissertation were approved by the University of Maryland Institutional Review Board (IRB Package 1610063-8). A copy of the IRB approval form is included in the Appendix. When working with marginalized communities, it is important to exercise care and to be intentional about consent procedures. Prior to each workshop, I received informed consent from the young adults and/or their guardians for their participation in my research study, as well as consent to be audio/video recorded. Participants had the right to withdraw their consent at any time during or after the workshop.

While audio/video recording may allow for a fuller representation of participants' experiences throughout the study, some participants may feel uncomfortable being recorded or may purposefully alter what they choose to share if they are aware of being recorded. Thus, note-taking may be more appropriate in certain situations or if participants do not wish to be recorded.

Data Collection

In my case studies, I triangulated data from a variety of sources to gain a better understanding of how the young adults engaged with their materials throughout the design workshops. I triangulated data across four primary sources including: 1) observations, 2) artifacts and traces, 3) focus groups and surveys, and 4) pre and post

interviews. Most of the data I collected was qualitative in nature, with the exception of the slider questions in the surveys participants completed. All data collected was anonymized to protect participants' privacy.

Observations: First, I collected observational data from the co-design workshops. I observed participants' interactions with their personal objects, Talisman, and other participants with an eye towards both verbal and nonverbal communication. I paid particular attention to examples of actions, responses, or expressions that may have signaled a certain phenomenon, like feelings of inclusion or power over the design process.

Artifacts and traces: Second, I collected artifact and trace data from the co-design workshops. This included artifacts that participants brought in as well as any design outputs. I paid attention to what sorts of objects participants brought in, the conversations these objects elicited, and how these objects were used in the co-design of solutions for the communities. I also paid attention to anything that was produced in the workshop, such as ideas written down on a whiteboard, big paper, or Post-it notes.

Focus groups and surveys: To gather feedback at the end of each workshop, the young adults participated in a brief focus group interview with the remaining time. Participants were given the opportunity to share their constructions of their experiences and perceptions of the session, personal objects, and design activities. After the focus group, participants completed individual surveys, which included short answer and slider questions. This was a chance for participants to share thoughts that they may not have been able to or were not comfortable expressing during the

focus group. Examples of survey questions include: *What made you feel included/not included? If you have participated in similar sessions before, how would you compare this session to others you have participated in?*

Pre and post interviews: Lastly, I also conducted 1-hour semi-structured interviews before and after the workshop with the workshop facilitators in order to understand the experience of facilitating the session from their perspectives. Examples from the pre-interview questions included: *How did you prepare for the session? Can you walk me through how you decided on the prompt?* Examples of questions from the post-session debriefing included: *Did the students find any connections between objects? What do you wish could be better next time?*

Along with the debriefings and as needed, I conducted follow-up member checks with facilitators and near peer mentors. Member checking is a technique used in qualitative research to assess reliability of the interpreted data through confirmation and review with research participants (Lincoln & Guba, 1985). One consideration to keep in mind, however, is the need to balance data fidelity while respecting community members' time, which is especially salient when working with marginalized people. Thus, member checks were done in whatever format was conducive to the facilitators and near peer mentors (i.e., via email and Zoom).

In each of the case studies, I was interested in observing how each of the communities took up Talisman on their own. My eventual goal was for Talisman to be handed off to communities for use independent of me or a research team having to facilitate. I recognized that in order for Talisman to be taken up by communities in the future, this would mean having to "*decenter [myself] from the process*" (Gonzalez

et al., 2022). Thus, I intentionally tried to minimize my direct intervention and to unobtrusively observe how the facilitators would lead the co-design session without my assistance. I did this by observing some of the co-design sessions synchronously via Zoom, not directly observing at all. I describe my level of participation further in each session in the section *My Role*.

Qualitative Data Analysis

Recordings from the co-design workshops and interviews with facilitators were transcribed in full. I conducted qualitative data analysis to examine the range of factors relating to how Talisman supported users to identify, bring in, and engage with their own materials in co-design. To make sense of the data in relation to these research objectives, I performed thematic analysis across the transcripts and other data sources. As highlighted by Braun and Clarke, "*the 'keyness' of a theme is not necessarily dependent on quantifiable measures—but rather on whether it captures something important in relation to the overall research question*" (Braun & Clarke, 2006). I first open coded the data to identify similarities across the co-design workshops as units of analysis. Examples of initial open codes included "Opening up to the group," "Participant reservations," and "Feelings of connectedness." I then collated the initial codes into broader, emergent themes and iterated upon these themes with assistance from my dissertation advisors. My analysis produced four broad, descriptive themes, which I present in Chapter 6: Case Studies:

1. How did the design partners *instantiate* Talisman in their co-design workshop?
2. How did the personal objects and Talisman impact the *design work*?
3. How did the personal objects and Talisman impact *inclusion* of the young adults?
4. How did the personal objects and Talisman impact the young adults as *designers*?

After identifying themes across the co-design workshops, I looked for themes across the three case studies as units of analysis. In Chapter 7, I present a cross-case analysis of the three case studies using a comparative approach. A comparative approach to cross-case analysis looks for points of convergence across the cases and treats them as instances of the same social phenomenon (Khan & VanWynsberghe, 2007). The aim is to synthesize the patterns or replicative relationships that occur across cases (Yin, 2018). I synthesized my findings across the case studies in parallel with extant theories from Assets-based design and Equitable Participatory Design in order to gain a better understanding of my data and to generate design implications for inviting users to engage with their own materials in co-design. My analysis generated the three following themes:

1. *Shifting Control* of Design Materials
2. *Expanding the Range* of Design Materials
3. *Scaffolding Interaction* of Design Materials

Reflexivity and Positionality

Lastly, given that data collection and qualitative analysis and interpretation are subjective processes, I engaged in reflexivity and recognize the influence of my positionality and personal identity in my interactions with participants as well as write-ups of my findings.

In terms of reflexivity, I must acknowledge the role that being a member of an academic institution played in my research. Although there was established trust with the community champions through sustained engagement, academic institutions have historically contributed to upholding structural racism and oppression. This can largely affect the power relations (Liang et al., 2021) and ways that participants view the researcher, study, and academia in general. Part of reflexivity also includes questioning whether one's research helps to break down or further reinforces oppressive social structures (Bardzell & Bardzell, 2011). In my research, I tried to respect the decisions of communities as best as I could, such as by agreeing not to record or use participants' data if they were not comfortable. I expand upon the role I played as a researcher within each case study.

In terms of positionality, I identify as a young, able-bodied, non-white Middle Eastern/North African woman pursuing higher education. I recognize my privileges including but not limited to being able-bodied, a native English speaker, and in pursuit of higher education in the United States. As an ethnic and racial minority and female, I have a personal commitment towards the inclusion and empowerment of marginalized people. My dissertation advisors, who greatly assisted in the development of Talisman and discussions on emergent themes, are also ethnic and

racial minorities committed to the inclusion of marginalized people. Our personal identities have thus played a large role in shaping this dissertation's research agenda.

Chapter 6: Case Studies

I deployed Talisman across three separate communities and contexts to observe its impact and effectiveness in applied, real-world settings (Yin, 2018). The three case studies in which Talisman was deployed were focused on 1) "Safe Spaces;" 2) Environmental Justice; and 3) Programming Education. Below, I present direct observations and my empirical analysis of each case study and its respective co-design workshop(s). I include direct quotations from the young adults and facilitators as well as constructions of their experiences.

Case Study 1: Safe Spaces

Designing STEM-Focused "Safe Spaces" in Chicago

I present findings from my first case study alongside a STEM (science, technology, engineering, math) education nonprofit in Chicago, IL focused on providing meaningful and empowering workforce development and out-of-school opportunities for local underrepresented youth. Specifically, the nonprofit aimed to serve youth and young adults with an interest in science who face barriers to high-quality, extracurricular science programs. Throughout the course of a year, I collaborated with nonprofit leadership and a group of Black young adults (ages 16-21) who served as community ambassadors. The young adults were selected to participate in a year-round youth development program sponsored by the city of Chicago with the goal of creating youth-led "Safe Spaces." Nonprofit leadership described this process as "*youth curation for youth*." The young adults received a stipend from the nonprofit for their participation in the youth development program.

I first became acquainted with the STEM nonprofit in November 2022. Dr. Sheena Erete, who had established trust through sustained engagement, facilitated my connection to the nonprofit. I organized an introductory meeting with members of my dissertation committee and two members of the nonprofit leadership team (anonymized): 1) Jude, the founder of the nonprofit, and 2) Noora, a community liaison and program manager. Noora was simultaneously pursuing a Master's degree in experience design, and thus had experience in co-design. Jude and Noora shared information about their initiatives focused on connecting students to out-of-school activities, such as previous design workshops with young adults where they created "asset maps" of opportunities and barriers to student involvement in STEM activities. Together, we discussed overlapping interests relating to ways of structuring co-design workshops and thinking about tangible solutions. After our introductory meeting, I continued to engage in rapport building with the nonprofit by attending and helping take notes at one of their community workshops in December 2022, which was facilitated by Noora. This workshop enabled me to observe how their sessions were structured and to become better acquainted with members of the nonprofit leadership team.

In January 2023, Noora and I began working closely together in several rounds of planning meetings to brainstorm ways of incorporating Talisman into the nonprofit's programs and processes. One of the main programs that Noora managed was a year-round youth development program focused on creating "Safe Spaces." Going on its second year, the program was a workforce opportunity for young adults to convene regularly throughout the year and especially throughout the summer

months during their time off school. Noora had an established relationship with the young adults, having facilitated the program during its first year and also due to the fact that she was only a few years older than most of them. We felt this program was the most well-suited for Talisman due to alignment in participatory goals, flexible timeline, and small number of participants. However, because the local mayoral election was happening at the same time, the nonprofit had to wait until their pending grant application for the youth development program was approved by the City of Chicago in order for it to run. It was surprising to see the effect that local politics had on the community, and, in virtue, this research.

Once the program was approved in March 2023, Noora and I worked together to organize the first co-design workshop with the young adults. The first workshop was focused on co-designing a safe, spring kickback[2] event. We also conducted a second workshop during the summer, which was focused on translating youths' passions and interests into community change. In the following subsections, I present findings and key takeaways from the two design workshops.

Workshop 1: Spring Kickback Event

Note: The results from this workshop have been published open access in the 2023 Companion of Computer Supported Cooperative Work and Social Computing (CSCW) and were presented at the conference in October 2023. Please find the citation for this article below:

[2] Kickback: As described by the STEM nonprofit, these are events "designed by teens for teens." They are enriching, out-of-school opportunities for young adults to gather and socialize with their peers, with frequent opportunities to network with job recruiters as well.

Salma Elsayed-Ali, Elizabeth Bonsignore, and Joel Chan. 2023. Personal Objects as Design Materials: A Case Study of Co-Designing Safe Spaces With Young Adults. In *Computer Supported Cooperative Work and Social Computing (CSCW '23 Companion), October 14–18, 2023, Minneapolis, MN, USA*. ACM, New York, NY, USA, 6pages. https://doi.org/10.1145/3584931.3606991

Overview

In March 2023, I conducted a design workshop alongside 9 Black young adults (ages 16-21) to explore how they brought in and engaged with a myriad of personal "safe" objects in the design of a spring kickback event for peers in their community. I found that the personal objects and Talisman helped inform participants' event design, add structure to the workshop and conversation, and connect participants to one another and foster common ground. Below, I present observations and direct accounts from young adults and Noora into their experiences of engaging in the co-design of a spring kickback event for peers.

Setting

The goal of the co-design workshop was for young adults to plan a "Safe Spaces" kickback event for peers, which entailed brainstorming event themes and activities. I was interested in how the young adults' personal objects would help them achieve this goal. Noora and I worked closely to embed Talisman into the communities' existing processes and settings. For example, design activities were structured like a discussion while Noora recorded the conversation in a visual way using markers on a wall-mounted whiteboard, as this was what the young adults were

accustomed to. The co-design workshop also took place in a STEM learning center in a community space rented by the organization, in which all young adults had been to on numerous occasions. The co-design workshop lasted 1.5 hours. All co-design activities were conducted as a group.

Design Partners

9 young adults in total participated in this design workshop, in addition to Noora. In the post-session survey, all of the young adults self-identified as Black. 6 identified as female, 2 identified as male, and 1 identified as non-binary. All the participants were familiar with each other and with Noora. While Noora and I had already worked together, this was the first time the young adults and I met. Participants' pseudonyms and demographics are provided in Table 3.

My Role

I played an observatory role throughout the co-design workshop, attentively taking note of participants' objects, verbal and nonverbal communication, and dialogue throughout the design activities and debriefing. I was not physically present at the workshop but attended synchronously via Zoom. It was also useful to capture how Noora and the young adults used Talisman independent of me or a research team member being physically present. My role throughout the workshop was limited to introducing myself in the beginning of the workshop and reminding participants to fill out the post-session survey at the end of the workshop.

Prompt: Objects Representing Safety

Using the Talisman prompt template, Noora and I worked together to come up with a generative prompt reflecting the theme of "Safe Spaces," which was to "*bring in something from your life that represents safety or makes you feel safe*." The young adults texted Noora what they planned to bring in a day before the workshop.

Participant and Object Table

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words)
Leire	21	Female	Black	Black tourmaline crystal	"My crystal makes me feel safe because it radiates this protective energy. I usually just leave it in my car like it's all the bad juju bounces off of my car."
Zuri	18	Non-binary	Black	Water bottle	"The thing I brought today, or like my safe item, is a bottle of water. It makes me feel safe because I relate to water so much like our body is made up of 72% water. My sign is Aquarius, we are bearers of water. I just love water so much and water loves me."
Aisha	16	Female	Black	Headphones	"My safe thing that I brought was my headphones because I love music. Like the vibrations from music exude me. It's like when I turn it up on the highest level I can't hear nothing else around me."
Eabha	17	Female	Black	Art [picture on phone]	"The thing I brought in was my art, and I say art because it allows me to get away from my thoughts."

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words)
Coral	18	Female	Black	Dog [picture on phone]	“I brought a picture of my dog [named Cash] because he is really my baby. He is so sweet, even though he can get his moments when I'm gone.”
Ana	18	Female	Black	Necklace	“The thing that I brought in today is a necklace. It represents cause and effect within my life. It's like chaos to peace. Before there was chaos and then I feel like I connected with a talk that brought peace in my life [necklace reminds her of a talk].”
Emad	17	Male	Black	Fringes on clothes	“I brought my fringes that I wear every day [unzips jacket to show shirt underneath]. These are something I wear every day because I follow the Bible. These are something that God told us to wear to protect us and to keep us with like a righteous mind.”
Baoyi	17	Male	Black	Candle	“I brought a candle from my grandpa who passed away. He used to make me feel safe.”
Rosa	16	Female	Black	Mr. Snuggles	“I brought in Mr. Snuggles [stuffed animal in the shape of a purple sloth]. He makes me feel happy and I've had him since I was 10 years old.”

Table 3: Participants’ name (pseudonyms for anonymity), age, gender, race, and personal object (as described by participants).

Findings

How did the design partners instantiate Talisman in their co-design workshop?

Choose: Seated around a conference table (Figure 12a), the young adults went around the room sharing their names, items they brought in that made them feel safe, and something they learned about another participant. Noora wrote down participants' objects and descriptions on the whiteboard while they shared. Participants' objects and their descriptions are noted in Table 3 and listed in Figure 12. Seven of the objects were physical and two of the objects were digital.

Connect: Noora then asked the young adults, "*So in looking at the board and looking around at the people who have these kind of items, which do you feel connect or are on the same page as far as what they do for somebody? Or any themes that you may notice?*" Noora drew arrows between the objects that participants made connections between. The connections participants drew tended to be pairwise, meaning participants tended to connect a single object to another, rather than drawing connections among many objects or all of the objects. Participants drew the following connections: 1) Leire connected the crystal and fringes for spirituality; 2) Ana connected the necklace and headphones for "vibrations" and overcoming difficulties; 3) Aisha connected the dog and Mr. Snuggles for comfort; 4) Rosa connected the crystal and necklace for how similar they are; 5) Emad connected the headphones and art for expressing emotions; 6) Ana connected the crystal and water bottle for radiating energy; and, 7) Zuri and Aisha connected the necklace and candle for serving as reminders. While participants drew connections between some objects

more than others (i.e., Leire's crystal and Ana's necklace), participants found connections between every object at least once.

Consider: Next, Noora posed the question, "*Keeping in mind these items and what y'all discussed already today, what are some key things that you think we should consider when designing a 'Safe Space?*'" Noora listed these considerations to the right of the whiteboard (Figure 12b). Young adults mentioned the following eight things to consider: 1) Good energy; 2) Boundaries; 3) Transparency; 4) Open-mindedness; 5) Respect of the space; 6) One mic, so one person talking at a time; 7) Correlation and how people connect; and 8) Love. While there were no direct descriptions from participants about which considerations came from which objects, I can infer from the overlap in concepts and language that the two previous activities, *Choose* and *Connect*, helped to inform participants' considerations like Good energy, Transparency, and Connection. For example, Good energy was likely informed by Ana connecting the crystal and water bottle for radiating energy; Transparency was likely inspired by Zuri's water bottle; and Connection was likely inspired by the *Connect* activity itself.

Create: Lastly, the young adults brainstormed themes and activities for the spring kickback event (Figure 12c). Young adults came up with themes including "Spring Fling," rebirth, and Hawaiian luau. Noora asked, "*Do you all want to do any activities based off of the items that made y'all feel safe?*" Leire, Zuri, and Ana suggested doing something relating to art (inspired by Eabha's object), such as having an art gallery or painting activity. The young adults agreed music was a given, harkening back to Aisha's headphones. Ana also suggested including affirmations

inside Easter eggs, with statements like “You’re so beautiful,” an idea inspired by their objects that made them feel good.

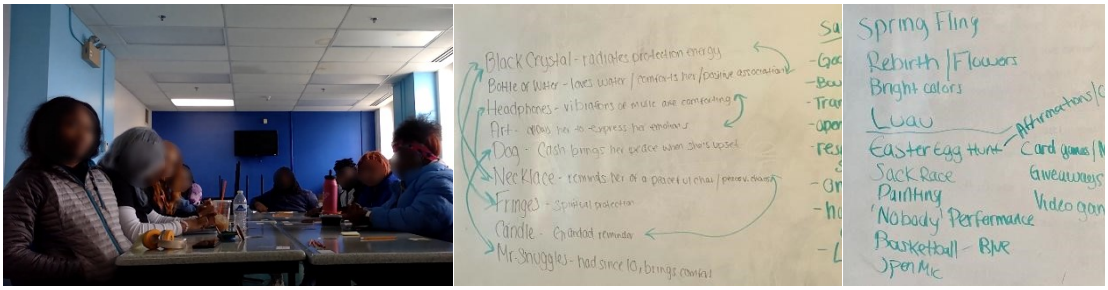


Figure 12: (a) Young adults seated around table; (b) Choose, Connect, and Consider activities; (c) Create activity

How did the personal objects and Talisman impact the design work?

The young adults drew on their personal objects as sources of inspiration in the design of a kickback event for peers. We can trace how participants' objects, in Noora’s words, “*informed their designs*.” For example, it is reasonable to infer that Leire's crystal and Zuri’s water bottle motivated the young adults to think about the importance of transparency and good energy in their event. Eabha’s art inspired her peers to come up with art-related activities. Likewise, Ana came up with Easter egg hunt affirmations based on a peers’ object that made them feel good. In Noora’s post-workshop interview, she said “*like with the Easter egg hunt with the affirmations and all that kind of stuff I feel like directly came from what they talked about what made them feel safe versus usually it's just 'I saw a silent party last week that looked cool, let's do that.' You know, so definitely different*.”

Along with drawing inspiration from their personal objects, the young adults felt their objects and Talisman helped enhance their engagement and structure the conversation. Sharing their personal objects was a way to get “*everybody to talk, like it got me wanting to talk… It didn't feel like work, you feel me? You tricked us into*

working," as Leire expressed. Compared to previous workshops, participants thought this workshop was more structured. For example, Baoyi shared "*This one was pretty quick, others usually drag too long, this one was perfect."* Ana added, *"It was good, it was like very accordant, like everything was in order*."

In her post-session interview, Noora shared that she felt this workshop was more intentional and thoughtful: "*I will say it was a lot more intentional of a session. because a lot of it [previous sessions] is just kind of them thinking in the air. We talk, we brainstorm, and then we vote on the best ideas and like, although that still solicits results, they're less thoughtful of a result*." Noora considered what the session would have looked like had the young adults only participated in the first design activity (*Choose*): "*I think the process was helpful. I think, just bringing in items minus the process probably would not have elicited the same feedback*." This points to the value of additional structured design activities, such as the *Connect*, *Consider*, and *Create* steps.

How did the personal objects and Talisman impact inclusion of the young adults?

Overall, the young adults shared that they felt more included in the co-design process. Sharing their personal objects was a way for young adults to open up to their peers. Ana recounted how "*it made me feel good to have a nice, safe place to open up to tell people about my experience, my cause and my effect*." Similarly, Emad felt "*It was good, got to show who I am to my coworkers*." Young adults recounted how the experience of bringing in and sharing their personal objects helped them to feel heard and seen. In their post-workshop survey responses, the young adults shared what

made them feel included: 1) Zuri wrote "*people listening to me, I don't feel like many people do that*." 2) Baoyi wrote, "*how everyone spoke to each other and made you feel included*." 3) and Emad wrote, "*I had a voice*."

In the post-session survey, participants were asked "*On a scale of 1 to 10, with 1 being 'not at all' and 10 being 'extremely' - How included did you feel in the session?*" Of the 8 participants who completed the survey, the average response to the question was a score of 9.125, indicating how the young adults felt included in the session. Only one participant, Zuri, shared in the focus group and survey that "*it was scary, I don't like letting people in my personal life*," but liked the process of "*getting to know and understand each other better*." Zuri's feedback was an important reminder of the need for mechanisms that support different social preferences or personalities in co-design.

The personal objects and Talisman were also a way of building connections and fostering common ground within the group. In Noora's words, "*I think finding the connections between the artifacts helped the students to find connections just between each other in general and find common ground*." The young adults recounted how they enjoyed connecting with their peers and how opening up to one another made connecting easier. Leire stated, "*It made me feel more connected and like, I feel like when people open up you can actually like connect with people. You get to do some introspection with people you've been working with*."

How did the personal objects and Talisman impact the young adults as designers?

The personal objects and Talisman led to outcomes participants could carry over into other workshops and their personal lives. Young adults emerged with a newfound understanding of their objects and what can constitute a design material. The young adults were encouraged to think about their objects in new ways and to recognize the viability of everyday objects, whether tangible or intangible, as design material. An outcome of this was participants, like Ana, wanting to adopt this approach outside of the immediate design context and on their own. Ana shared that "*It made me want to think more about things on a deeper level, like if I got a teddy bear at home I can take this thing home and do it to my teddy bears*."

Workshop 2: Passions and Community Change

Overview

Alongside the same Chicago-based STEM education nonprofit, I conducted another design workshop in August 2023 to explore how 10 young adults (ages 16-21) envisioned transforming their passions into positive change in their community. I found that the community partners modified Talisman to include probing questions, participants felt more connected as a group, and participants emerged with a strengthened sense of empowerment and desire to actualize their proposed solutions in their community.

Setting

The goal of the co-design workshop was for young adults to translate their passions and interests into action plans for positive change in their community. Because this design workshop occurred ahead of their annual overnight youth empowerment conference, the young adults were encouraged to frame their thoughts and ideas into things they could tangibly propose to local elected officials who would be in attendance at the conference. While Noora and I worked closely to integrate Talisman into their practice in the first design workshop, this time Noora and Leire planned the workshop together primarily as they were already familiar with the process. Noora created the discussion guide before the workshop and then handed it off to Leire to facilitate the discussion. Leire led the design activities while Noora recorded the conversation in a visual way using markers on poster paper attached to the wall. The co-design workshop took place in the same STEM learning center space the nonprofit rented out, which was a common and familiar meeting space for the

participants. The co-design workshop lasted 1 hour. All co-design activities were conducted as a group.

Design Partners

10 young adults in total participated in this design workshop. 7 participated in the previous design workshop in March, while 3 participants were new. All 10 of the participants were familiar with each other and had worked with each other throughout the summer. The young adults who participated in the first design workshop were already familiar with Talisman and this study, while the 3 new participants were exposed to it for the first time in this workshop. In the post-session survey, all of the young adults self-identified as Black. 6 identified as female, 3 identified as male, and the tenth participant did not complete the survey. Participants' pseudonyms and demographics are provided in Table 4.

Co-Facilitator and Near Peer Mentor

One of the more experienced participants from the previous workshop, Leire, volunteered herself to co-facilitate this session with Noora because she was interested in seeing "*the different perspective of facilitation*." At the time of this study, Leire was an undergraduate student in university studying Sociology. Leire had previous experience facilitating Restorative Justice circles with another community group she is a part of. In this design workshop, Leire occupied a middle space as both a facilitator and participant, and could be described as a "near peer mentor." In addition to interviewing Noora, I was able to interview Leire individually after the workshop in order to obtain a better understanding of her experience as both a facilitator and participant.

My Role

Similar to the previous co-design workshop, I observed participants' verbal and nonverbal interactions from afar live via Zoom. I played an unobtrusive role throughout the design activities but participated in the debriefing by asking participants a probing question, which was "*If there is only one thing you could take away from this workshop, like an action item, what would it be*?" I also reminded participants to fill out the post-session survey.

Prompt: Objects Representing Passions

Using the Talisman prompt template, Noora came up with a generative prompt reflecting the workshop theme, which was to "*bring in something that represents what you're passionate about*." The young adults texted Noora what they planned to bring in a day before the workshop.

Participant and Object Table

Pseudonym	Age	Gender	Race	Attended Previous Workshop?	Personal Object	Object Description (In participants' words)
Leire	21	Female	Black	Yes	Money crystal	"This symbolizes basically my stride to become more successful, to help people around me not only for myself but also for my loved ones."

Pseudonym	Age	Gender	Race	Attended Previous Workshop?	Personal Object	Object Description (In participants' words)
Zuri	18	Female	Black	Yes	Polaroid picture of herself	“My item is a picture of myself. I am very passionate about all of my goals and my dreams, and I am also very passionate about being the best version of myself that I can be.”
Aisha	16	Female	Black	Yes	Wig	“I brought a wig because I'm very passionate about becoming a very successful hair stylist and owning my own shop in different states, cities, countries.”
Eabha	18	Female	Black	Yes	Lipgloss tool	“My item that I brought is a lip gloss tool and that's because I'm passionate about starting my own cosmetic line”
Ana	19	Female	Black	Yes	Pendant of her cousin	“The reason that I brought this pendant is because we both went to the same school, we both following our dreams and we both love helping people and like being honest and careful. So I feel like this is my passion.”
Baoyi	17	Male	Black	Yes	Microphone	“Because music has been my passion for as long as I can remember.”

Pseudonym	Age	Gender	Race	Attended Previous Workshop?	Personal Object	Object Description (In participants' words)
Rosa	16	Female	Black	Yes	Photograph of her nephew [picture on phone]	"I choose this item because I feel as though it represents me and how I'm passionate about my mental health and how I can work in bettering myself."
Pablo	18	Male	Black	No	Headphones	"I chose my headphones because they are how I mostly listen to my music, and I love music."
Daiki	17	Male	Black	No	Clippers	"I chose this because I love cutting hair."
Kevia	N/A	N/A	Black	No	Framed scholarship	"I've brought my framed scholarship that my grandma and my granddad had gifted me before they passed… I'm passionate about this because I know they know how determined I am to finish school."

Table 4: Participants' name (pseudonyms for anonymity), age, gender, race, and personal object (as described by participants).

Findings

How did the design partners instantiate Talisman in their co-design workshop?

Choose: Seated around a conference table (Figure 13a), the young adults went around the room sharing their "passion items," or the items they felt represented their passions, and why they brought them in. Participants' objects and their descriptions

are noted in Table 4. Nine of the objects were physical and one of the objects was digital.

- ***Choose - Follow-Up Question 1***: Instead of moving directly onto the *Connect* activity, Leire and Noora asked participants a series of follow-up questions relating to their objects and the first design activity. Noora, who devised the questions independently before the session, explained why she was motivated to ask those questions. In the post-session interview, Noora explained the follow-up questions were to: 1) help "*guide the conversation under each [design activity]*," 2) get participants "*more into the emotive side of thinking about their item*," 3) obtain more "*information that I need out of them*" in order to guide nonprofit programming and initiatives for young adults, and 4) get participants to "*think about [their passions] in different ways, because they've now talked about that artifact in different ways*."

  Leire posed the first follow-up question to participants, which was "***When you engage or interact with the object that gives you passion, how does that make you feel?***" In summary, seven of the ten young adults shared that when they engage with their passion objects they feel more confident, relieved, peaceful, supported, and motivated. For example, Baoyi shared that "*Whenever I interact with my microphone I feel relieved, like a lot of stress taken off me and that I can really express myself*." Participants also shared that it gave them something to keep striving towards instead of giving up. For example, Ana described how the pendant of her cousin "*makes me feel confident just because like from past experience like, I never really felt that*

confident, but knowing that I still got her with me it really helps me strive for all my goals and it makes me feel like I belong here."

- ***Choose - Follow-Up Question 2***: Leire posed a second follow-up question, which was "***How often do you get to enjoy this passion? Or, how often do you interact with your passion artifacts or pieces?***" Participants' responses to this question varied from very often to not enough, and to depending on the circumstances. Ana, Baoyi, and Aisha shared that they engaged with their passion objects every day. Eabha did not feel like she interacted with her lipgloss tool enough. Daiki, Leire, and Kevia shared that they interact with their passion objects every now and then or whenever they need it.

Connect: Leire then asked participants, "*How are these artifacts connected to one another in any sense?*" While in the previous workshop participants tended to find pairwise connections between singular objects, in this workshop the participants focused more on the connections among all of their objects. This could have been due to a variety of reasons, such as participants' familiarity with Talisman, the different workshop topic, or the follow-up questions posed by Noora and Leire. The connections drawn were as follows: 1) Zuri mentioned sentimentality and how "*all of us are talking about something that we're very in tune with, a lot of people are talking about stuff that is very sentimental to them*." 2) Ana brought up legacies and how their passions were passed down across generations: "*somebody important has come into our lives and then just left us with something to enjoy and keep on following our passions*." 3) Based on one of Zuri's comments, Ana also felt like all the objects related in terms of "*development and self*." Participants also mentioned connections

between specific objects, which included: 1) Ana connected the microphones and headphones for music; 2) Aisha connected Zuri's picture of herself and Rosa's picture of her nephew in terms of mental health and self-development; and, 3) Ana connected the wig, clippers, and lipgloss tool as "*something that helps them make money. Like basically they all have small businesses*."

- ***Connect - Follow-Up Question 1***: Beyond the connections between artifacts, the facilitators were curious about the connections between the artifacts and the participant's community. Leire posed the following question: "***Do you see your passions reflected in your community? If so, where, is it enough, or if not then why not?***" Most participants felt like their passions were not represented in their communities enough, or that there are not many other people in their community who are passionate about the same things as they were. However, participants recounted how community interest in their passions is on an upward trajectory, especially if they could earn money doing it. For example, Aisha and Eabha remarked how businesses relating to hair and makeup were on the rise in their communities, even if people were not necessarily passionate about doing them.

Consider: Design partners did not have a formal design activity for this step and moved straight from the previous follow-up question to the *Create* design activity. When asked why they did not implement this design activity, Noora said "*I changed it to flow better into the design portion, to see how their items related to the subject at hand*."

Create: Lastly, the young adults brainstormed tangible things they could advocate for relating to their passions and interests. Noora jumped in to clarify, "*That's why we asked you all how often do you see your passion reflected* [in your community] *because if you don't see it reflected then what kinds of programs for make-up or music would you want to see moving forward?*" Many of the ideas young adults came up with directly tied back to the objects they brought in and discussions about them during the *Connect* and *Consider* activities. For example, Aisha, who brought in a wig, shared that she wanted to advocate for cosmetology programs to "*lower their age ranges. So I can't start cosmetology until I turn 17, but I feel like they should start earlier because I actually met hair stylists who are like 14 years old who do a very good job but they don't have the certifications to be able to get into the shops*." Baoyi, who brought in a microphone, also wanted to advocate for access to safe and soundproof recording studios: "*it's not easy to get to a studio to record in, and it's expensive. So I'd like in our community more open studio spaces and, in general, more open places for young people who got dreams like we do*." Young adults also wanted to advocate for more resources to help them open small businesses, which related back to their passion objects and discussions in the previous design activities. Eabha, who brought in the lipgloss tool, wanted "*more programs to teach kids the responsibility of running a business, how to finance it, how to budget, stuff like that*." Many young adults also reiterated the value of these types of participatory engagements where they get to share what they want for their community. Zuri, who brought in a polaroid picture of herself, shared that "*we need more opportunities like the one that was just presented to us for everybody, because I feel a lot of times youth*

are passionate about a number of things but they don't necessarily have a say in what gets funded and what gets to have those kinds of resources."

Figure 13: (a) Young adults seated around table; (b) Young adults debriefing their experience

How did the personal objects and Talisman impact the design work?

Young adults' "passion objects" and the design activities helped inform their ideas for positive change in their community. We can trace how the objects and Talisman helped to inspire their ideas, such as lowered age ranges for cosmetology programs taking inspiration from Aisha's wig, and more safe and soundproof recording studios taking inspiration from Baoyi's microphone.

Along with informing their ideas, the personal objects and Talisman helped to promote grounding, focus, and a change of pace to the design work. The design partners compared this session to other sessions they had. Leire shared that "*This felt more grounded…you could have a regular conversation about that topic, but having a grounding piece and how it connects with the conversation is more substantial*." Noora thought "*there's definitely more engagement with this method because you're sitting there talking about yourself and everybody's kind of focused and listening and it's a lot less intermittent conversations and distractions*." Baoyi touched on the increased engagement, "*everyone was engaged and talking to each other*." Leire liked

the change of pace, "*sometimes you get into the everyday routine with stuff, so it was nice to not get into the everyday routine*."

The facilitators compared this workshop to other design work they have engaged in previously. Leire likened the personal objects to Restorative Justice talking pieces[3] and underscored how the objects helped participants to share things about themselves they otherwise may not have: "*I don't think it would have come up in a conversation without it. The item was a talking piece in a sense, like in the Restorative Justice circles, it got the conversation started and going*." Noora also compared this to other sessions she has participated in, commenting on how Talisman in contrast promoted a level of scaffolding and personalization:

> "*I've been seeing this out in the way people hold meetings, but like they'll just come into a meeting. For instance, like, it's a violence prevention meeting [and facilitators ask] 'Okay, like how do we stop the violence.' There's so many ways you could do that, and it doesn't give people the umbrellas or the kind of thought lanes to put some boundaries on those questions…that's what's cool about your activity is even the thought of bringing in something physical or something tangible, especially from that person's life, you know. Now you're creating new lanes, because now there's already a piece of me and what we're about to talk about, that's its own kind of lens*."

[3] Restorative Justice talking pieces: A typically meaningful object often selected by a facilitator/circle keeper that signifies whose turn it is to speak in a circle (Hughes, 2021). As noted by Geske, a talking piece "is handled as a sacred piece giving a party the right to speak from the heart" (Geske, 2019).

How did the personal objects and Talisman impact inclusion of the young adults?

In the debriefings (Figure 13b), the young adults touched on various things relating to inclusion. The young adults recounted how bringing in and sharing their personal objects was an opportunity for them to open up to their peers in deeper ways than they had previously experienced, and was also a way to gain introspection and learn more about each other. For example, Rosa shared that she enjoyed "*listening to all my peers and getting an understanding from them and what they are passionate about*." Similarly, Leire recounted how "*bringing in the object made me feel like I was sharing a piece of myself with them, and normally we don't ever get like that personal with each other…I felt the same way when they showed me their items, because they were super personal…I didn't know that most of them engaged in the things they did, so it was an eye-opener*." Leire's feedback highlighted how this session was one of the first times the young adults shared certain personal details about themselves, and how it was also one of the first times she learned what her peers were passionate about. This is an important note given how the young adults had been working together for months prior.

In their post-workshop survey responses, the young adults shared additional ways they felt included in the workshop: 1) Eabha wrote "*hearing all my peers and them hearing me*." 2) Baoyi wrote that "*it was cool to share something personal with my peers*." 3) Daiki wrote "*the fact I had a choice*." While Daiki's comment—about having the ability to choose—did not mention anything in specific (e.g., being able to choose his object, being able to choose what to share with his peers, etc.), it nonetheless provides some indication of what Daiki values in terms of inclusion. Like

in the previous workshop, I asked participants in the post-session survey "*On a scale of 1 to 10, with 1 being 'not at all' and 10 being 'extremely' - How included did you feel in the session?*" Of the 9 participants who completed the survey, the average response to this question was a score of 8, which shows how the young adults felt included.

The young adults recounted how their personal objects and Talisman also helped bring them together as a group, specifically through the ways they were able to connect with each other and their objects. For example, Aisha, who wanted to open her own hair styling business, shared "*I felt included because everybody is interested in becoming an entrepreneur*." After they wrapped up the design activities, Ana congratulated her peers and shared "*Y'all did a great job trying to relate stuff together and coming together as a group, as a team. It's very empowering*." Similarly, Rosa wrote in her survey response how she felt included because "*I could connect myself to my peers*." In her post-session interview, Leire mentioned how "*I really like the connection and the unity that it brings with people*." Leire also touched on the culture of the group, and how the ease of communication and transparency made her feel included. In her interview she shared, "t*he flow, it was the atmosphere that was based on transparency*."

Noora mentioned an interesting point in her post-session interview, which was how bringing in personal objects, in a way, "automated" inclusion. She noted, "*This is a people-centered activity, and I do think that it gives everybody the space to bring themselves. So, I definitely think by nature of bringing in the item from your personal life it kinda automates the inclusion… And I think this is because they're a group that*

knows each other... That may not be said for every item, type, or group of people." From these observations and accounts, we can see how the objects and Talisman helped the young adults share aspects of their identities and lived experiences in the design process, perhaps more than in previous workshops they have been a part of. It also brings up the consideration of how the dynamics of the session may have differed had the young adults not known each other beforehand. Our following case studies attempt to address this point.

How did the personal objects and Talisman impact the young adults as designers?

Like in the previous design workshop, I found that the personal objects and Talisman contributed to positive outcomes for the young adults that extend beyond the scope of this session. For example, the young adults recounted how they felt more empowered in terms of their passions and community work. First, the young adults shared how they felt more empowered to actualize their individual passions. Eabha said that bringing in the lipgloss tool "*made me realize that I need to keep working for it* [starting her own makeup line]." Daiki also shared that the design workshop helped him to realize that he needed "*to have confidence in what I'm passionate about*." Second, the young adults shared how they wanted to be more active in bringing about change to their communities. In the debriefing, Ana said that "*I feel like I am being the change and I am making the change as we speak now just talking to you and my fellow comrades.*" Aisha also planned on "*putting my foot down and actually trying to make these changes and enforce those changes [participants snapping in agreement]....Imma go straight to [elected officials] prepared with all the information on what changes I want to see*."

In addition to the outcomes relating to self-actualization and empowerment, another outcome of this session is that the young adults emerged with a broadened perspective. For example, Zuri remarked that bringing in the objects "*put my brain to use, it made me look at things differently*." In her post-session interview, Leire mentioned how the personal objects and Talisman offered a new perspective. She stated, "*People tend to keep their personal items to themselves, so having a vulnerable and transparent conversation about the items was very warm to me in a sense. It was a nice perspective. It was different*." The young adults also managed to find connections among their objects, even if these objects may have seemed disparate at first. For example, the young adults thought they related in terms of sentimentality, legacy, and self-development. Zuri shared how she "*learned that everything can relate to each other in one way or another.*"

Lastly, Leire mentioned in her post-session interview how the personal objects and Talisman could be helpful in other contexts. She shared, "*I think this is a great activity. It could be used in many different ways, and so I would like to see the other ways that it could be used*." For example, she mentioned how it could be helpful in the Restorative Justice circles she facilitates with another community group she is a part of: "*I feel like this could be incorporated with my Restorative Justice and teaching my students how to use it. I feel like it could be a great icebreaker for meetings…or just trying to get to know people at the workplace*." On the other hand, Leire thought that Talisman may not be as appropriate in contexts that are "*trying to get down to a serious issue*." Across their individual post-session interviews with, I

observed how Noora corroborated Leire's account on the adaptability of Talisman to other contexts, especially with regards to Restorative Justice:

> "*This is exactly the type of framework that a restorative justice leader or trainer or organization could use to help… because those types of circles are geared toward conversations where self should be centered. And you're learning about other people and learning about the people around you*."

Case Study 2: Environmental Justice

Summer Internships on Environmental Justice in Baltimore

I present findings from my second case study with a high school summer internship program focused on environmental justice in Baltimore, MD. The internship program was sponsored by an education nonprofit in Baltimore that focuses on increasing representation of underrepresented students in STEM (science, technology, engineering, math) and STEM careers. The internship coordinator, lead intern assistant, and the high school interns were selected through a competitive application process and received a stipend from the nonprofit for their participation in the summer internship.

The environmental science internship was coordinated by Dr. Ramos (anonymized), a faculty member in engineering who works at a nearby, private research university. Dr. Elizabeth Bonsignore, who had previously collaborated with Dr. Ramos on research projects, facilitated my connection to Dr. Ramos, who then subsequently introduced me to the summer internship program he was selected to coordinate as a possible venue for collaboration. Dr. Ramos was interested in incorporating design methods into the internship, and looked to me to provide expert advice on ways to do so. From December 2022 through August 2023, Dr. Ramos and I worked together over 5 meetings to brainstorm ways of incorporating Talisman into the summer internship programming and activities. While we had originally planned to embed Talisman into two separate co-design workshops throughout the summer, due to changes in the schedule we were able to conduct only one co-design workshop during the third week of the nine-week internship (late June 2023).

The goal of the co-design workshop was to help students decide on topics for their summer research projects relating to environmental justice. A major component of their summer internship entailed completing a group project where students would 1) select a research topic relating to environmental justice, 2) deploy mobile air quality monitors in their community to collect data, and 3) analyze and present their findings at a final internship showcase. In the pre-session interview, Dr. Ramos shared that in the co-design workshop he wanted the interns to "*craft a vision for what they want to produce by the end of the internship… and start envisioning the research process that would have to occur in order for them to get to that point*." Two days prior to the co-design workshop, interns had informally pitched their ideas for their research projects. Dr. Ramos had also shown them examples of concept maps in preparation for the co-design workshop. The co-design workshop was intended to help them further develop their ideas in preparation for developing their research project outlines that included their problem statements and sampling plans. I present my findings from the co-design workshop in the following subsections.

Workshop 1: Summer Research Project Topic Exploration

Overview

In June 2023, I helped organize a design workshop with 8 high school summer interns to explore how they brought in and engaged with objects that connected their personal experiences to environmental justice concerns in the Baltimore Metropolitan area. The goals of the workshop and the personal objects were to help the students refine their research project topics and to create concept maps of all the things they want to account for in their projects. Overall, I found that the personal objects and

Talisman informed students' summer research projects, helped the students relate environmental justice concerns to their own lives, and helped the group find connections and common ground among their personal objects and experiences. Below, I present direct accounts from the high school interns, a lead intern assistant, and Dr. Ramos into their experiences of bringing in and engaging with personal objects to inform their summer research projects.

Setting

The primary aim of the co-design workshop was for the high school interns to refine the topics of their group research projects, which entailed creating concept maps in order to help them further develop their ideas and to plan all the things they wanted to account for in their projects. I was interested in how the personal objects contributed to these design goals as well as the experiences of the interns. Prior to the workshop, Dr. Ramos and I worked closely to plan the structure and intended design outputs of the workshop, which included concept mapping for the *Create* activity. We had to plan the workshop with the knowledge that we would be constrained on time due to a field trip happening on the same day. On the day of the workshop, interns spent the morning taking a tour of one of the Smithsonian Institution Museums in Washington, DC. The morning museum visit was intended to provide background information on environmental science and concerns. After lunch, Dr. Ramos conducted the design workshop in a meeting space at the museum. The co-design workshop lasted 1 hour. The co-design activities were conducted either as a whole group or in dyads.

Design Partners

8 high school students in total participated in this design workshop, in addition to Dr. Ramos and a lead intern assistant. This was the first time that many of the interns participated in a design workshop. With the exception of the lead intern assistant who the interns met for the first time, all the participants were slightly familiar with each other. In his post-session interview, Dr. Ramos shared that the co-design workshop was only the third time since the start of the internship that he had met with the interns. Of the 6 interns who consented for their data to be used, 5 were Black and 1 was Asian, and 4 were female and 2 were male. The pseudonyms and demographics of the interns who consented for their data to be used are provided in Table 5. Two of the interns did not consent for their data to be used, and thus we did not include their demographic information or personal objects in this report.

Co-Facilitator and Near Peer Mentor

The lead intern assistant, who I refer to as Maya, identified herself as a 20-year-old undergraduate student. Maya was selected by the sponsoring nonprofit to provide support to Dr. Ramos during this co-design workshop. Maya helped answer interns' questions and provided suggestions and insights on various environmental subjects that could be of interest to the interns (e.g., food deserts, biodiversity, effects of air and water pollution). Maya completed the post-session survey, which provided a glimpse into her experience participating in the co-design workshop and mentoring the high school interns.

Special Note About Data Collection

While I was able to collect data before and after the workshop, it was not possible for the actual design workshop to be recorded using audio or video. The first reason, as noted earlier, was because two of the interns did not consent for their data to be used in this research study. Part of the reason why these interns did not consent was because they did not want their personal items to be recorded. Second, Dr. Ramos shared in the post-session interview that the students first and foremost signed up to be interns and not necessarily to be part of a research project, "*Like they didn't sign up for research, they signed up to be part of the internship*." He continued describing the challenges of recording, "*Because of the way the workshop was set-up like a discussion, I didn't think it would be possible to record and then delete them later* [the data from the two interns who did not consent]*, especially since that might have not just changed what the students were willing to talk about, but also it would have changed the way that I would have been able to relate to them the rest of the summer*." It is also important to keep in mind that the design workshop was only the third time Dr. Ramos had met with the interns, so they still were relatively unfamiliar with each other. Thus, the findings from this case study rely primarily on data collected from pre and post-session interviews with Dr. Ramos and the post-session surveys. Dr. Ramos shared with me that he did not get to administer the survey with the interns due to time constraints, and thus interns had to complete the surveys in their own time. This may have been a contributing factor to the low response rate whereby only 2 interns completed the survey. One of the interns however, Farida,

provided a thorough reflection of her experience participating in the design workshop. I include these reflections in the findings below.

My Role

I was not physically present at the co-design workshop, and thus played a limited role. Dr. Ramos was additionally constrained in terms of his phone's battery and the equipment he could bring on the field trip, which made it difficult for me to attend the workshop synchronously. Despite these challenges, I was able to gain a better understanding of participants' experiences through triangulation of multiple data sources before and after the workshop. This case study provided a unique complement to the others in that it shed light on how the community took up Talisman on their own without my intervention throughout the session.

Prompt: Objects Representing Environmental Justice Concerns

Using the Talisman prompt template, Dr. Ramos came up with a prompt inviting the interns to bring in personal objects that related to environmental justice. Specifically, Dr. Ramos invited the interns to "*bring in something from your life that represents, makes you feel, or reminds you of your connection to Baltimore city or your Baltimore-area community and the environmental justice concern you have begun to explore*."

Participant and Object Table

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words, speaker noted)
Farida	17	Female	Asian	Research findings from class science project on the urban heat island effect [digital document]	"I chose to bring in the research materials from my [class] final because that project marked the beginning of my interest in environmental justice… It was this initial exploration that sparked my passion for environmental justice work in Baltimore and led me to delve deeper into this area of study and activism."
Amy	N/A	Female	Black	Mother's wedding ring	Pete: "Someone brought a ring of their mother. This object had automatically piqued my interest as I had expected to see something more closely related to the environment. But this piece was used as a representation of the environment that this woman had remembered from her past. She went on to connect it to the present and her environmental justice goals."
Jada	N/A	Female	Black	Empty water bottle	Dr. Ramos: "The items the other person brought in was an empty plastic water bottle, and they talked about how people mishandled waste in the communities and don't dispose of it properly."

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words, speaker noted)
Kaili	N/A	Female	Black	Pack of seeds	Dr. Ramos: "They brought in a pack of seeds because they wanted to know about air quality's impact on plant growth and plant life…They are interested in understanding the impact of development on green space in those communities."
Pete	17	Male	Black	Unripe peach from tree planted at his home	"I chose this object because I believed it stood as a great symbol of the innocence of the environment."
Jordan	N/A	Male	Black	Basketball [picture on phone]	Farida: "Another intern brought in a basketball because he was passionate about playing basketball. What struck me was his description of how, when he goes to play on outdoor courts, he can physically feel himself inhaling the pollution from passing cars. This connection between a beloved activity and the tangible effects of pollution served as a powerful reminder of the everyday impact of environmental issues on our lives."

Table 5: Participants' name (pseudonyms for anonymity), age, gender, race, and personal object (as described by participants or Dr. Ramos).

Findings

How did the design partners instantiate Talisman in their co-design workshop?

Choose: Seated around a round table (Figure 14a), the high school interns went around sharing the items they brought in and how their objects related to their environmental justice concern. Participants' objects and their descriptions are noted in Table 5. Of the six objects we could record, four of the objects were physical and two of the objects were digital.

Connect: To encourage active listening, Dr. Ramos decided to conduct the *Connect* activity in tandem with the *Choose* activity. In his pre-session interview, Dr. Ramos shared that "*I want to encourage them to do something while they're listening, so that they are creatively constructing the knowledge they're hearing someone else's perspective on the knowledg*e." So, while each of the interns went around sharing their objects, the other interns wrote down the connections in their internship journals. Dr. Ramos shared in the post-session interview, "*After the individuals spoke they had some time for all of them to reflect on why those items may have indicated connections to themselves, society, and so on*." The group discussed those connections while two of the interns scribed on a big paper that everyone could see in the middle of the table. Some of the connections the participants drew include: 1) Farida connected her science project on the urban heat island effect to Jordan's basketball in terms of air pollution and transportation impacts; 2) Jada connected her empty water bottle with Pete's unripe peach in terms of waste management and the effects of mishandled waste on the community; and 3) Kaili connected her pack of seeds to Pete's unripe peach in terms of the impacts of air quality on plant growth and

plant life. One of the interns, Farida, reflected on her experience connecting her peer's personal objects: "*My favorite part of the design workshop was the discussions that followed each intern's presentation. It was intriguing to observe how different individuals interpreted and related to the objects and stories shared. Some connections were deeply personal, while others were more abstract*."

Consider: The *Consider* activity was built into the preceding and following design activities. Participants shared how their peers' objects, and the conversations about them, helped them to consider new ideas or aspects to environmental justice they had not considered before. For example, Amy's mother's wedding ring helped participants like Farida to reflect on legacy and passing things down through generations: "*One of the interns shared their parents' wedding ring, which symbolized not only a cherished family heirloom but also the idea of preserving a legacy for future generations. It made me reflect on the importance of safeguarding the environment for the well-being of our loved ones and the generations to come*." In another example, Jordan's basketball inspired the other interns to consider the effects of transportation pollution in their projects. Farida reflected on this:

> "*One intern brought a basketball, symbolizing his passion for the sport. He explained how he often played basketball on outdoor courts but was concerned about inhaling transportation pollution from passing cars. This personal connection to the issue of transportation pollution resonated with me and my group. It influenced our decision to include transportation pollution as a focal point in our research*."

Create: Lastly, to help the interns consider the different aspects of their potential research topics, they were invited to create concept maps using markers on Big Paper. Some of the aspects they were encouraged to consider included 1) the purpose of their projects, 2) principal stakeholders of their projects, 3) community resources, 4) scientific resources, 5) community persons, 6) data they aim to collect, 7) potential budget, and 8) how their topics relate back to air pollution. Interns were encouraged to draw inspiration from the personal objects they brought in that represented the space that their environmental justice interests fit into. Dr. Ramos assigned research project groups of 2 to 3 interns based on their shared project interests. The groups then worked together to create their concept maps. In Figure 14b, one group created a concept map exploring the effects of excess waste on poor air quality. They considered how gas emissions from vehicles—previously mentioned in discussions about Jordan's basketball—could lead to public health concerns. As described by Farida in the post-session survey, "*The basketball served as a reminder of the potential health impacts of transportation pollution on individuals and communities, reinforcing our commitment to addressing environmental justice concerns in our research*." In Figure 14c, another group created a concept map exploring the environmental issues with waste. They considered how litter on streets—such as Jada's empty water bottle—eventually ends up in landfills or as runoff into natural ecosystems. Due to time constraints, the interns were not able to complete their concept maps in their entirety, but managed to break ground on

defining their project topics. Dr. Ramos shared, "*The exercise that I had planned took a lot more time than I actually expected it to take*."

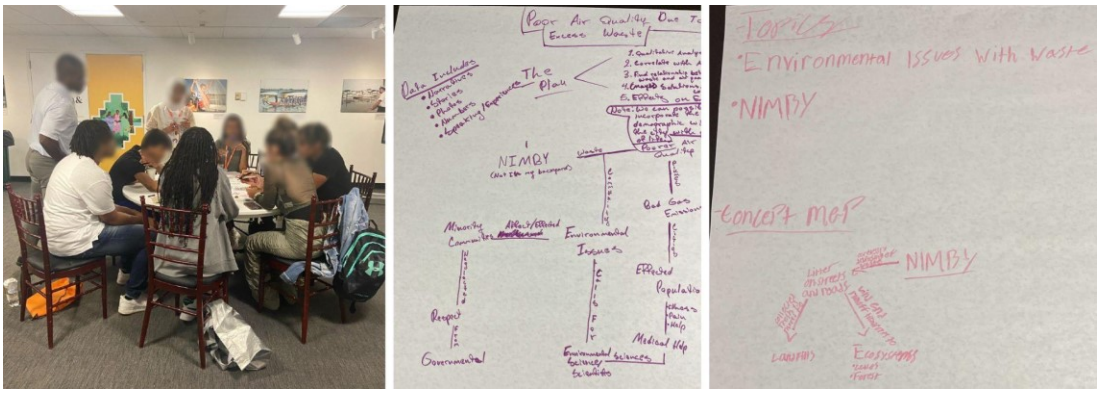


Figure 14: (a) Young adults seated around table; (b) First concept map[4]*; (c) Second concept map*

How did the personal objects and Talisman impact the design work?

The personal objects and design activities helped influence the interns' project topics and directions. For example, Dr. Ramos recounted how one intern "*brought a food item but they didn't end up going in that direction, it was heavily influenced by the interest of the other partner they had who brought in an empty water bottle*." Many of the interns came into the design workshop with a vague idea of what they wanted to pursue for their research projects. Through their group discussions surrounding their personal objects and interests, the interns were able to emerge with a clearer understanding of the topics they wanted to pursue. Dr. Ramos described how two of the group project topics came about this way: "*So both of those projects clearly came out of the ideas from those groups*."

[4] NIMBY: An acronym for the term 'Not in My Back Yard,' which refers to groups or individuals who are opposed to unwanted development in their residential neighborhoods.

The personal objects and surrounding conversations also served as sources of inspiration for participants like Pete, who recounted how he "*used the objects that me and my peers shared in the project to gain inspiration before and motivation during my project. Other people's objects had given me some ideas about what I could focus on for my project*." Similarly, participants like Farida were inspired by objects like Amy's mother's wedding ring and Jordan's basketball, to name a few. These objects motivated the interns to consider the importance of protecting the environment for the wellbeing of loved ones and future generations, as well as the everyday impact of pollution and environmental disparities on public health, respectively. Farida summarized the impact of the personal objects and Talisman on her project, as well as internship experience: "*The objects my peers brought in had an impact on me and served as a source of inspiration*." She continued, "*The objects shared by my peers during the design workshop had a significant impact on our project and internship*."

How did the personal objects and Talisman impact inclusion of the young adults?

Overall, the interns felt that their personal objects and the design activities promoted a sense of intimacy and emotional connection. For example, Pete shared how his favorite part of the workshop was the "*intimate communication with peers*." Sharing their personal objects was a way for the interns to open up to one another and to share their lived experiences, interests, and fears. Farida recounted how the emotional connection her peers had to their personal objects resonated with her deeply:

> "*What resonated with me most during the design workshop was the deep personal connections the interns had with their objects. As they shared stories about how their objects related to their families, hobbies, and everyday lives, it became evident that many of them were motivated by a shared concern for their loved ones' well-being. They expressed fears about how polluted air could impact the health of their family members and limit their ability to enjoy the activities they loved (such as basketball). This emotional connection to their objects underscored the profound impact that environmental issues can have on individuals and communities, and it resonated with me deeply*."

Having the opportunity to share their personal objects and experiences allowed the interns to feel heard by their peers. Pete reflected on his experience, "*My experience was great. Everyone listened to me and was intrigued by my explanation*."

Participants recounted how a diversity of viewpoints and opinions were supported throughout the co-design workshop. Echoing calls for "safe spaces" in participatory design (Bustamante Duarte et al., 2021; Elsayed-Ali et al., 2023a; Erete et al., 2021), Maya discussed how the design workshop fostered a safe place where participants could share their opinions freely: "*This workshop was more loose and informal, compared to others that I have participated in, but it promoted a safe atmosphere to share one's opinion*." Farida also mentioned how the design workshop promoted a space where a diversity of viewpoints could surface:

> "*It highlighted the diversity of perspectives and motivations among the interns participating in the program. I learned that each person had distinct reasons for joining the internship, and it meant different things to them individually. It was fascinating to discover what they considered significant environmental issues and how deeply they were connected to these concerns. The workshop underscored that people have unique and personal relationships with the environment, which can profoundly influence their commitment to environmental justice work and their approaches to addressing these issues. This diversity of viewpoints enriched our collective understanding and emphasized the importance of collaboration and empathy in our efforts to tackle environmental challenges*."

The personal objects and Talisman were also a means of fostering common ground. Because this was only their third time seeing one another, the interns were able to get to know each other better by sharing their personal objects and engaging in the design activities with one another. Farida was intrigued by the connections her fellow interns made amongst their personal objects, despite how disparate they may have seemed on the surface: "*What made it particularly fascinating was when multiple interns found common ground or had similar connections to the presented objects, despite their initial differences*."

Overall, while participants felt that the personal objects and Talisman helped to promote a sense of connection and a safe place for sharing their experiences, other factors played a role in the inclusion of participants. First, Farida at times felt

concerned that her object (science project) was "*out of place*" when compared to the other physical objects her peers brought in. As the co-design workshop progressed, however, Farida recounted how she became less worried about her object not fitting in once she realized that the lived experiences associated with her object were more meaningful:

> "*Bringing in my research materials to share at the design workshop was a somewhat unique experience for me. While my object wasn't a physical item like those brought in by some of the other interns, it represented a significant part of my academic and personal journey. However, I must admit that I initially felt somewhat out of place. I was concerned that my 'object' might not convey its significance effectively and that the other interns might struggle to connect with what I was discussing. Nevertheless, as the workshop progressed, I found that the focus was less on the physical nature of the object and more on the stories and experiences we associated with them*."

Nonetheless, Farida's feedback was an important reminder of the need to consider how the personal objects may influence how participants feel in the session, especially if they compare what they brought in to those of their fellow participants. Besides the personal objects and Talisman, another factor that played a role in inclusion was the seating arrangement of the group. Pete mentioned that the seating arrangement was one of the things that made him feel included, and that it helped promote a sense of egalitarianism and community: "*The fact that everyone at the*

table (including my instructors) were sitting at the table. This attribute gave me a sense of community, engagement, and respect from the table." On a scale of 1 to 10, in the post-session survey Pete responded "10" and Farida responded "7" in terms of how included they felt during the co-design workshop.

How did the personal objects and Talisman impact the young adults as designers?

I found that the personal objects and Talisman influenced the interns positively in ways that extended beyond the co-design workshop. For example, Farida touched on aspects of empowerment and how her peers' personal object inspired her to continue working towards alleviating environmental injustices: "[Jordan's basketball] *inspired me to continue my work on environmental justice, striving to address these real-world challenges and make a positive difference in communities affected by pollution and environmental disparities*."

The personal objects and Talisman also contributed to the building of capacities relating to environmental justice, research, and design. Interns shared how the session enriched their understanding and awareness of environmental science and justice concerns. For instance, Pete gained a deeper appreciation and understanding of environmental justice, citing how "*I learned that environmental justice was deeper than extinguishing forest fires. One of the most important lessons that I learned was that understanding the impact of the environment is integral to bringing justice to the environment*." Likewise, Farida mentioned how she learned about the various angles of environmental justice she has not known before: "*These discussions allowed us to explore the multifaceted nature of environmental justice and how it resonated with*

each of us uniquely. It was a reminder that, while we all come from diverse backgrounds, we share a common goal of addressing environmental issues, and our varied perspectives can enrich our approach to finding solutions." The personal objects and Talisman encouraged participants like Pete to put in his best effort towards his summer research project: "*[His peers'] objects and stories had also given me motivation to produce quality results that could be used to find solutions to the investigated issues*." These outcomes relate to work by Clegg et al. on life-relevant learning and scientific disposition, where drawing personal connections to science can 1) help learners recognize the value of science in their lives and 2) make a commitment to engage with science more in their everyday lives (Clegg & Kolodner, 2014).

Case Study 3: Programming Education

Redesigning Undergraduate Programming Education in the Age of Generative Artificial Intelligence (AI)

I present findings from my third case study completed alongside a university faculty-led research project aiming to redesign an introductory programming course to support undergraduates, particularly those underrepresented in computing. The research project was focused on examining the ways that students learn programming and apply their knowledge to their future goals, especially in light of the recent rise of Generative AI and Large Language Models (LLMs) like ChatGPT. The larger part of the research project entailed an interventional study within an instructional setting, whereby faculty would compare how the formal incorporation of LLMs into their instruction would impact students' programming abilities and sense of belonging. Prior to conducting the interventional study, the faculty was interested in using co-design alongside previously taught students to learn more about their interests, aspirations, and challenges with coding. This would also help faculty glean information they are otherwise unable to obtain in class settings in order to tailor the programming curriculum to fit students' needs.

The research project was led by Dr. Joel Chan, a faculty member part of an information science department (iSchool) at a large, public university in the United States. As my doctoral co-advisor alongside Dr. Elizabeth Bonsignore, Dr. Chan had been heavily involved in the development of Talisman since 2021. Thus, rapport had already been established between us. In August 2023 during one of our weekly advisor meetings, Dr. Chan floated the idea of conducting co-design workshops using Talisman for the research project he is leading. His motivation for using co-design

was as follows, "*philosophically if you're going to redesign [a course for the students] they should have a say*." Dr. Chan wanted to gain a deeper understanding of his previous students' experiences learning programming, as well as identify ways of supporting his students in terms of inclusion and acquiring the programming skills they need to achieve their personal goals. Additionally, we thought this setting would provide an interesting contrast to the prior two case studies, especially given the fact that the co-design participants would also be young adults.

While Dr. Chan was very familiar with Talisman and co-design theoretically, in the pre-session interview Dr. Chan recounted feeling nervous as this was the first time he would be in charge of leading a co-design session solo. As an expert in co-design, Dr. Bonsignore offered to provide Dr. Chan with assistance facilitating the co-design sessions. Over the course of 6 meetings, including our regularly scheduled advisor meetings, the three of us worked closely together to plan the first co-design workshop. We sent out a call in early September 2023 to recruit participants for the first workshop.

The target participants of this study were undergraduate students who had previously taken the 100-level course "Introduction to Programming for Information Science," a required course for students pursuing a Bachelor of Information Science. Compared to a computer science department, the information science department serves a more diverse student population, enrolling more BIPOC, female, and first-generation students (Weintrop & Chan, 2023). Students who were members of these underrepresented groups or who did not have a traditional programming background were especially encouraged to participate in this study.

For the first workshop, Dr. Chan recruited students from a section of the course he had previously taught during the Spring 2023 semester, thus he knew all five participants personally. We also conducted a second workshop remotely in November 2023, where Dr. Chan had taught one of the participants. The remote co-design workshop provided an interesting complement to the in-person workshop, and allowed me to examine how participants engage with the Talisman Padlet. Conducting the workshop remotely also adds empirical depth to my earlier discussion on instantiating shared spaces (Elsayed-Ali et al., 2023a) and places and space (Harrison & Dourish, 1996) across various modalities such as Distributed Participatory Design.

Workshop 1: Coding Aspirations (In-Person)

Overview

In September 2023, I helped organize a co-design workshop with 5 undergraduate students (ages 18-22) studying information science to explore how they brought in and engaged with personal objects that represented their aspirations for learning how to program. The objective of the co-design workshop was to bring together faculty and undergraduate students from an information science department to co-envision how to best redesign an introduction to programming course, particularly in light of the rise of Generative AI technologies like ChatGPT. Overall, I found that the personal objects and Talisman gave students an opportunity to tap into their personal motivations and to reflect on their personal programming journeys. Faculty and students also emerged with new ideas relating to changes in the

programming curriculum, such as including more project-based learning and giving students the option to learn programming languages besides Python.

Setting

The aim of the co-design workshop was for students to brainstorm ideas for redesigning an introductory programming course to better support them to achieve their goals in light of Generative AI. I was interested in how the personal objects and Talisman contributed to this aim and influenced the experiences of the students participating in the workshop. Dr. Chan then created a rough plan and facilitation guide for himself before the workshop to use as reference throughout. During the workshop, Dr. Chan led the design activities while Dr. Bonsignore helped to record the conversation visually using Post-it notes clustered on a physical whiteboard. Along with tag teaming, Dr. Bonsignore asked the students follow-up questions and took pictures throughout the session. The co-design workshop took place in a meeting room in the information science department building, which was a central meeting point and familiar space for the students. Dr. Chan explained that he wanted a space that had a wall-mounted whiteboard and was not too big or too small for the number of students. The duration of the co-design workshop was 2 hours. All co-design activities were conducted as a group.

Design Partners

The participants in this co-design workshop were 5 undergraduate students pursuing a Bachelor of Information Science. This was the first time that all 5 students participated in a design workshop. While some students seemed closer than others (e.g., Saif and Badri were friends and had taken multiple classes together), all the

students were at least familiar with each other since they had taken the introduction to programming course with Dr. Chan in Spring 2023. Dr. Chan knew all of the students as well and shared that 3 of the students would attend his office hours regularly. Thus, there was a pre-existing relationship and trust established between Dr. Chan and the workshop participants. In the post-session survey, 3 of the students identified as Black, 1 student identified as Asian, and another student identified as Middle Eastern and North African. 3 identified as male and 2 identified as female. Participants' pseudonyms and demographics are provided in Table 6.

My Role

Prior to the workshop, I communicated with the students regarding bringing in their objects and filling out the consent forms. Throughout the workshop, I mostly played an unobtrusive role observing participants' interactions silently and taking hand-written notes. I was not physically present at the workshop but was able to join live over Zoom. My role throughout the workshop was limited to introducing myself at the beginning to the participants and reminding Dr. Chan to distribute the post-session survey to participants at the end.

Prompt: Objects Representing Coding Aspirations

Dr. Chan considered multiple options for the prompt before deciding on one. In his pre-session interview, he shared that "*the prompt was a big part of the preparation, like what we're gonna ask them to bring in*." He continued, "*We were discussing between emphasizing things to help them learn, or things that represent what they want to accomplish or be. We ended up choosing the second one because it felt more expansive I think*." Dr. Chan used the Talisman prompt template to come up

with a generative prompt relating to coding aspirations, which was "*bring in something that represents what you aspire to accomplish, make, or be, if you could code as well as you want to*." Dr. Chan also remarked how he wanted to keep this prompt as open-ended as possible for students by purposefully not saying 'career aspirations' but rather 'coding aspirations.' Prior to the workshop, the students emailed me the objects they planned on sharing with the group along with a short description.

Participant and Object Table

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words)
Saif	21	Male	Black	Digital photograph of a nanobot	"I love learning, exploring and trying new things. Something that I would make if I could code the way I would like to is nanobot. Small mechanical devices to roam and explore space, collect data and images to send back to the control center whether it's located somewhere in space or here on Earth."
Xiao	22	Male	Black	Photograph of a custom PC he built	"This is a PC I personally built on my own, initially I built it for gaming purposes but after a while it has become a tool for me to improve on my programming skills. So I see this machine is somewhat of a representation of my goal of becoming a great programmer."

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words)
Gyeong	18	Female	Black	Cameroonian grammar book that translates common languages to her native language, Nweh	"It was my inspiration for what I hope to achieve with coding, which is to promote cultural learning and connections through less-known languages that may not have as many resources."
Badri	22	Male	Asian	Photo album of his family in Indonesia	"I chose this object because if I had the ability to code better, I would create a digital album that includes audio interviews, a timeline of family photos, and personal stories."
Cara	21	Female	Middle Eastern/ North African	Video of a student who created an AI platform to translate ASL (American Sign Language) to English	"I chose this because I'm interested in language and how it can be applied to technology. I'm interested in projects that are very creative and impactful. I think it is very innovative to create an AI platform that translates ASL to English. "

Table 6: Participants' name (pseudonyms for anonymity), age, gender, race, and personal object (as described by participants).

Findings

How did the design partners instantiate Talisman in their co-design workshop?

Choose: Seated around a conference table, the undergraduate students went around the room and introduced themselves and the objects they brought in representing their coding aspirations and the reasons why they chose to bring them in. Participants' objects and their descriptions are noted in Table 6. Three of the objects

were digital and two of the objects were physical. Dr. Chan displayed the digital objects on his laptop screen for participants to see (Figure 15a), including Cara's video. Dr. Bonsignore wrote down participants' objects on Post-it notes while they shared. The facilitators and participants engaged in back-and-forth conversation with each other during this activity, asking each other follow-up questions about their objects. For example, Dr. Chan asked Saif "*How did you get interested in robots*?" and Saif asked Xiao "*How much data do you expect to fit in the machine to be able to get closer to [forecasting the 3-5 year future of the Boston housing market]*?" Participants also drew parallels between their experiences. For example, after Gyeong shared her struggles with learning her native Cameroonian language, Dr. Chan, Badri, and Dr. Bonsignore shared similar experiences relating to learning their heritage languages and growing generational language gaps.

Connect: Dr. Chan then asked the participants, "*I'm curious to hear from you all like where do these experiences and ideas connect? Where are they similar, different…trying to find some higher level connections and themes?*" Dr. Bonsignore arranged the Post-it notes of participants' objects on the left-hand side of the whiteboard and wrote down connections, later drawing arrows between the objects and connections using a whiteboard marker (Figure 16a). Participants focused mostly on the connections among all of their objects. The connections drawn included the following: 1) Saif mentioned how they all need a "*human interface*" in order to be controlled or manipulated. 2) According to Badri, all of the objects involved "*processing data to improve a certain model."* 3) Saif distinguished between all of the objects, saying "*The nanobot and custom PC are physical hardware, everything*

else is software." This connection led to Dr. Chan having a lightbulb moment where he realized that hardware was missing from the department's curriculum. 4) Gyeong mentioned how *"all of the objects have to do with social good, meaning something that will help a certain population*." 5) Cara and Badri mentioned that the nanobot and custom PC tended to generate new knowledge while the Cameroonian grammar book, photo album, and ASL video used existing knowledge. 6) Cara thought that "*they all kind of represent longevity because it's something you can do over time…like family photos you can always put more*." Participants also drew a few connections between specific objects, such as 1) Xiao connecting the photo album and ASL video in terms of their reliance on visual data and Graphical User Interfaces (GUIs). 2) And lastly, Badri shared how the Cameroonian grammar book, photo album, and ASL video all require real human, social interaction. Alongside drawing connections, participants also—without knowing the next activity—shared considerations relating to privacy, consent, accuracy, and human error.

- ***Prompt Modification Between Connect and Consider Activities***: Before moving onto the *Consider* activity, Dr. Chan decided to alter the focus of the co-design workshop, shifting the focus from redesigning the introductory programming course to redesigning all programming education in the department. This significant shift in the faculty's focus happened as a direct result of Talisman and discussions surrounding the personal objects. Dr. Chan shared:

> "*Initially we were focused on [the Introduction to Programming course] but this is inspiring me to broaden the question a little bit. So initially the prompt was 'how can we redesign the introductory course to support students from all different backgrounds…to achieve their goals especially in light of Generative AI.' I want to change that to 'how can we redesign programming education at the iSchool to support every student to learn to code as well as they want to in light of Generative AI*."

Consider: Next, Dr. Chan posed the question, "*Think back to our problem formulation, like what are the requirements, constraints, considerations…how do we want programming education to support students at the iSchool?*" The students mentioned the following key considerations when redesigning programming education to support students in light of Generative AI: 1) Many students do not know how to use ChatGPT because they do not know how to talk to the AI ("prompt engineering"). 2) Consider broadening course offerings as students want to code in other languages like HTML/CSS for web development. 3) Companies that are hiring tend to ask about personal projects rather than coursework. 4) Students feel there are gaps in their programming courses between the concepts they learn and the code they write. 5) There is a stigma in higher education around using AI, even though ChatGPT has not been updated since 2021[5]. 6) Students may have relied on ChatGPT

[5] At the time of this co-design workshop (September 2023), the conversational AI model used in ChatGPT had not yet been updated since 2021. A few days after this workshop, OpenAI revealed an update where ChatGPT was no longer limited to data from before 2021.

during the onset of the Covid-19 pandemic as they were lacking instructional resources and support. 7) Human resources are limited in time and place while ChatGPT is available 24/7. 8) Students want to connect to faculty across departments working on topics that interest them but do not know how. Badri, who shared the previous consideration, mentioned potential cross-departmental collaborations directly inspired by the personal objects they brought in:

> "*Being able to reach out to advisors that we're interested in. Like you said, the archival, robotics, you could probably reach to like machine learning, and you could reach to like the languages department here. But we just don't know how as students…like bridging between the sign language department and the computer science department.*"

Create: Lastly, Dr. Chan asked the participants to "*Think now, building on these [considerations] and the objects, let's take 2 minutes to write down some ideas…it could be high-level or specific, but how might we actually go about this [points to research question on whiteboard]*." The students came up with ideas relating to redesigning programming education including: 1) Cara suggested opportunities for "*coding in languages other than English*," which was inspired by earlier discussions on spoken and sign language. 2) Based on the considerations relating to project-based learning, Xiao recommended that students with similar interests should be grouped together in class projects, "*if you're doing a project it's better to work with people who have similar interests, that way you can exchange ideas rather than having*

students who have different interests." 3) Also related to project-based learning, Saif suggested that students work on a personal project across multiple classes, that way they would have something personal and substantive to show to possible employers. 4) Gyeong also suggested an idea relating to prompt engineering, which came up earlier in the *Consider* activity, "*I had the idea of doing a workshop on prompt engineering to get students familiar with how to use AI to help them*." 5) Lastly, Badri wanted to see "*a course module in [the introductory programming course] where faculty introduce the history of ChatGPT, what is AI, and how we use it*."

Figure 15: (a) Dr. Chan displaying Saif's nanobot on a laptop; (b) Badri sharing his family photo album

Figure 16: (a) Whiteboard with the objects and connections to the left in yellow, considerations and solutions to the right in pink and blue respectively; (b) Cara and Badri placing their ideas on the whiteboard

How did the personal objects and Talisman impact the design work?

Using their personal objects and the structured design activities as a foundation, the undergraduate students co-created ideas for redesigning the introductory programming course—and programming education in general—in the Information Science department. As is the case with the Layered Elaboration technique (Walsh et al., 2010), the students kept iteratively expanding on ideas that were mentioned in the previous activities, so that ideas shared in the final design activity were a culmination and combination of all the ideas shared in the previous activities. For example, in his post-session interview Dr. Chan shared that in the *Connect* activity "*We put the stuff on the board. The connections were built from their stuff, so the whole conversation was shaped by each person's contributions quite tangibly*." Dr. Chan continued that following the *Connect* activity "*in Consider it wasn't just about ASL, it was about social good, complicated projects, and using*

multiple languages. It wasn't anchored in only a few specific objects, but rather the connections between them."

The personal objects and design activities inspired the students to come up with concrete suggestions to the programming curriculum, such as having a greater emphasis on project-based learning. For example, the students brainstormed the idea of having a personal project they could work on across multiple classes, which would be seen favorably by employers. As summarized by Gyeong, "*We talked about the idea of incorporating personal projects into the curriculum to fuel creativity and become competitive applicants*." The personal objects also inspired Badri's idea of having more cross-departmental collaborations, such as those with the ASL, world languages, and computer science departments. The students also suggested having more instruction in hardware, programming languages besides Python, and coding in spoken languages beyond English. Saif's distinction between hardware and software sparked the idea of including more instruction on hardware, which Dr. Chan realized for the first time that there was a blind spot in the Information Science curriculum. Gyeong brought up the "*question of whether Python, the language we mainly use, would support the projects that we're thinking of doing*." As represented by their personal objects, the students' coding aspirations were rich and complex, and would necessitate them to learn other languages in order to turn their aspirations into reality. Lastly, Cara's suggestion of teaching to code in languages other than English may have been inspired by the fact that 2 participants brought in objects relating to language (Cara's ASL video and Gyeong's Cameroonian grammar book),

participants' cultural backgrounds, and/or related discussions on learning heritage languages and generational language gaps.

One of the major changes brought about by the students' personal objects and design activities was Dr. Chan's decision to shift the focus of the co-design workshop from redesigning the introductory programming course to redesigning all programming education in the Information Science department. In his post-session interview, Dr. Chan shared that "*I felt I had to because of how rich and broad the conversation was.*" Based on students' personal objects and the conversation, Dr. Chan added, "*For example, hardware, that's a huge blind spot. We don't talk about hardware. And there's all this language stuff that's so interesting and important and I don't know if it shows up in any of our coursework*."

The personal objects and Talisman also helped to boost engagement and momentum in the session. Gyeong shared that "*I haven't participated in design workshops before, but this set the standards high because everyone was really engaged*." Dr. Chan remarked on the momentum the design activities in succession helped to elicit: "*It felt like there was momentum created from not just the bringing of the objects, but the idea of responding to each person, and asking questions and brainstorming and connecting that created a momentum in participation*." This points to the value of not just having participants bring in objects, but also engaging with those objects in the design activities.

How did the personal objects and Talisman impact inclusion of the young adults?

The students recounted the things that made them feel included in the design workshop, such as the ability to share their personal interests and ideas freely and to

learn more about their peers. Students like Badri and Saif expressed their enthusiasm towards bringing in their personal objects. Badri expressed his enthusiasm while sharing his photo album, "*I love to collect photographs, like whenever I go to my grandparent's house I'm like the first one to run to their stash of photos*." In the debriefing, Badri followed up by saying "*When you say bring your personal item, it's like everyone's so personal, we can see where we all come from."* Saif also expressed his enthusiasm for bringing in the nanobot, "*I was very enthusiastic and always happy to share and inform more people about what it's possible to use it for*!" In the post-session survey, Saif wrote how the co-design workshop was "*Very engaging, friendly environments and relatable students*." Cara also wrote how "*I really enjoyed this design workshop. It was really nice to share ideas*." In the survey, I invited the participants to rate how included/not included they felt on a scale of 1 to 10. I received a unanimous response of "10" from all 5 students for this question.

The co-design workshop was an opportunity for the students to find connections between each other's personal interests and experiences, despite how different they may have seemed from the onset. Students recounted how there were multiple points of convergence, such as AI and heritage languages. For example, Xiao shared how "*We all have somewhat different interests but at the same time we have something that ties all the interests together like AI and Machine Learning*." Likewise, Badri described how *"When somebody else, when [Gyeong] shared about your native language, I also related to that too. That was an experience I also go through and there's a need for that. So I think the ability to share different personalized experiences is good*." Getting to physically see their connections was

also something that the students acknowledged. Gyeong gave a nod to the role of the Post-it notes on the whiteboard, "*The Post-it note wall was nice to see everyone's ideas connected together*." In a similar fashion, Cara stated "*What resonated with me the most is seeing all the connections between the different ideas we had.*" She continued, "*I enjoyed interacting with other Information Science students. We had a lot of ideas and all want to see the Information Science program become even better*."

Beyond sharing and finding connections between their personal interests and ideas, the students described other things that affected their inclusion during the session. The first related to the role of the facilitator in gently nudging students who had not yet provided their input. Cara appreciated how Dr. Chan called her by her name to see if she had additional thoughts to share: "*Being called on to share my ideas made me feel included because I am someone that has a lot of thoughts and ideas but might not feel comfortable enough to share them sometimes. I liked how everyone was encouraged to participate and share their ideas related to each question*." Another thing affecting inclusion related to the role that other participants played. Xiao noted how he "*felt included because everyone made me feel included*." This points to how inclusion could be considered a collective effort in the sense that everyone in the room has to be working towards it. Third, students expressed uncertainty regarding the choice of object they brought in. Prefacing the ASL video she brought in, Cara shared "*I didn't know exactly what to share because I'm still a beginner and everything*." Badri was also unsure of what to bring in, "*At first I wasn't sure what to share but I think reflecting on my interests and what I want to do helped me realize what to bring*." These are all important factors to keep in mind when

conducting a co-design workshop and inviting participants to bring in their personal objects.

How did the personal objects and Talisman impact the young adults as designers?

Bringing in the personal objects and participating in the design activities was an opportunity for the students to engage in self and group reflection. By doing so, the students emerged from the workshop with an awareness of new applications, implementations, and limitations to explore further. For example, in terms of self-reflection, Saif shared how "*Talking about the nanobot made me realize some limitations of what I can do with it…looking through the computer's point of view, it's going to be difficult to make something that can travel long distances because the signal might get lost*." Gyeong noted how the session helped her tap into her personal motivations and broaden her understanding of AI applications:

> "*I feel like it actually helped because it kind of unlocked all the ideas I had about AI in general and how I can use it in my personal life cause I feel like tapping into that personal motivation allowed me to see the bigger picture of how to use AI and coding in general to help the greater good in terms of not just redesigning [the introductory course] but other things too*."

The students also engaged in group reflection, exchanging new perspectives and suggestions. For example, Gyeong and Saif suggested that Badri could use Optical Character Recognition (OCR) and facial recognition to identify dates and people in his family photographs. Gyeong suggested that Saif's nanobot *"could be used not just*

for ocean exploration or space exploration but for helping people who may be disabled." The students enjoyed the process of exchanging ideas and valued the unique perspectives of their peers. For example, Xiao remarked how "*You get to share your ideas and while sharing those ideas you get to learn how to implement those ideas. So having different points of view and experiences is really helpful."* Cara also "*thought it was really interesting to explore other people's projects and what they did and understand how I can go in a different direction than that."*

Workshop 2: Coding Aspirations (Remote)

Overview

Alongside the same faculty-led research project, I helped organize another co-design workshop in November 2023 to explore how 2 undergraduate students (both age 20) engaged with their personal objects representing their coding aspirations. This time, however, the objective of this co-design workshop was to co-envision how to redesign programming education in general to support students to learn to code as well as they want to in light of Generative AI—based on the modifications made midway to the focus of the previous session. Another major difference is that this workshop was held remotely using Zoom and the Talisman Padlet. Overall, I found that the personal objects and Talisman offered the students an opportunity to reflect on their motivations for learning to code, as well as previous experiences learning and teaching programming. The students also found the Talisman Padlet easy to use and helpful for visualizing the discussion throughout the session.

Setting

The faculty's goal of the co-design workshop was for the students to brainstorm ideas to address the high-level question of how to best redesign programming education to support their learning in light of Generative AI. Dr. Chan explained that the co-design session would enable him and faculty to make sense of what kinds of things students care about and want to be able to use programming for. For my research, I was interested in examining how the personal objects and Talisman contributed towards the faculty's goals and the experiences of the students. In contrast to the other co-design workshops, this workshop took place online using

Zoom and the Talisman Padlet. Thus, I was also interested in examining how the Talisman Padlet supported participants to choose and utilize their personal object throughout the design activities. Prior to the workshop, Dr. Chan and I walked through the Talisman Padlet interface together. We also worked together to modify the Talisman prompt template to account for the session being remote and use of the Talisman Padlet to support the design activities. The Talisman prompt template for remote participation can be found in Appendix B: Supplementary Materials for Dissertation Research.

During the workshop, Dr. Chan and Dr. Bonsignore recorded the conversation visually on the Talisman Padlet, though all participants added to the canvas at some point. Dr. Bonsignore also responded thoughtfully to participants and asked the participants insightful questions. The co-design workshop lasted just over 1.5 hours and all the co-design activities were conducted as a group.

Design Partners

The workshop participants included 2 undergraduate students pursuing a Bachelor of Information Science. While we had initially recruited 4 students—our minimum threshold of participants to hold the session—2 of the recruited participants notified us that they were no longer able to participate (one dropped out 15 minutes before the session began). It is common for unexpected scenarios to arise in Participatory Design engagements (Constantin et al., 2019), thus participants' attrition or drop out did not come as a surprise. In retrospect, however, Dr. Chan reflected "*in the future I would not do it again with two participants*." Of the two students who did participate, this was the first time that either student engaged in a co-design

workshop. Neither student knew each other, and one of the participants, Jada, was a former student of Dr. Chan. However, since the participants and facilitators all belonged to the same department, there was some level of existing rapport. Jada, who was studying abroad at the time in Spain, was only able to participate in the session since it was held virtually. In the post-session survey, both participants identified as female. One participant identified as Black and another identified as white. Participants' pseudonyms and demographics are provided in Table 7.

My Role

Before the co-design workshop, I communicated with the participants via email about filling out the consent forms and uploading their objects to the Talisman Padlet. My role was quite limited in that I spent most of the workshop observing interactions between participants, facilitators, objects, as well as Talisman Padlet. Compared to previous workshops, however, I was relatively more involved because everyone was participating remotely (level playing field) and there were only two participants. Times where I was involved included introducing myself in the beginning, asking a few probing questions during the workshop, and reminding participants to fill out the post-session survey. An example of a probing question I asked during the *Choose* activity was "*I'm curious, are you interested in doing [hacking] as a career, or is this just knowledge you'd like to carry over into your life*?"

Prompt: Objects Representing Coding Aspirations

Dr. Chan decided to use the same generative prompt from the previous workshop, which was "*bring in something that represents what you aspire to*

accomplish, make, or be, if you could code as well as you want to." Prior to the workshop, the students uploaded the objects they planned on sharing along with a short description and their name to the Talisman Padlet.

Participant and Object Table

Pseudonym	Age	Gender	Race	Personal Object	Object Description (In participants' words)
Naya	20	Female	Black	A GIF of someone hacking into a system	"I chose this image because I aspire to be a very good hacker! If I know all of the ways you can hack, I can also know the best ways to protect myself. This is a particular concern of mine since my older family members constantly get scammed and hacked on the internet!"
Jada	20	Female	White	Emotion detector [description]	"Using AI to make face scanning technology is not new, but I think it would be really cool to make an emotion detector. This can be used for both practical and enjoyment reasons, in many different ways. I'd really like to learn to code face detection some day."

Table 7: Participants' name (pseudonyms for anonymity), age, gender, race, and personal object (as described by participants).

Findings

How did the design partners instantiate Talisman in their co-design workshop?

Choose: In the video conference room on Zoom, Dr. Chan shared his screen with the Talisman Padlet (Figure 17), which contained the personal objects the undergraduate students uploaded beforehand underneath the *Choose* label. Naya and

Jada then shared their objects and motivations for choosing their objects. For example, Naya described how she "*chose this image because I aspire to be a good hacker, especially since my mother and my grandmother and my father, like all of them, are really struggling on the Internet. I worry about their Internet safety*." Likewise, Jada described her motivation for choosing facial recognition/emotion detection, "*the main thing I was thinking about was to help people that have disabilities, especially those who have trouble understanding other people's emotions*." The facilitators engaged in back-and-forth conversation with the students, such as Dr. Chan asking Naya "*Where did you find this image*?" to which she responded, "*I think I just put 'hack' into the GIF search*." During this activity, Naya also realized that what she meant was that she likes cybersecurity: "*I just realized that by 'hacking' I meant I was interested in cybersecurity, that's what I meant to say. I don't know why I couldn't think of the word last night. But yeah, I want to do a career in cybersecurity*." While Naya and Jada shared their objects, Dr. Chan wrote brief notes onto the Talisman Padlet of what the participants were saying. Participants' objects and their descriptions are noted in Table 7. Both objects were digital.

Connect: Dr. Chan then asked the students, "*the next thing we want to do is connect the experiences and ideas. So, as a group, we can share words or phrases that relate to what each of you brought in and try to draw connections and common themes between these ideas*." Dr. Bonsignore helped write down participants' connections onto the Talisman Padlet, and made use of the available arrows to connect posts. Naya and Jada drew the following connections between cybersecurity and facial recognition/emotion detection: 1) Jada thought both could be used for

"helping out other people, so for the greater good." 2) Naya felt the objects related in terms of "*Internet ethics, like there's some ethical issues with face recognition but there's also the ethical side of how we phrase things on the Internet so people don't get easily pursued in a way that can hurt them*." 3) Naya considered the interplay between facial recognition/emotion detection and cybersecurity and how the former could be used to improve the latter, such as with biometrics: "*They could go hand-in-hand, like you could use facial recognition to increase Internet safety, like how you use facial recognition to get into your phone. So that might be easier for older people than remembering a password*." 4) Naya thought that both technologies have room for improvement, specifically with regards to inclusion: "*Another connection could be innovation, improving already existing things, like for cybersecurity we need to make it more accessible for older people, but also for emotion detection there's an issue with not enough representation*." 5) Lastly, Jada pondered the potential applications of pattern recognition and Machine Learning to improve both facial recognition/emotion detection and cybersecurity.

Consider: Dr. Chan introduced the *Consider* activity by writing the overall research question at the top of the Talisman Padlet: "*How can we (re)design programming education in the iSchool to support all students in light of Generative AI*?" Dr. Chan then invited participants to share key considerations such as requirements, constraints, and available resources before brainstorming ideas or solutions to address the overall question. To begin, Jada shared how she still references a GitHub Pages website Dr. Chan created for his class containing coding samples, links to additional resources, etc., even after the course was completed. In

another tab, Dr. Chan displayed the GitHub Pages website for everyone to see on the shared screen in Zoom (Figure 18a). This inspired two considerations, 1) having longer-term references for learning beyond the class and, 2) having "practice" blocks to be able to test sample code. Both Naya and Jada then discussed the challenges of not knowing exactly what the code they are writing is doing. Naya shared an R code snippet from another programming course she took (Figure 18b), explaining how she "*only knew how to do it this way, because they told me to use it this way, and that's why I don't think I could replicate this in a different testing setting or a project setting*." This inspired the consideration of 3) the need to break coding principles down to the most basic syntax and operator level. Bringing ChatGPT back into the picture, Jada and Naya brought up how 4) AI can explain "obvious" code to students that they are too shy to ask their instructor or teaching assistants about. They also discussed how dialogue with ChatGPT feels easier than with an instructor because 5) ChatGPT can save or archive conversations, and 6) ChatGPT gives students an opportunity to ask additional questions without them having to feel pressured, shy, frustrated, embarrassed, or that they are annoying their instructor.

Create: Lastly, the students brainstormed things to address the high-level question related to redesigning programming education. Dr. Chan suggested that they could use the personal objects they brought in as inspiration, but were not limited to them. Both Jada and Naya's ideas related back mostly to their discussions in the *Consider* activity. Jada mentioned wanting more group projects where students with stronger coding skills could be paired with beginner students to help explain things to them. Naya came up with an online "Giant Notebook" that could contain students'

notes and solutions to assignments from previous semesters, approved by the instructor. Another idea Jada came up with was for instructors to have a Frequently Asked Questions (FAQ) or Ask-Me-Anything (AMA) forum on the course page where students could ask questions, since students tend to ask the same questions after class or during office hours. The last idea Jada came up with was inspired by the earlier discussions in the *Choose* and *Connect* activities. Jada suggested that course projects could have multiple "streams" for students to pick from, that way they could work on something more aligned with their interests in cybersecurity, AI, human-centered design, etc.

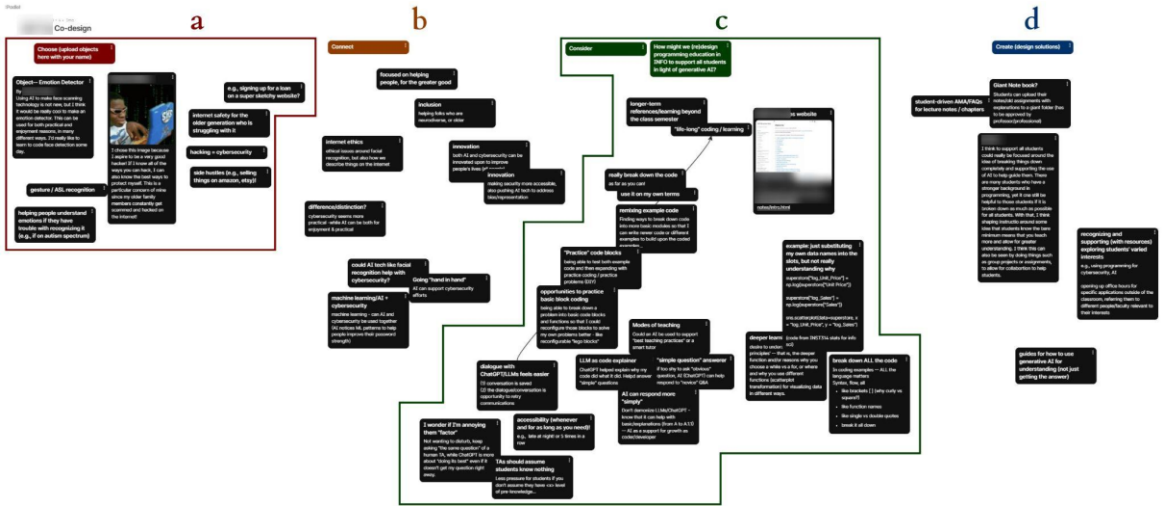


Figure 17: Zoomed out Talisman Padlet interface where co-design activities occurred. a) Choose activity. b) Connect activity. c) Consider activity. d) Create activity.

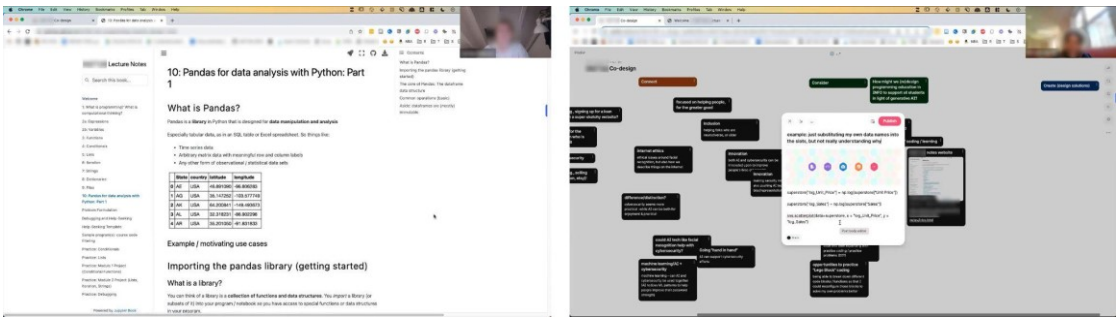


Figure 18: (a) Jada discussing the GitHub Pages website Dr. Chan created for his class containing coding samples, links to additional resources, etc.; (b) Naya showing an R code snippet from another programming course she took

How did the personal objects and Talisman impact the design work?

Overall, the personal objects and Talisman offered a springboard and structure to scaffold the co-design workshop. While the parallels between the personal objects and participants' solutions may not have been as obvious compared to previous workshops, the personal objects still informed participants' thought processes and designs. For example, Jada drew direct inspiration from the personal objects in her idea of having an option where students can choose from various project "streams" relating to their personal interests and aspirations. Jada provided a salient reflection on how generative the session was:

> "*Looking at it, we were able to take like 2 different things like cybersecurity and AI and make a whole list of ways they're connected and how we could use that for things in the classroom. I never would have thought we would have gone from those 2 things all the way across the board like that*."

Along with how productive they felt the session was, the participants seemed to have genuinely enjoyed the experience. Jada recounted how she "*had a really enjoyable and intellectually stimulating time talking about AI and cybersecurity today!*" The Talisman Padlet also provided a visual, shared space to scaffold the conversation. Naya and Jada found the Talisman Padlet practical and easy to use. Jada shared, "*I thought it was easy to use and helpful when visualizing the session's discussions*." Likewise, Naya said that "*Padlet is very interactive and easy to use!*" The persistence of the Talisman Padlet being in front of the participants throughout the duration of the session is something that differentiates this remote workshop from the previous in-person workshop. The permanence of displaying the Talisman Padlet in front of the participants the entire time may have shifted their focus from each other's faces and body language to a shared canvas instead.

An interesting shift occurred between the *Connect* and *Consider* design activities; participants went from mostly talking about their personal objects relating to cybersecurity and facial recognition/emotion detection to talking mostly about Generative AI. This shift may have been due to differences between the prompt and overall research question. In the post-session interview, Dr. Chan shared how the prompt was "*for them to get to know each other and themselves better. There could have been prompts that were more helpful for the research question*." He felt that having a more interest-driven prompt (i.e., coding aspirations) as opposed to a research-driven prompt (e.g., things that help you learn) was more conducive to rapport-building, especially since the participants did not know each other.

How did the personal objects and Talisman impact inclusion of the young adults?

Participants recounted the ways in which they felt included in the co-design workshop, such as being able to share more about themselves and their opinions. Jada and Naya appreciated the individualized attention and ability to talk about things that mattered to them including their interests and learning to code. In the post-session survey. Naya wrote how she "*felt very included because we talked specifically about my post and ideas*." She added, *"Talking about how learning code could be easier for students made me happy.*" Similarly, Jada wrote how she liked "*Being able to share my opinions on everything that was discussed.*" Both Jada and Naya responded with a "10" to the survey question that asked how included/not included they felt on a scale of 1 to 10.

The personal objects and Talisman also enabled the participants to connect with one another in interesting ways. Along with finding connections between each others' coding aspirations, Naya and Jada found comfort in knowing that they took a similar approach to coding. For example, in the session debriefing Naya appreciated how Jada "*had the same ideas about needing to take a slower approach or a more detailed approach, especially being around people who just seem to know what they're doing all the time*." Likewise, Jada shared how "*talking about it made me realize a lot of people learn in similar ways, or they need things to be explained in simpler ways.*"

Participants shared additional things that affected their inclusion in the session. Like in the previous in-person workshop, Naya and Jada touched on the care shown by facilitators. They appreciated how the faculty displayed genuine interest

and enthusiasm for the students' interests. Naya touched on the attentiveness shown by facilitators, "*Dr. Chan seemed very attentive and cared a lot about what we had to say, and that made me hopeful for incoming students*." They also appreciated how the facilitators invited them to personally contribute. Jada liked *"always being asked to contribute if I had not already*," and Naya liked how "*The mentors asked me a lot of questions about what I was thinking and seemed genuinely interested."* This echoes sentiments from the previous workshop where Cara appreciated how Dr. Chan called her by her name to see if she had anything else to contribute. Another parallel between the previous co-design workshop and this one was how the students expressed uncertainty about the object they could choose to bring in. Jada shared that she *"didn't know exactly what I was supposed to be sharing, and I didn't know if what I shared was correct."*

How did the personal objects and Talisman impact the young adults as designers?

The objects and Talisman was an opportunity for participants to reflect on their own experiences and interests, and led to positive outcomes extending beyond the scope of this session. It gave them an opportunity to think about, vocalize, and make tangible their coding aspirations. For example, Naya recounted how this experience was the first time she reflected on why she was interested in cybersecurity: "*I have always known that I was interested in cybersecurity. But this was the first time I really had to think about why…my parents' and a lot of older peoples' Internet safety actually does mean a lot to me, and I wouldn't have known that until I had taken the time to sit and write it down*." This was also the first time that Naya realized she wants to use cybersecurity for the greater good: "*I had a lot of*

fun and the session helped me realize that I want to protect people from getting harmed on the Internet."

Jada similarly engaged in reflection-on-action (Schön, 1983) about her own experience and practice of teaching younger students. Jada shared how reflecting on her own experience of learning to code allowed her the opportunity to reflect on her experience teaching others to code as well: "*From my own experiences where I've helped instruct others how to code. I think having a conversation like this would have been helpful for my own experiences because I hope I helped out students over the summer when I taught them…talking about it makes me wonder if I did break it down all the way or if I missed some of these important features when I was teaching*."

Along with engaging in reflective practice, another outcome of this session was that it introduced participants to design enquiry and provided them an opportunity to engage in knowledge production through design (Cross, 1982). For example, Jada emerged with an improved understanding of her thought process in relation to coding as well as designing. Jada shared that she "*learned about my thought process on all these things and I was able to talk about something that I had never really talked about before*." She continued, "*I don't think I would have thought about any of this on my own. So, it really got the creative juices flowing for me, which I appreciate*."

Chapter 7: Cross-Case Analysis

In this chapter, I present a cross-case analysis of the three case studies in which Talisman was deployed. Cross-case analysis is a research method that allows for the comparison of cases across different settings, communities, or groups (Khan & VanWynsberghe, 2007). Specifically, a comparative approach to cross-case analysis focuses on the ways in which the cases are comparable and treats points of convergence as instances of the same social phenomenon (Khan & VanWynsberghe, 2007). Using a comparative approach to cross-case analysis, I synthesize my research findings by identifying common themes across the case study deployments. I explicate how Talisman advances previous work and consider relevant design implications for supporting users to bring in and use personal objects as design materials.

Theme #1: Shifting Control of Design Materials

Materials matter in Participatory Design. As described by Turkle, materials are "*things we think with*" (Turkle, 2007), playing an important role in the mediation and configuration of participation and meaning-making (Jung & Stolterman, 2010; Knutz et al., 2019). However, when not selected or exercised carefully, design materials can put up barriers to the inclusion of users. Previous work has described instances where design materials have been exclusionary, such as when they are imposed on users (Charlotte Smith et al., 2020), inappropriate for the community (Giglitto et al., 2018), or irrelevant to the design context (Harrington, Erete, et al., 2019). A common problem underlying these instances is the lack of users' agency and flexibility over the materials with which they design, as facilitators often select the

design materials using a top-down approach. This comes as a surprise given that one of the core tenets of Participatory Design is the sharing of power (Bratteteig & Wagner, 2012). I posit that one way to address this problem is by shifting control of design materials to users. While this hypothesis may seem straightforward at first, in practice there is a lack of systemized, methodological knowledge on how to support users to identify and bring in their own materials to use in co-design of technology or other solutions for their communities (Karusala et al., 2019). To help scaffold material selection and provide clarity and structure to this process, I developed a sociotechnical system called *Talisman*. In this dissertation, repeated system deployment across three distinct community contexts provided rich insights into the ways that Talisman helped to promote users' control over their design materials. I expand on these ways below.

As touched on by Harrington et al., Equitable Participatory Design aims to dismantle the top-down hierarchies that exist between researchers and participants by dismantling barriers to power-sharing and power transfer (Harrington, Erete, et al., 2019). Shifting control is thus core to the ethos of Participatory Design, yet little work has been done on the relation and interplay between power and design materials. I aim to address this gap through Talisman. One of the ways that Talisman supports a shift in control is by attempting to cede decision-making power over material selection from the facilitator to the user. Using the Talisman prompt on their own time, participants shared their positive experiences bringing in their personal objects. For example, Daiki (Case Study 1) appreciated the fact that he "*had a choice*" and Saif (Case Study 3) expressed enthusiasm for getting to bring in and inform his peers

about nanobots. While choosing their objects, participants were also able to think about and engage with the project outside of the prescribed workshop time (DiSalvo et al., 2008) and to begin building connections between their lives and the design topic. For example, Naya (Case Study 3) recounted how the pre-session activity was the first time she sat down and thought about why she was interested in cybersecurity.

The underlying mechanism of Talisman to support users to bring in things from their lives draws parallels to Assets-based approaches, such as ABCD and Assets-based design. In Assets-based design, the aim is to shift design from a deficit-based view to an *assets-as-insights* view where the resources of individuals and communities are leveraged (Cho et al., 2019). While *assets* are broadly defined, there has been an emphasis in recent Assets-based design work in HCI and CSCW on intangible assets such as knowledge, strengths, capacities, social capital, and relationships (Karusala et al., 2019; Wong-Villacres et al., 2021). Assets including infrastructure and physical resources such as buildings, organizations, and technology are also emphasized (Cho et al., 2019). On the other hand, there is little work in Assets-based design that examines personal objects as assets. This comes as a surprise given the critical role that objects play in grounding our everyday lived experiences and identities (Brulé & Spiel, 2019), serving as emotional companions and provocations of thought (Turkle, 2007). The personal objects the young adults brought into the workshops were conduits through which they could share aspects of their identities and lives experiences that they had not previously shared before with their peers. My findings in this dissertation add depth to current understandings of Assets-based design by presenting a focused examination of a particular asset—

personal objects. In doing so, my research adds a layer of materiality and physical grounding to the growing body of Assets-based design research.

Alongside power-sharing and Assets-based approaches, shifting control of design materials to users has implications on advancing inclusion in Participatory Design. A key aspect of inclusion is the ability to freely enact aspects of one's identity and lived experience. Across all three case studies, there are examples where Talisman supported participants to bring in things that had personal meaning or significance to them. For instance, participants like Leire (Case Study 1) and Farida (Case Study 2) felt like they were bringing in "pieces of themselves" to share with their peers. They underscored how being able to have intimate conversations around their lived experiences—as well as to share something that people would normally keep to themselves—was different from what they were accustomed to. Not only did this impact participants on an individual level, but also on a peer-to-peer level. It enabled participants like Badri (Case Study 3) to see where his "peers are coming from," promoting a space for fruitful connection and exchange.

While most participants welcomed the idea of bringing in their own personal objects, there was one instance where a participant, Zuri (Case Study 1), expressed reluctance towards letting people into her personal life. This finding complements work by Harrington et al. who, despite the researchers best efforts to shift power in co-design, still observed hesitation by participants to share their personal narratives (Harrington, Erete, et al., 2019). This is often the case in Participatory Design where there is a power imbalance, such as workers engaging in Participatory Design with their managers not feeling comfortable with sharing their experiences or opinions

(Costanza-Chock, 2020). While it is hard to pinpoint exactly what caused Zuri's hesitation, it could have also been due to being recorded, general feelings of discomfort, differences in personality, or researcher presence. Harrington et al. also speculate that the reluctance to share could stem from intergenerational trauma from historic harms caused by academic institutions or the fear of disclosing stigmatizing information (Harrington, Erete, et al., 2019). Additionally, participants from marginalized groups may need more time to recognize that they have control over the design process and that their contributions are worthy and welcomed (Elsayed-Ali et al., 2023a; Wong-Villacres et al., 2020). Inspired by Zuri's feedback, one implication is the need for mechanisms to support different personalities in co-design, such as people who may be more reserved or hesitant to share something personal with a larger group. Perhaps one way to go about this is by reminding participants in the prompt that they can choose not to bring in anything at all, or to have participants complete the design activities in pairs as opposed to a larger group.

Theme #2: Expanding the Range of Design Materials

One challenge in Participatory Design is that current implementations do not accommodate the possible range of objects or forms of expression that participants may wish to bring in. Previous literature has mentioned instances where participants preferred to draw on intangible artifacts, like personal narratives, over tangible objects in co-design. For example, Charlotte Smith et al., observed that Namibian youth were reluctant to bring in physical artifacts when prompted, opting instead to bring in oral stories relating to legacies of colonialism in their daily lives (Charlotte Smith et al., 2020). In contrast, Gautam et al., observed that Nepalese trafficking

survivors found it difficult to recount their life stories, and instead preferred to participate in a photo-elicitation exercise using photographic artifacts (Gautam et al., 2018). These examples illustrate how, even when invited to bring in their own personal objects, users may not feel fully supported to bring in the objects of their choosing to use in co-design. A reason for this problem is that facilitators may place overly rigid constraints on the space of allowable design materials. Another reason may be that users themselves may not know what they can bring in or have biased preconceptions about what may constitute a design material. I posit that one way to address this problem is by expanding the range of design materials that users can bring into co-design. Mechanisms ought to be put in place to accommodate a range of tangible and intangible materials and artifacts, while also keeping in mind different modalities and settings where Participatory Design may occur. This is where a system like Talisman may be useful.

As a part of Talisman, I developed a generative prompt that provides users with examples of the types of materials they can bring in. And to accommodate a range of personal objects in Distributed Participatory Design, I instantiated Talisman in Padlet—which can support various media types including files, GIFs, drawings, live videos, and audio recordings, as well as other affordances noted in previous sections. Through field deployments in three distinct case studies, I observed the ways in which Talisman empowered users to share *what they wanted in the format they wanted*. Down to individual workshop level, I observed how participants brought in an assortment of personal objects—from the physical and the digital to one-of-a-kind heirlooms and abstract representations of personal narratives. Of the 32 objects

that participants brought in across all 3 case studies, 22 of the objects were of a physical nature and 10 of the objects were of a digital nature. In Case Study 1: Safe Spaces, the overwhelming majority of objects were physical (16 physical:3 digital). Case Study 2: Environmental Justice had a combination of both, and Case Study 3: Coding Aspirations were mostly digital (5 digital:2 physical). This may be an indication of the role that the design topic and Talisman prompt play in influencing what type of design materials users decide to bring in. For example, a prompt relating to safety may emphasize qualities such as closeness or touch, thus possibly lending itself more to physical objects. On the other hand, a prompt relating to programming may lend itself more to digital objects. Along with eliciting objects of both a physical and digital nature, the prompt can lend itself to objects of a more personally meaningful nature, or to a different type of material—which may also be personally meaningful—like found, everyday objects. It is important for facilitators and communities using Talisman to carefully consider their overarching design goals and what types of objects their prompts might elicit. Additionally, while in preliminary work users were confused about the number of objects they could bring in, this was not as important in the deployments with the stable prompt. This may indicate that the current version of the prompt provides enough scaffolding in terms of the number of objects participants may want to bring in.

One of the goals of my dissertation was to work towards the identification and broadening of capacities, which is a core aspect of Assets-based approaches. Capacities typically refer to the intangible resources and capital that individuals and communities already possess, such as knowledge, skills, and wisdom (Wong-

Villacres et al., 2020). Bridging the literature on Assets-based approaches with HCI and CSCW, another capacity is the ability to view materials and their potential qualities, otherwise known as "material vision" (Feinberg, 2017). The outcomes of Participatory design engagements may not always be tangible solutions, but may be increases in self-efficacy, capacities, and shifts in mindsets. An example of this is how Hussain et al. focused on building local capacity of Cambodian prosthetists and engineers by teaching them design principles so that future design projects could be carried out independent of researchers (Hussain, 2012). In my system deployment, I found that Talisman helped to promote participants' design capacities and material vision. This included a shift in participants' mindsets regarding what might constitute a design material. For instance, Ana (Case Study 1) shared that the design activities made her think about things on a deeper level, and that she could apply the same principles from the design activities to personal objects in her home such as a teddy bear. Zuri (Case Study 1), who had previously expressed reluctance towards letting people into her personal life, also shared how the design activities made her look at things differently and taught her that everything can somehow be related.

In terms of allowable design materials, my findings reveal that there is a tension between the range not being expansive enough versus being too expansive. While an open-ended range of design materials may support users to share what they want in the format they want, depending on various factors, this may lead to confusion or uncertainty from participants. Across the case studies, I observed that some participants second-guessed the personal objects they brought in due to the open-endedness of the prompt. For example, Farida (Case Study 2) recounted feeling

"*out of place*" because she sensed that her peers could not readily connect with the science project that she brought in. She felt that her object was not as relatable because it was not tangible, as opposed to the other objects her peers brought in. Later on, however, Farida realized that what was more important than the actual object was her personal connection to it. Interestingly, all four participants who expressed uncertainty about their personal objects were female, including Farida as well as Cara, Jada, and Naya (Case Study 3). While this may be a pure coincidence, previous literature has noted the systemic inequities and barriers that hinder nondominant girls' and youths' sense of belonging in STEM (Pinkard et al., 2017). Although this was a small subset of participants, one of the implications to emerge from this finding is the need to consider how the intersectional identities, axes to marginalization (Erete et al., 2018), and lived experiences of participants play a role in the deployment of systems like Talisman. Additionally, there must be an awareness of local communities' situated contexts including political and cultural practices, knowledge systems and epistemologies (Charlotte Smith et al., 2020), and understandings of participation (Sabiescu et al., 2014) that may differ from Western-centric models for design. If we do not account for these various considerations, then, like other systems and approaches that may have been well-intentioned, in practice Talisman may have an adverse effect on inclusion.

There are additional design implications for Talisman. We may need to consider possible compromises to the tension of too much expansiveness versus not enough expansiveness in terms of the range of design materials. Dr. Ramos (Case Study 2) provided a few suggestions in his post-session interview. One of these

suggestions was to constrain the range of allowable design materials to a specific type, such as either physical or digital, instead of both. His thinking was that this could help direct participants' attention as well as level the playing field. However, one tradeoff of this approach is that it may prevent participants from bringing in something that they wanted to share with their peers. As Dr. Ramos noted, "*I feel like in providing more structure you can also become more exclusive*." The second suggestion Dr. Ramos made was to provide participants with additional questions to consider during their material selection in order to help them think through what they want to bring in. For example, facilitators could ask participants "What is the first thing that comes to your mind when you think of [e.g., environmental justice]?" These recommendations call for further consideration and reflection in future deployments of Talisman.

Theme #3: Scaffolding Interaction of Design Materials

Beyond shifting control and expanding the range of design materials, it is important to consider how participants can engage with their artifacts in Participatory Design. This is a core part of an Assets-based approach to technology design, which entails identifying assets in a community and then acting upon them (Karusala et al., 2019; Wong-Villacres et al., 2020). However, one of the shortcomings of an Assets-based approach is its lack of "*a standardized course of action based on the assets it uncovers, especially in regard to tool-building*" (Cho et al., 2019). There must be systems in place to help scaffold users' interactions with their objects and assets in co-design. In this dissertation, I developed Talisman as a systematic, methodological way of identifying and leveraging users' personal objects as assets in the design of

technology-driven solutions for their communities. Part of Talisman entails a series of co-design activities to support participants to engage with their objects and to identify opportunity spaces relating to the design topic. Working alongside three communities who were interested in integrating Talisman into their STEM education-related design practice, I observed how young adults leveraged their personal objects in the design of solutions of benefit to themselves and their communities. From these findings we see how Talisman might be a promising approach for scaffolding users' interaction with their personal objects. Specifically, it might offer an approach to operationalizing Assets-based design that is generative, reproducible, and adaptable. I delve further into these aspects below.

Generative approaches to co-design aim to amplify people's creativity and support their ideation (Vaajakallio et al., 2009). Across the three case studies, I observed how the personal objects and Talisman served as sources of inspiration and motivation for the young adults. For example, in Case Study 1: Safe Spaces, the Black young adults recounted feeling more empowered to actualize their passions and bring about change in their communities. Aisha—who advocated for lowering age ranges for cosmetology certification programs—left the session feeling inspired to go to her elected officials to propose these changes. In Case Study 2: Environmental Justice, the young adults conveyed ways that personal objects inspired them to continue striving towards finding solutions for safeguarding the environment and alleviating environmental disparities. For instance, Pete shared how his peers' objects and stories motivated him to "*produce quality results*" in his summer research project. In Case Study 3: Programming Education, the young adults emerged with

new ideas and understandings regarding their personal coding aspirations. For example, through their discussions, Saif realized that the nanobot he brought in was limited in terms of how far it could travel (i.e., deep space or sea exploration) but could be used to improve healthcare for disabled people. These are only a couple of examples that illustrate the impact the personal objects and Talisman had on the participants, helping to motivate them and spark new ideas for enacting change in their communities and lives. In doing so, participants are able to gradually become *assets-based thinkers,* forming attachments to their available assets and "*valuing them as a source of power from within*" (Wong-Villacres et al., 2021).

Deploying Talisman across three case studies provided insight into the ways that it helped scaffold underrepresented young adults' interactions with their personal objects across various settings and modes of engagement. I observed how Talisman led to comparable, productive outcomes across co-design sessions focused on a breadth of design topics including safety, passions, environmental justice, and coding aspirations. For example, across all five co-design workshops participants' personal objects directly informed a number of their design ideas. Examples from each workshop, respectively, include: 1) Easter egg hunt affirmations, 2) safe and soundproof recording studios, 3) accounts for the everyday impact of pollution, 4) instructional offerings in hardware and other languages, and 5) project "streams" relating to students' interests. Deploying Talisman in one fully distributed setting with comparable outcomes also points to its potential to scaffold interaction across modes. In future work (Chapter 8), I foreground opportunities for potential use of

Talisman and personal objects with different communities and across different contexts.

An implication of these findings, however, is that the adoption of Talisman and scaffolding is contingent on having a community-embedded facilitator or champion who is aware of the context and trusted by the community (Ssozi-Mugarura et al., 2016). This champion is essential for creating a sense of safety for the participants and shepherding the process. Additionally, the champion must be committed and intentional in their power-sharing efforts (Bratteteig & Wagner, 2012).

As defined by Walsh et al., *techniques* are creative endeavors used to construct design ideas and system requirements, and are meant to be modified depending on the design topic or goals of the community (Walsh et al., 2013). When developing Talisman, one of my goals was for the suite of techniques to be adaptable by communities into their existing practice, and carried out without intervention of supervision from the research team. Additionally, I wanted communities to have the flexibility to modify the prompt and design activities to suit their design goals. In the system deployment, I observed how Talisman was both adapted and modified by different communities with different design goals. In Case Study 1, for example, Noora and Leire added their own follow-up questions to the *Choose* and *Connect* design activities, inviting the young adults to share how their objects made them feel, how often they interacted with their objects, and connections between their objects and broader community. They also chose to omit the *Consider* activity, explaining how this may have helped improve the flow into the design portion of the session.

Another dimension of adaptability relates to when in the user-centered design process the technique can be integrated. This could be early on during the discovery phase or in defining what will be developed, or later on during the prototyping or evaluation phases (Rogers et al., 2023). Across the case studies, communities tended to integrate Talisman earlier in the design process during the phases of discovery and defining. While I suspect that it may be useful to incorporate Talisman into the later phases of the design process, this is a fruitful area for future inquiry. I expand upon this in future work (Chapter 8).

Chapter 8: Conclusion

In my early dissertation work, I was interested in exploring some of the challenges to inclusion in Participatory Design. Based on an interview study I conducted with expert Participatory Design practitioners (Chapter 3: Preliminary Work), I found that inclusion was about more than just physical access—it was about instantiating a shared space where users could enact aspects of their identities and lived experiences in Participatory Design. While wrestling with ways to construct shared spaces, I discovered that a recurring problem in Participatory Design research was that users were often ascribed their design materials, which sometimes led to disempowerment or alienation. Conversely, there were a few instances where users preferred to draw on their own tangible and intangible objects, though this was often a tertiary finding in previous work. Drawing on the underlying mechanism of Assets-based design, I posited that one way we might be able to better support users to enact their identities and lived experiences in design may be by shifting control of design materials.

I argued that by shifting control of design materials to users, we might be able to get closer to the core ethos of Participatory Design that promotes power-sharing and inclusion. Using Research through Design, I developed a sociotechnical system called *Talisman* consisting of a repertoire of techniques to support users to identify, bring in, and engage with their own materials in Participatory Design (Chapters 3 and 4). To evaluate its impact and effectiveness in real-world settings, I deployed Talisman alongside three communities focused on STEM education for young adults (Chapter 6). I observed how the communities instantiated Talisman in their design practice, as well as how personal objects and Talisman impacted the design work, inclusion of the young adults, and the young adults as designers. I then synthesized

these findings across all three case studies (Chapter 7), discussing the ways in which Talisman helped to shift control, expand the range, and scaffold users' interaction with their materials. I observed how Talisman was adaptable across design contexts and modalities (e.g., DPD); what happened when the design activities were implemented differently than suggested; and how, despite tactical issues and surprises, communities were still able to adapt Talisman to changing circumstances.

Along with seeing the potential of Talisman to change how we design with communities from a methodological standpoint, perhaps the most salient takeaway for me was that I got to see how Talisman had a tangible impact on the young adults as designers. By bringing in and engaging with their personal objects, participants recounted how they felt heard and seen, in control of their decision-making, and connected to each other in deeper ways than they had previously experienced. Additionally, participants shared how the approach promoted the broadening of capacities, both in terms of design and in other ways. For example, participants learned to think about their objects in new ways (i.e., material vision) and gained a deeper understanding of their particular design topic (e.g., environmental science projects and coding aspirations). This dissertation provides only a small glimpse into the potential of this approach, but it is not without limitations. I now turn to these limitations, as well as opportunities beyond the scope of this dissertation.

Limitations

Limitations serve to caution against faulty interpretation or over-generalization of findings (Wobbrock, 2015). One of the inherent limitations of both qualitative and case study approaches is that the findings are difficult to replicate or generalize (Simon & Goes, 2013). With this in mind, I share some of the limitations that I felt were important to acknowledge to readers. These limitations relate to the narrow contexts in which Talisman was deployed, as well as the myriad of factors that may have influenced participant's inclusion unrelated to Talisman.

Narrow contexts

The first limitation is that Talisman was evaluated by participants of a similar demographic. In all three case studies, the participants were young adults between the ages of 16-22 years old who are underrepresented in STEM and attended high school or undergraduate universities in urban cities in the United States. Although this may have allowed for a closer comparison of the case studies, it remains unclear how other populations with different axes of marginalization would respond to this approach. While we cannot know for certain the role that the personal objects and Talisman might play in co-design with other groups, there still may be useful findings and implications in this dissertation for Participatory Design and Assets-based approaches more broadly. Second, all of the participants either knew each other and the facilitator, or were at least affiliated with the same community (e.g., university department). This raises the question of whether a similar level of sharing and comfort would emerge if the participants do not know each other or are not affiliated with the same community. Third, the case studies were focused on specific topics that

resonated with the communities. However, I acknowledge that Talisman may not be appropriate for certain topics or settings, such as ones that may be sensitive or possibly triggering for participants.

Other factors affecting inclusion

There are other factors worth mentioning that may affect the inclusion of participants beyond their personal objects and Talisman. As put forth by actor-network theory (ANT), all human and nonhuman elements within a social situation are inseparable and in constant conversation with each other (Walsham, 1997). Based on findings from my case studies, inclusion can also be influenced by *who* is in the space, *how* the space is set up, and broader contexts. In terms of who is in the space, all participants must have a collective commitment to inclusion as a precondition for nurturing an inclusive shared space. It is important to consider the relationship both between and among design partners, facilitators, researchers, and any other involved stakeholders, such as how long they have known each other and in what contexts. Inclusion can also be impacted by participants' identity categories (e.g., age, gender, race, religion, ability, and socioeconomic status), personalities, content knowledge (e.g., programming knowledge), appearance, opinions (e.g., political leanings), responsibilities (e.g., childcare), or vocalness and sociability. For example, Zuri (Case Study 1) liked how her peers listened to her but felt it was scary letting people into her personal life. Even the frequency of facilitators calling participants by their names, as observed in Case Study 3, can play a big role.

In terms of how a space is set up, there are additional factors that can affect inclusion. Whether in a physical or virtual space, participants' familiarity of the space

or lack thereof can have an impact. As described by Fails et al., even the room layout choice, lighting, or temperature level in a room can all impact how participants feel (Fails et al., 2012). For example, Pete (Case Study 2) mentioned that the seating arrangement was one of the main things that made him feel included because of the sense of egalitarianism and respect it helped to engender. An additional factor that can affect inclusion of participants is broader contexts, such as the feelings associated with being a part of a research study. In case Study 2, for example, two participants did not feel comfortable with their personal objects being used as a part of an academic research study. A caveat to participants bringing in their personal objects is that it may dissuade them from wanting to be recorded. Conversely, this points to how much participants value and care about their personal objects.

Future Work

Here, I discuss potential future opportunities for Talisman and personal objects as design materials. These include: 1) the possibility of adapting Talisman and personal objects in other contexts; 2) ideas for shifting control elsewhere; 3) suggestions for refining the Talisman Toolkit; and 4) other communities who have expressed interest.

Adapting Talisman and personal objects to other contexts

Areas for fruitful inquiry include exploring how Talisman and personal objects can be used with other groups, in other settings, and in different parts of the design cycle.

In this dissertation, I shared young adults' constructions of their experiences using Talisman and their personal objects. In the future, it may be worthwhile to explore how other populations with different axes of marginalization, such as older adults or young children with disabilities (Walsh et al., 2013), may derive benefit from using Talisman. This may also have potential implications for work with communities who may not necessarily be underrepresented or marginalized. Drawing on principles from Universal Design (Shneiderman et al., 2017; St. Jean et al., 2021), these communities may also benefit from using Talisman and personal objects in co-design. Additionally, it may be interesting to explore how the findings and themes that emerged from my analysis carry over to other groups and communities.

In my research, I deployed Talisman in three specific communities who are based in US urban cities and focused on STEM education for underrepresented young adults. Future explorations might examine how Talisman can be adapted in different

geographical settings or sectors, such as nonprofits, government, or industry. We must be mindful, however, of the differences between these settings and how different concerns may make it easier or harder to implement Talisman than was presented in this academic dissertation. Future research is needed to explore how Talisman might inform Participatory and Assets-based design in general, as well as beyond. For example, in Case Study 1, Noora and Leire speculated that Talisman may be useful in violence prevention programs or in workplaces as an icebreaker.

I observed how the communities integrated Talisman earlier in the design process to gather insights and further define their topics (Rogers et al., 2023). Future explorations might examine how Talisman may be reappropriated or reused in various parts of the user-centered design process. For example, how the personal objects might be manipulated and used in the physical prototyping of solutions may be worthwhile to examine, though this may require extra care depending on the objects participants bring in. Additionally, it may be interesting to explore how Talisman may be applied beyond a single workshop, such as extended engagement on one topic or with the same personal objects.

Ideas for shifting control elsewhere

In this dissertation, I explored how shifting control of design materials to users might be a useful mechanism to empower them to enact aspects of their identities and lived experiences in co-design. I observed what happens when the power to select design materials is transferred to design partners. Continuing along this ethos, a step further might be to explore other aspects of Participatory Design where there is potential to promote additional power transfer and power-sharing from

facilitators (or other leading stakeholders) to design partners. For example, in Case Study 1, Leire suggested that participants have the opportunity to ask follow-up questions or participate in co-facilitation roles. Both Leire and Dr. Chan also suggested that participants have more control over the framing of the design topic or prompt.

Relatedly, future explorations could explore the possibility of combining Talisman with other approaches. For example, this might look like a "hybrid" approach, where users are free to select their design materials in combination with other traditionally-used materials, like big paper, whiteboards, and Post-it notes. In all three case studies, I observed how the communities still used these to take notes in a format that was visible by all participants. Another possibility might be to combine Talisman with other design techniques, such as Bags of stuff (Druin, 1999), storyboarding, or walkthroughs.

Suggestions for refining the Talisman Toolkit

In the future, I plan to continue iterating on the Talisman Toolkit and sharing it with communities. Findings from the three case studies revealed insights into some of the things that may be useful to include in the toolkit. For example, Dr. Ramos and Dr. Chan suggested that the toolkit have more guidance for people with less experience facilitating co-design, such as aspects of facilitation that may be more tacit. This may include additional guidance on how to ask probing questions and reassuring participants that there are no right or wrong answers. Dr. Chan also wanted video demonstrations or example implementations of Talisman (Ledo et al., 2018), that way he could get a feel for how the sessions are run and how the space is set up.

The hope is that Talisman and its accompanying toolkit will be a publicly available design resource for community organizers and co-design facilitators to support their practice (Bray et al., 2022). In the future, the Talisman Toolkit should be publicly available at https://www.TalismanToolkit.com.

Other communities who have expressed interest

Beyond the three communities whom I collaborated with in this dissertation, there are other communities who have expressed interest in or already used aspects of Talisman on their own.

The first community who has used parts of Talisman on their own is the intergenerational Cooperative Inquiry design team at University of Maryland known as KidsTeam, led by Dr. Bonsignore. Alongside the child design partners, Dr. Bonsignore and an HCI Master's student facilitated a co-design session in mid-November 2023 relating to culturally relevant storytelling and cultural heritage expression. They invited the child design partners, who had help from their parents/guardians, to bring in an object representing their culture (i.e., "heritage items"). See Appendix B: Supplementary Materials for Dissertation Research for the full prompt that was sent to the parents of child design partners. After sharing their objects with their peers, the child design partners participated in a guided storyboarding activity where they wrote down stories on big paper about their cultural artifacts and imagined how AI could assist them with their storytelling. In this instance, the community chose to conduct only one of the Talisman design activities (*Choose*), and combined it with other design techniques such as storyboarding.

Afterwards, the HCI Master's student independently conducted a co-design session with youth in India using elements of Talisman. The student described how the youth were able to "*anchor their creativity in their cultural heritage, producing a variety of stories and creative expressions that celebrated their individual identities*." See Appendix B: Supplementary Materials for Dissertation Research for more information on the session conducted with youth in India. These instances reveal how there is potential for Talisman to be integrated into communities' existing practice, and modified or combined with other design techniques. Additionally, they reveal how Talisman may be a potentially useful approach for design work with other populations—in this case, young children who also involved their parents/guardians in the material selection process.

Second, there has been expressed interest in including Talisman as a part of undergraduate and graduate curricula relating to technology and information design and Participatory Design. Dr. Bonsignore suggested that Talisman could be included in the range of community-based design methodologies and techniques that are covered in teaching modules. Lastly, Dr. Chan had mentioned how he might want to use Talisman in all of his future co-design sessions.

Appendices

Appendix A: Supplementary Materials for Preliminary Work

IRB Approval Letter

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DATE:	September 3, 2021
TO:	Salma Elsayed-Ali
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[1610063-4] Democratizing Design
REFERENCE #:	
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	September 3, 2021
EXPIRATION DATE:	June 17, 2022
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

Thank you for your submission of Amendment/Modification materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a MINIMAL RISK project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of June 17, 2022.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Semi-Structured Interview Guide

Introduction

Hi _____. Thanks for agreeing to be interviewed by us. As part of this interview, we will be asking questions about your experience as a Participatory Design (PD) practitioner. Our session should last approximately an hour but may be shorter or longer depending on how much information you choose to share.

Before we begin, I want you to go through the consent form and sign if you are willing to continue. Please let us know if you have any questions about anything in the consent form.

[Provide the consent form or ensure the consent form has been signed prior]

This interview will be video and audio recorded and stored for research purposes in a secure location. Only the research team will have access to it, and we will keep your identity and affiliations anonymous while reporting the results of our research.

Also, if you feel uncomfortable at any point in the interview and would like to take a break or terminate the interview, please let us know. We will now begin recording.

Introductory questions

1. Can you tell us a bit about yourself?
2. Please describe Participatory Design (PD) using your own words.
3. What is your experience using Participatory Design (PD)?
    a. How long have you been working as a PD practitioner?
    b. Do you have experience both in academia and industry using PD?
        i. If yes, what are some differences you have noticed between PD in industry versus PD in academia?
4. Who are the users you typically work with?
    a. Do you have experience working with other user groups or populations?

Breadth questions

1. Can you walk us through the steps you use for recruiting your users or participants?
    a. How many users do you usually recruit?
    b. What forms of communication do you use to get in touch with them?
    c. How important is getting a diversity of users to you?
        i. How do you strive towards getting a diversity of users?

Depth questions

2. How do you get users to actively participate?
3. What does “successful” user participation look like to you?
4. How long do you engage with the same users?

Tradeoff Challenges

1. What challenges do you frequently face to getting a breadth and depth of user participation?
2. Have you noticed any tensions or tradeoffs between the different aspects of what makes a PD effort successful?
3. What have you found to be effective methods / tools / approaches for navigating these tensions / tradeoffs?

Methods and Tools

1. What methods do you use in PD?
    a. To date, what have been the most successful methods in your sessions?
    b. What methods do users seem to enjoy most?
    c. What methods do users seem to enjoy least?
2. What tools do you use in PD or co-design sessions?
    a. Are these the tools that users use?
        i. If not, what tools do users use?
3. Do you have experience with distributed PD (DPD)?
    a. How has Covid-19 affected how you run PD/co-design sessions?
    b. Do you prefer in-person or remote DPD and why?

Output

1. What are the output artifacts of PD projects you typically work on?
    a. Systems/products, papers/reports?
2. Who gets ownership of ideas born out of PD projects?

Reflective Practice

1. What was the most successful PD project you have worked on so far?
    a. Why do you think it was the most successful?
    b. What methods did you use?
2. What was the least successful PD project you have worked on?
    a. Why do you think it was the least successful?
    b. What methods did you use?
3. How do you think PD as a field has transformed from when you began to now?
    a. How about co-design and design research in general?

[Probe participants with more follow-up questions if time allows and they are willing]

That was the last question I had for you. Before we conclude, do you have anything else you want to add about what we discussed or what we did not discuss surrounding your experience as a PD practitioner?

[Thank the participants for their time and inform them about the next steps with regards to analyzing and reporting results]

Pilot Studies: Iteration 1 Prompt

Thank you for volunteering to help with my pilot study. The goal of this study is to collectively build new ideas using content drawn from people's everyday lives. The study consists of two main steps: 1. Building a shared repository of content, and 2. Creating collages using content from the shared repository.

IMPORTANT: Before our session, please take 5-10 minutes to upload content into the following folder in Drive. There are no limitations as to what you can upload, as long as it relates to you and your life! Please upload a minimum of 10 items to the folder–the more the better.

Unique folder link: ____

Content will be anonymized before the session (unless the content itself contains anything identifiable such as a face or name).

We will be using this Zoom link: ___

Please let me know if you have any questions or concerns in the meantime!

Pilot Studies: Iteration 2 Prompt and Protocol

Prompt:

Thank you very much for your willingness to participate in our pilot session tomorrow. In this session, we will be exploring and co-designing ways of preserving and representing cultural heritage.

IMPORTANT: Before our live session, please take a few minutes to share something that represents your cultural heritage. This can be a tangible object like a photograph of a handmade item or building, or an excerpt of text from a meaningful book or family recipe. Alternatively, it can be intangible like a video of a traditional dance performance or audio recording of spoken word. There are no limits as to what you can bring in, as long as it is meaningful to you and your cultural heritage! Feel free to also add a caption and description, should you wish. During the live session, you will have the opportunity to describe what you chose to bring in with the larger group. **Please use the following link to share: ___**

Please let me know if you have any questions or concerns about using Padlet, this study, or anything else. Thanks again and greatly looking forward to working with you during the session!

Protocol:

For a 30-minute session (expected times in the left column)
Link to Google Sides: ___
Link to Padlet used during the session: ___

5 min	**1. Set-up, 2. Introduction, 3. Sharing screen with Padlet and Google Slides**
Hi everyone, thank you for your willingness to participate in this session. In this session, we will be exploring and co-designing ways of preserving and representing cultural heritage. If it is alright with you, can we please record this session? We'll be walking through 4 activities today. Give overview of what cultural heritage is and how it is divided into tangible heritage and intangible heritage.	
5 min	**Show and Tell/Circle Time – Establishing Common Ground**
We're going to go around and share our answers to these three questions:	

Questions: 1) Name 2) What did you bring in today to share? 3) How is it special to you? Each person spends around 1-2 minutes sharing what they brought in today. You may either share your screen or just say your ideas verbally if you feel more comfortable.	
3 min	**Tagging Speed Round**
List off in a really fast-paced manner keywords or categories that you think are relevant to what everyone brought in. Any tags about each thing in particular are welcome (doesn't have to be about everything overall, can be about specific ones). Say the first ones that pop in your head. No discussion unless just elaborating on what you said.	
3 min	**Preservation Requirements**
Try your best to use what was brought in today to think of these requirements. When preserving cultural heritage, what information do we need to make sure is captured and made available?"	
10 min	**Tools for Preservation**
Based on everything that was discussed prior, now we are going to brainstorm tools that could be used to preserve cultural heritage. This can be literally anything, try to think outside the box.	
5 min	**Debriefing**
What did you like? What did you dislike? Anything you would have liked to have seen?	

Pilot Studies: Iteration 3 Prompt and Protocol

Prompt:

Thanks for your willingness to participate! I'll send you a Google Calendar invite with the Zoom link for the sessions on Wednesday and Thursday.

Important - Short Pre-Session Activity
Before Tuesday evening, please take a few minutes to upload 2-3 things on this shared canvas that you feel represent your cultural heritage. These can be in any format. Just click the "+" in the bottom right-hand corner of the canvas to upload. You will have the opportunity to briefly share what you uploaded during the session and then we will use these to design.

Let me know if you have any questions about uploading to the shared canvas or about the study itself!

Session #1 Protocol:

5 min	**1. Introduction, 2. Sending Padlet Link, 3. Sharing screen with Padlet**
Wait until every participant arrives Hi everyone, thank you for your willingness to participate in this pilot study. This pilot study will consist of two sessions: today's session is all about problem refinement and tomorrow's session will be the design activity. We will be walking through a few short group activities relating to the preservation of cultural heritage using a shared canvas on Padlet. If it is alright with everyone, could we please record this session? This will be used just for analysis purposes and any personal information will be de-identified. This recording will also only be accessible by myself and my two PhD advisors, Dr. Beth Bonsignore and Dr. Joel Chan for research purposes ONLY. Also to respect fellow participant's privacy, please make sure everything said in this session stays in this session. We want everyone to be able to share their thoughts and ideas freely. Also, reminder to please think aloud (verbalizing your thoughts) and provide feedback while we go through the activities together. Any questions before we get started? We'll be using the Padlet you should have access to during this session. I'm going to be sharing my screen but feel free to follow along either on Zoom or your own screen. Here's the link again if you need it: ___ Send Link and Share Screen	

2 min	**Ensuring Everyone Uploaded Something**
Before this session, you should have taken some time to upload 2-3 things that represent your cultural heritage. Is there anyone who didn't have the opportunity to do so? *(Please take a few minutes to upload 2-3 things on this shared canvas that you think represent your cultural heritage. These can be in any format. Just click the "+" in the bottom right-hand corner of the canvas to upload.)*	
20 min	**Sharing (Objects Uploaded)**
Now we're going to go around and have everyone share what they brought in. 1) What did you decide to share? 2) How does this represent your cultural heritage?	
8 min	**Tagging**
Next, we're going to move on to the next activity. In this activity, we want you as a group to list off keywords or categories that you think are relevant to what everyone brought in. You can try to find connections between what you uploaded, or you can just shout out tags that relate to one thing in particular. Please specifically mention what this tag relates to. We will be connecting the tag to the object. I will be writing down the tags for you all.	
8 min	**Specifying (Design Requirements)**
Next, we're going to move on to the next activity. When preserving cultural heritage, what information do we need to make sure is captured and made available? Again, we would like to see how these requirements relate to the tags and objects you shared, so please mention what the requirement relates to so that we can draw connections.	
2 min	**Explaining Pre-Session Exercise for 2nd Session (Bring in Found Objects)**
In preparation for tomorrow's session, please upload 1-2 things you would like to design with. I leave this open-ended and up to you to decide.	
10 min	**Debriefing**
Asking relevant questions like what they liked, find challenging, learn, how was the Padlet UI	

Session #2 Protocol:

10 min	**Sharing (Objects Uploaded)**
Now we're going to go around and have everyone share what they brought in. 1) What did you decide to bring in? 2) Why is this helpful to have when designing?	
5 min	**Recap of Session #1**
As a group, what were some of the most important key takeaways from yesterday?	
15 min	**Designing (Solutions)**
Based on everything that was discussed prior, now we are going to brainstorm systems or tools, broadly construed, that could be used to preserve cultural heritage. You can use not only what you brought in today but also you can draw inspiration from what other participants brought if it would help. This can be literally anything, try to think outside the box. Just click the "+" in the bottom right-hand corner of the canvas to ideate your solution.	
15 min	**Big Ideas**
We're going to go around and share and discuss what everyone created.	
5 min	**Debriefing**
How did you feel the second session differed from the first session? Do you feel like you could have created these ideas without yesterday's session? Anything you would have liked to have seen? What do you all think about group dynamics over the two sessions?	

Appendix B: Supplementary Materials for Dissertation Research

IRB Approval Letter

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE:	September 11, 2023
TO:	Salma Elsayed-Ali
FROM:	University of Maryland College Park (UMCP) IRB
PROJECT TITLE:	[1610063-8] Democratizing Design
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	September 11, 2023
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7. Subpart D applies, 45CFR46.404. Waiver of consent documentation, 45CFR46.117(c).

Thank you for your submission of Amendment/Modification materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to final approval of this project scientific review was completed by the IRB Member reviewer.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a MINIMAL RISK project.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate Amendment forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed. All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Please note that all research records must be retained for a minimum of seven years after the completion of the project.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

Prompt Templates

In-Person

To help us with planning and to make the session more personal, we're asking everyone to bring in something from your life that represents (design topic). You will be able to share this with the group. This can be a physical object like a handmade item or book, or it can be digital like a photo or audio recording, or something else we haven't thought about! We're not looking for anything in particular, so feel free to be as creative as you wish, and you can bring in more than one thing to share! We'll be doing a "show and tell" and then using whatever you all bring in for inspiration and brainstorming.

IMPORTANT: By (date), please email/text the facilitator the thing(s) that you will be sharing with the group on Saturday. Please include a 1-2 sentence description, photo, or link in your message.

Distributed Participatory Design

To help us with planning and to make the session more personal, we're asking everyone to share something that represents (design topic). This can be a physical object like a handmade item or book, or it can be digital like a photo or audio recording, or something else we haven't thought about! We're not looking for anything in particular, so feel free to be as creative as you wish, and you can bring in more than one thing to share! We'll be doing a "show and tell" and then using whatever you all bring in for inspiration and brainstorming.

IMPORTANT: By Wednesday evening, please upload to Padlet (link) as a Padlet post the thing(s) that you will be sharing with the group. Please include a 1-2 sentence description in your post. If you plan on sharing a physical object during the live session, please still create a "digitized" post of it in Padlet. For your reference, we created this very short video for instructions on how to create a post and all the different media types you can upload into Padlet!

Modified Prompt Used With KidsTeam

Courtesy of Dr. Elizabeth Bonsignore

“For one of the design projects, we will explore the ways in which a ‘large language model’ (LLM) AI system might become a **storytelling partner** with children -- with a focus on culturally meaningful stories that are from the children's families and culture overall. Think of the stories that your families might tell and share -- especially those from Grandparents and Great-grandparents (many of whom are immigrants to the United States - or the children of immigrants)…

*** Relatedly, we would like **each of the children to bring in a little memento of a family / cultural story. The memento can be a photo, it can be an object, it can be a photo of an object. It can even be a link to a video or audio file that you send to me. Any media that you would like to use, OR, the object/artifact itself** (e.g., a little toy that is the child's favorite, that may have come from a grandparent or someone who is from another country).

We also ask that you and your child (or children) share any culturally relevant words that relate to the memento, object, photo, video, etc…

Our goal is to share different words and objects that we can use to tell a story, and then explore how the children would like an AI chatbot system or image-creation system to help them create that story. We will mostly be working with the children's artifacts/photos/etc, and not that deeply with an AI. Our goal is to help them to storyboard their ideas on paper -- as low-fidelity prototypes first. The words are important, we are considering how AI systems might support children's interest in learning languages and/or cultural heritage that is part of their family but that may disappear (e.g., “heritage languages”).

Please let me know if it's possible for your child (children) to bring in a special artifact -- something that is meaningful to them from their family and cultural heritage. Again, it can be a photo, a link to audio/video, a toy, a memento, etc.

Whatever they think of when you discuss it with them. It would be perfect if they could bring it on Thursday, Nov 16th (or if it's digital, please send me a link by Thursday).”

Modified Prompt Used With Youth in India

Courtesy of Dinesh Kumar Nanduri

"Get an artifact from your house that reflects your culture. It can be food, clothes, toys, or whatever you think reflects your culture but not your religion." (I noticed youth often get confused between Religion and Culture. Though Religion can and maybe is a major part of that culture, I did not want to include religion in my study)

"Can you share a unique word from your heritage language that relates to your artifact and tell us what it means?"

"Write a story based on your artifact. It can be a story explaining your artifact, a story with characters with your artifact as a character itself, or it can be drawings like comics, or altogether anything you can imagine. This story will be read by other kids who do not know about your culture and will help them understand, follow, and spread the word about it."

Examples of artifacts brought by participants included:

- Panchi (a traditional clothing worn during festivals and events)
- Rice (their staple food)
- Veena (a musical instrument)
- Wooden toys

Short reflection:
"Notably, because of the session being conducted around the cultural artifact, participants were able to think and bring out their creativity through cultural storytelling, avoiding the limitations of a westernized form of stories and creative outputs. The unique approach allowed the children to anchor their creativity in their cultural heritage, producing a variety of stories and creative expressions that celebrated their individual identities. This aspect significantly enhanced the authenticity and diversity of the narratives shared."

Semi-Structured Interview Guides

Pre-Session Interview Guide

Possible Questions:

1. What are your expectations for the session?
2. How did you prepare for the session?
3. Can you walk me through how you decided on the prompt?
4. Why co-design as your "method of choice?"
    a. Why in this particular context?
5. What do you plan to do in the session?
6. Do you plan on using other materials?
    a. Do you plan on writing down what they say in front of them?
7. Location of the session?
8. Anything else you would like to share?

Post-Session Interview Guide

Possible Questions:

1. How did the session go in your opinion?
2. Can you walk me through the session?
3. Can you share your experience facilitating the workshop?
4. What went well?
    a. What did not go so well?
5. How did showing and telling go?
6. What objects did participants bring in (any photos etc. taken)?
    a. Digital or physical?
    b. Did any participants not bring anything in?
    c. Was bringing in personal objects a helpful exercise?
7. Did the participants find any connections between the objects?
8. Do you think the participants were included? Or had a voice? Did every person get to participate?
9. What if you didn't know all the participants?
10. What has resonated with you most from this workshop/experience (until now what has stuck with you most)?
11. What are you still thinking about?
12. What do you wish could be better next time?
13. Now that you've run through the process, is there anything you wish you could change or add to the 4 design activities? (Choose, Connect, Consider, Create)
14. Did you reference the toolkit at all?
15. Anything else you would like to share?

Post-Session Qualtrics Survey Questionnaire

Demographical questions:

1. First and Last Name (required for the gift cards)
2. Email (required for the gift cards)
3. Age
4. Gender
5. Race

Questions:

1. What object(s) did you bring in to share today?
2. Why did you choose this particular object(s)?
3. How was your experience bringing in something to share to the design workshop?
4. What resonated with you most from the design workshop?
5. If you have participated in design workshops before, how would you compare this workshop to others you have participated in?
6. What ideas or things did you create inspired by the objects you and your peers brought in?
7. On a scale of 1 to 10, with 1 being “not at all” and 10 being “extremely.”
    a. Do you feel like you contributed something to the session?
    b. How personalized do you feel was the session?
    c. Do you feel bringing in something to the session was helpful?
    d. How included did you feel in the session?
8. What made you feel included/not included in the design workshop?
9. What did you learn in today's design workshop?
10. Is there anything you're still thinking about from the design workshop?
11. Lastly, what feedback or questions would you like to share with us?

Appendix C: Research Conducted Throughout Doctoral Program

Funding Sources for My Research

Department Funding (College of Information Studies)

1. iSchool Doctoral Student Research Award (DSRA) (2022)

University Funding (University of Maryland, College Park)

1. Ann G. Wylie Graduate School Semester Research Fellowship (2023-2024)
2. Graduate Student Summer Research Fellowship (2022)
3. International Conference Student Support Award (ICSSA) (2023)
4. ArtsAMP Interdisciplinary Graduate Student Research Grant (2023-2024)

ACM SIGCHI

1. Gary Marsden Travel Award (2023)
2. SIGCHI Development Fund HCIxB CHI 2023 Workshop Registration Waiver

List of Publications Authored During Ph.D.

CHI and CSCW are the top two venues in HCI according to Google Scholar; see Google Scholar for full list of publications.

Refereed Conference Papers

C.9 Utkarsh Dwivedi, **Salma Elsayed-Ali**, Elizabeth Bonsignore, and Hernisa Kacorri. *Exploring AI Problem Formulation with Children via Teachable Machines.* Conference on Human Factors in Computing Systems (CHI 2024), 28 pgs.

C.8 **Salma Elsayed-Ali**, Elizabeth Bonsignore, and Joel Chan. Personal Objects as Design Materials: A Case Study of Co-Designing Safe Spaces With Young Adults. Conference On Computer-Supported Cooperative Work And Social Computing (CSCW 2023), 8 pgs.

C.7 **Salma Elsayed-Ali**, Elizabeth Bonsignore, and Joel Chan. *Exploring Challenges to Inclusion in Participatory Design From the Perspectives of Global North Practitioners*. Conference On Computer-Supported Cooperative Work And Social Computing (CSCW 2023), 25 pgs.

C.6 **Salma Elsayed-Ali**, Sara Berger, Juana Becerra Sandoval, and Vagner Figueredo de Santana. *Responsible & Inclusive Cards: An Online Card Tool to Promote Critical Reflection in Technology Industry Work Practices*. Conference on Human Factors in Computing Systems (CHI 2023), 14 pgs.

C.5 **Salma Elsayed-Ali**. *Solidarity and the Self: The Role of Personal Objects and Materials*. HCI Across Borders (HCIxB) Workshop at CHI 2023.

C.4 Utkarsh Dwivedi, **Salma Elsayed-Ali**, Elizabeth Bonsignore, and Hernisa Kacorri. *Examining the Values Reflected by Children During AI Problem Formulation*. Workshop on Child-Centred AI Design: Definition, Operation, and Considerations (CCAI) at CHI 2023, 5 pgs.

C.3 Rachel Wood, Emma Dixon, **Salma Elsayed-Ali**, Ekta Shokeen, Amanda Lazar, and Jonathan Lazar. *Exploring Future Personalization Opportunities in Technologies Used by Older Adults with Dementia*. Hawaii International Conference on System Sciences (HICSS 2023), 10 pgs.

C.2 Kristen Byers, **Salma Elsayed-Ali**, Ebrima H. Jarjue, Rie Kamikubo, Kyungjun Lee, Rachel Wood, and Hernisa Kacorri. *Reflections on Remote Learning and Teaching of Inclusive Design in HCI*. EduCHI Symposium at CHI 2021, 12 pgs. **All authors contributed equally.*

C.1 **Salma Elsayed-Ali**, Elizabeth Bonsignore, Hernisa Kacorri, and Mega Subramaniam. *Designing for Children's Values: Conceptualizing Value-Sensitive Technologies with Children*. Conference on Interaction Design and Children (IDC 2020), 6 pgs.

Refereed Journals

J.4 Jason McDonald, **Salma Elsayed-Ali**, Kayla Bowman, Amy Rogers. *Considering What Faculty Value When Working with Instructional Designers and Instructional Design Teams*. Journal of Applied Instructional Design, Volume 11, December 2022.

J.3 Jerry Fails, Dhanush Ratakonda, Nitzan Koren, **Salma Elsayed-Ali**, Beth Bonsignore, and Jason Yip. *Pushing Boundaries of Co-design by Going Online: Lessons Learned and Reflections From Three Perspectives.* International Journal of Child-Computer Interaction, 2022.

J.2 Jason McDonald, Kayla Bowman, **Salma Elsayed-Ali**. *Objectivation in Design Team Conversation*. Design Studies: The Interdisciplinary Journal of Design Research, Volume 77, November 2021.

J.1 Rachel Wood, Emma Dixon, **Salma Elsayed-Ali**, Ekta Shokeen, Amanda Lazar, and Jonathan Lazar. *Investigating Best Practices for Remote Summative Usability Testing with People with Mild to Moderate Dementia*. ACM Transactions on Accessible Computing (TACCESS), 2021.

Magazines

M.1 Siobahn Day Grady, Pamela Wisniewski, Ron Metoyer, Pamela Gibbs, Karla Badillo-Urquiola, **Salma Elsayed-Ali**, and Eiad Yafi. *Addressing Institutional Racism within Initiatives for SIGCHI's Diversity and Inclusion*. ACM *Interactions*, June 2020.

Glossary

Term	Definition
Assets-based design	Taking root in community development work, this is an approach that aims to leverage the assets and capacities of groups and individuals in order to attain a lasting, shared vision (Wong-Villacres et al., 2020)
Co-Design	While often used interchangeably with Participatory Design, this refers to the collective creativity of designers and people not trained in design working together throughout the design process (Sanders and Strappers, 2008).
Cooperative Inquiry	An intergenerational, participatory approach to partnering with children aimed at understanding children as technology users in the present and future (Druin, 1999).
Deployment	The act of implementing or embedding the introduced system in applied, real-world settings.
Design implications	Actionable ideas for design and calls to action that emerge from empirical findings (Sas et al., 2013)
Design materials	The design objects employed by users in a project (Muller, 1991).
Design partners	A term referring to the highest degree of end user engagement, whereby end users are considered equal stakeholders throughout the entirety of the design process. This contrasts other roles such as users, testers, and informants (Druin, 2002).
Design workshop	One of the main activities in Participatory Design involving a structured design meeting between diverse stakeholders to engage in mutual learning and knowledge exchange (Bødker, 2022)
Facilitators	The person(s) who leads design activities with participants. A facilitator in co-design is usually a community organizer, researcher, educator, or designer.
Inclusion	The practice of developing and implementing intentional and attentive methods, processes, and environments through which individuals feel empowered to fully explore and enact their identities and lived experiences.

Term	Definition
Kickback event	Enriching, out-of-school opportunities for young adults to gather and socialize with their peers, with frequent opportunities to network with job recruiters as well.
Marginalization	The structural and systematic denial of a group or individual to actively participate as equals in certain facets of society and processes.
Near peer mentors	These can be defined as mentors who resemble their "*protégés in age, status, skills, and/or interest*," and thus can be more relatable or approachable to their mentees than non near peer mentors (Clarke-Midura et al., 2018)
Participatory Design	A methodological approach to designing interactive systems and experiences alongside end users and other stakeholders. It originated in the Scandinavian workplace democracy movement in the 1970s, and thus has a politically-motivated ethos and commitment towards the sharing of power and democratization of innovation.
Personal Objects	"*Emotional and intellectual companions that anchor memory, sustain relationships, and provoke new ideas*" (Turkle, 2007).
Prompt	Within the context of Talisman, a customizable brief that lends itself to the design topic at hand and supports participants to choose the personal objects they want to bring in.
Research through Design	A type of research practice and paradigm in HCI focused on making things that improve or transform the current state of the world (Olson & Kellogg, 2014).
Talisman	A repertoire of techniques and design activities to scaffold users' selection and interaction with their personal objects, with the end goal of supporting users to enact aspects of their identities and lived experiences in co-design; the system that is introduced in this dissertation.
Young adults	The term used to describe the participants in my dissertation work, all of whom were within the age range of 16-22 years old. This includes people in high school and college.

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