How People Critique Problematic Participation in Smart Technology Design Processes? Lesson Learned from Designing Smart Technologies for Pour-Over Coffer-Making Experience

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Participation is widely regarded as essential in designing smart technology, yet some current practices—dominated by top-down, designer-led paradigms—are increasingly criticized for fostering problematic participation that may marginalize people's value. Despite extensive academic assertions, there has been limited knowledge of how people themselves perceive and understand the issues surrounding their involvement in designing smart experiences for them. This work delves into this gap by actively amplifying people's voices to critically assess the challenges of integrating authentic values in smart technology design processes. Through a series of interdisciplinary workshops designing smart technologies for pour-over coffer-making experience, we investigate how people's values are frequently excluded, misinterpreted, and marginalized in design. Our findings reveal how people convey meaningful critique, challenge existing design paradigms, and expose power dynamics that shape technology development when configured as evaluators. We advocate pragmatically repositioning people as 'experts of their experience' in designer-led paradigms for technology changes.

CCS Concepts: ˆ Human-centered computing ! HCI design and evaluation methods ; Empirical studies in HCI .

Additional Key Words and Phrases: Participation, Smart Technology Design, Value, UCD

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1 Introduction

There is a consensus in HCI that people should be involved and have a role in designing smart technologies [11, 78, 83]. As the success of creating satisfying user experiences with smart products becomes increasingly dependent on the integration of well-being considerations for people, researchers and designers agree on moving away from engineering and techno-solutionism [2], instead advocating for more inclusive approaches to involve people in smart technology design [17, 33, 65, 67]. Within this trend, many design teams have been following human-centred philosophy and paradigms such as user-centred design (UCD) [48, 55] — a well-known and efficient design paradigm that encourages researchers to start from people's contexts, emphasize user inputs to inform design practices and incorporate participants' feedback into the final usability evaluation of smart devices, systems and services. The rhetorical construction of such designer-led and user[1]-considered modes has subtly shaped the execution process of many HCI research and

[1]We are acutely aware of the rhetorical issues surrounding the term "user" in human-centred design. We continue to use it to clarify discussions around the longstanding challenges of framing people's roles within UCD and the persistent power dynamics in traditional smart technology design.

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commercial AI projects around the world, which has clearly led to numerous successes in various domains (e.g. smart home, healthcare, public safety, workplace productivity, automotive).

However, while the designer-led principles and methods represented by UCD claim to consider people as one of its focuses - and do involve people in designing technology - this participation is increasingly being questioned as problematic, particularly in terms of the transmission of people's values in user experience design. For example, it has been cautioned that in many participatory AI studies [21, 50], people's involvement often follows a "hit-and-run" and consultative approach. They are often engaged through surveys and interviews to capture their preferences and values, and this data is then analyzed by the researcher in a wider cycle of design and development activities that are no longer relevant to them. Even these participants, in most of the projects included, only engage with the research team once, which contradicts the core goals of participation [28, 83] and undermines the opportunities for people's values to influence new technology. Additionally, the power and dominance of designers are often criticized for introducing questionable values into technology design, as designer assumptions and fallacies take the place of what users consider important in the use of technology, which has been found to lead to "accidentally evil " [10] in user experience. Moreover, while HCI values the participation of diverse stakeholders, the practice of involving non-experts but lacking agency in decision-making and agenda-setting has been criticized as "pseudo-participation" [56]. This risks failing to align with users' values, as research has pointed out that the value embedded in artefacts and design decisions is always influenced by positions of power [52, 64].

Despite the academic recognition of the challenges of promoting meaningful participation in the design of smart technology - and the preliminary efforts being made - there remains a significant gap in our understanding of how people themselves directly perceive these "issues" of value sharing and participation. It creates a paradox: with little in-depth engagement and voice from people, researchers are more likely to be trapped in a cycle where the absence of external perspectives hinders the opportunities for rethinking design processes for truly empowering participants. Therefore, rather than choosing to examine a top-down design paradigm from expert perspectives, we emphasize and advocate for activism that amplifies the voices of the ultimate beneficiaries of technology [66]. This brings us to several guiding questions in HCI [38, 47]: Where do participants' values get lost in the design process? What might be problematic with participatory configurations in designer-led design paradigms? In what roles should people influence the design of technology and motivate transformative change? By bringing people's voices and even critiques into the discussion, we gain novel perspectives on these issues in technical design and inspire new ideas within the HCI community about participation, values, and experience design.

In this paper, we report insights from non-experts derived from a series of pre-planned interdisciplinary design workshops on the design of intelligent pour-over coffee products, involving designers, engineers, and coffee enthusiasts. Recognizing the potential of pour-over coffee as a rich context for exploring how personal values can be integrated into smart technology, we engaged with this area because enthusiasts typically have a deep connection to the brewing process, closely tied to their personal preferences and values. Our aim was to encourage the five enthusiasts to give critiques on various aspects of the UCD-based design process and the intelligence-augmented capabilities created, as a means of facilitating reflection. To motivate this, we adopted a particular participatory configuration- explicitly positioning the participants as evaluators within the design process as design provocation so that they not only reflected on their interactions with the team members but also observed, recorded, and examined how the designers and engineers interpreted the raw data around them, defined key problems, and generated design prototypes. This was followed by a participatory design process where the participants were encouraged to conceptualize how smart technology could improve their pour-over coffee experience with pen-and-paper or generative AI tools.

Our goal is to critically examine the modes of design agency, participation, design processes, and outcomes in the design process of new smart technology, and to reveal obvious but still under-discussed dangers under common user-centred technical design: How are design tools, techniques and user interventions that are often used in UCD critiqued as problem-producing? In what ways and at what stage of the design process are the things that people value in experience lost, misinterpreted and invalidated? How does the designer's dominance over the design lead to meaningless intelligent-augmented capabilities and how do people's experiences make better choices? We provide phenomenological experience and stimulate a series of discussions about technical design and experience design from non-designer backgrounds.

Our work makes three main contributions: 1) identifying the reasons that have fueled the exclusion of people's value from designer-led paradigms: low levels of participation, top-down misinterpretation and the exercise of dominion rather than agency by designers. 2) revealing how configuring people as an evaluator can stimulate constructive critique of the design process and expose power dynamics that shape technology development. 3) highlighting concerns about the problematic nature of design methods that lead to a systematic exclusion and calling for the inclusion of people as 'experts in their own experience' to promote responsible AI and the democratization of technology.

2 Related Work

2.1 Participation in Designing Smart Technology

In recent years, theorists, designers, and technologists within HCI and smart technology design have increasingly emphasized the need for a participatory turn [21], recognizing that active user involvement is crucial in navigating the complexities of intelligence-augmented technologies. This shift in focus has led to research exploring how people make sense of and reason about intelligent technologies, products, and services when they do not fully understand the underlying principles, highlighting the unexpected negative impacts that AI algorithms and technologies can have on individuals [27, 46, 89]. There are also studies that have led to increased calls for AI systems to be more interpretable and responsible [1], and for deeper participation, transparency and inclusivity in the design process of smart technologies [26, 40, 58]. For example, Holstein et al. [40] explore how industry practitioners approach fairness in AI design and emphasize the need for participatory methods to ensure fairness and inclusivity in AI systems.

However, despite these well-intentioned efforts and advocacy, the practical challenges of fostering meaningful participation in technical design practice are still formidable. Vines et al. [83] identified the core pragmatic challenge of " in what form do people engage in design" in configuring participation, which underscores its importance in ensuring that stakeholders are truly included in the design process and contribute to technological innovation. However, in the recent review [21] on participatory AI, Delgado et al. claimed that a 'consultative mode' is prevalent reflected in 80 included studies, in which stakeholders are primarily asked about their preferences, opinions, and values regarding particular technologies or design concepts. While this approach indeed allows the researchers and designers to move beyond their own perspectives, real participation goes beyond being consulted. The top-down analysis and interpretation of participants' input are also mentioned. So far, the impact of this input on the actual development agenda remains questionable, as participation is often passive and reactive, responding to questions of interest to the designers. Furthermore, another relevant argument is that the lack of transparency in the design process, with insufficient technical details provided to participants, might hinder people's ability to identify potential issues in input analysis and technology shaping [21, 44]. These critiques suggest that it is not enough and even risky to inspire technological change with a consultative mode. In the context of our research, this means that investigating designer-led

design paradigms from people can help the HCI community better understand people's perspectives on these risks and the obstacles they believe hinder their control over technology.

Beyond this consultative model, indeed, participatory design and co-design techniques have been increasingly embraced by smart technical design studies to broaden the scope and depth of participation, aiming to provoke meaningful change in technology design. For example, Møller et al. [41] utilized interdisciplinary co-design involving data scientists, case workers, and system developers to gain diverse insights into the participatory algorithmic system design in urban contexts. Woodruff et al. [85] innovatively employed workshops and interviews to understand how traditionally marginalized groups in the U.S. perceive algorithmic fairness in order to promote responsible AI development within tech companies. As such, a core argument is that co-design researchers aim to elevate the public to 'experts of their own experiences' within design teams [63]. However, despite the potential of participatory and co-design techniques, realizing these benefits in practice is challenging. Especially in more constrained design settings, the significant investment of time and resources required for such large-scale co-design projects is often seen as a luxury. As reported by [21], some industrial researchers struggle with balancing pressures from organizational management with the need to ensure meaningful public participation in AI design projects. While this dilemma is difficult to resolve, it is important for researchers and designers to think about how to pragmatically allow people to contribute effectively to the design of smart technology with their situated expertise in experience.

Furthermore, despite the focus on countering the exclusion of traditionally marginalized groups and making technology design more inclusive, as highlighted in the aforementioned studies, these challenges reflect broader systemic issues that also marginalize the general public—the broader beneficiaries of technological advancements. our research contributes to this discussion and demonstrate how they are marginalized and overlooked in technology design practices. Therefore, it is crucial that the HCI community addresses these pervasive exclusions, not only by refining participatory methods but also by rethinking the power dynamics embedded within practical expert-led technological configurations.

2.2 the Rhetoric of Value and UCD

HCI research has actively emphasized the positive effects of incorporating people's values on the user experience [30, 57]. However, a portion of the research supporting this argument often suggests a narrow utilitarian intent. The philosophy of user-centred design frames a rhetoric around how people as 'users' are considered in technology design, advocating for the direct integration of their values and needs into the design process [80]. From the perspective of system designers, identifying user values is considered fundamental to ensuring the usability of intelligent products and systems [53]. While this discourse has helped HCI move beyond the mere pursuit of technological sophistication [84] and supports value as a primary concern, the rhetoric of "users" rather than "people" has been criticised under the third paradigm of HCI [38] for limiting researchers' understanding of what people value and what constitutes a good user experience, as it overlooks the broader social and cultural contexts in which these values are situated. This suggests a shift from viewing people's values as a "top-down view of knowledge" that serves design, to recognizing them as a resource for in-depth exploration of the construction of meaning in people's experiences.

Whilst the integration of people's values into design is widely acknowledged and even positioned as a central goal in participatory design and value-sensitive design research, however, it continues to face significant challenges in common user-centered design practices. Despite HCI's widespread emphasis on understanding critical contexts and target populations during the design process, the resulting design outcomes are often reported as failing to meet expectations from people. Some studies [79] suggest that the techniques used to elicit values in UCD, such as interviews and surveys, often fail to capture people's underlying needs. In other examples from qualitative method literature [60], there are

warnings about participants providing answers that are consistent with what they believe the researcher expects to hear. Additionally, the complexity of the design process and the lack of agency given to people in the decision-making process create barriers to the effective transfer of values from people to systems. There is often ambiguity in how designers and researchers interpret data from participants [73, 74], and there is also a considerable degree of subjectivity influencing the design decisions made by designers. In contrast, it is relatively seldom that a user-centered design process is as explicit as co-design [63] which calls for sharing design power and control with participants to address these issues. Ironically, while HCI research is adept at showcasing successful user value integration, there is a scarcity of studies that reveal why and how people's values are lost during the design process. This suggests that numerous design opportunities may be overlooked. In our work, we explicitly address this issue within the practical design process in a series of workshops, focusing on how people themselves perceive the relationship between value loss, ways of their participation, and power dynamics in design. By leveraging these insights, we challenge the designer-led paradigms often seen in user experience design and offer recommendations to influence control in technology design.

2.3 Harnessing critique for technology change

The HCI community increasingly values the role of critique in influencing technological development, especially in challenging traditional design thinking and motivating transformative change. Critique has been explicitly utilized by some researchers from different fields to provoke discussion and encourage reflection on the implications of technology. For instance, Vines et al. [82] advocate for considering critique as a design resource in processes involving older people. They designed "questionable concept cards" to elicit critique from the "eighty somethings" on provocative design concepts, which helped the researchers understand the values these individuals hold in traditional banking services, and translate these values into critical insights for the digital transformation of banking technologies. In the discourse on socio-technical arrangements, Sabie et al. [62] demonstrate how the context of agonism—a social environment that fosters collective critique and contestation "from below"—enables people to voice their expectations around technology and provides a dynamic space for multiple stakeholders to engage in learning, reflection, and meaning-making. In terms of the methods aimed at encouraging critique, "design as provocation" [35] and "provocative design" [8] are often mentioned to describe the use of artefacts or participatory techniques that stimulate the recognition of different perspectives on design, technology, society, and culture, thereby encouraging expression in the form of critique. These participatory setups often place participants in contexts in which pervasive but under-addressed issues, such as the design of sex toys [5], the excessive use of smartphones in domestic settings [15], or the ethical issues surrounding robots challenging human authority [61], are explored, with the expectation that participants will take an active role in shaping change [35].

Beyond the explicit use and arrangement of critique, the universal stance of provoking critique from non-traditional groups - such as non-technical experts, non-designers, or marginalized and excluded populations - is consistent with the principles of Scandinavian design practice [24], which emphasize a bottom-up perspective to critically reflect on current practices and inspire subsequent change. People can give a say to encourage reflection on traditional practices, which is also a common approach found in participatory design, critical design, speculative design and adversarial design research. As such, critique, as a radical form of participation, represents the resistance of overlooked voices, and motivates researchers to focus on enhancing the integration of user participation in the technological design process.

In our design workshop, we positioned pour-over coffee enthusiasts as evaluators and encouraged them to critically assess everything they saw in the design process. While this configuration is certainly unconventional, it highlights the very absence of non-authoritative voices in the design of intelligent technology. Closely related to our work is the

research on participatory evaluation [22, 45, 70, 71], which stimulates attention to different concerns and values about "how technology should serve people" by allowing them to lead the evaluation process and set the criteria beyond professional perspectives. Our focus is in line with this approach of highlighting non-theoretical evaluations, as we are interested in where critiques might arise in order to better understand how to create ideal technological design processes, rather than evaluating the effectiveness of a particular design framework or case. However, unlike the outcome-level evaluations, we have extended the critique to encompass the entire design process, drawing on people's personal experiences as a basis without adhering to a uniform standard. As such, the power dynamics between experts and non-experts, authority and grassroots perspectives within user-centred design processes are more clearly revealed, challenging conventional design standards often upheld by designers and user participation frameworks [81].

3 Study Context

3.1 Starting from estioning Design Framework

Our study builds upon the reconfiguration and process modification of a pre-planned design workshop, which was part of the broader "Design Methods for Smart Kitchen Support Systems" project conducted from 2022 to 2024. The overarching goal of this project was to develop a "smart kitchen supportive system design framework" (see Figure 2) rooted in a UCD approach. This framework was intended to guide design and technology professionals in collaboratively harnessing the strengths of AI to deliver tailored technology-enhanced experiences in the design of smart technology. The goal was to ensure that the design processes accounted for human abilities and machine capabilities while addressing user needs, diverse values, and social responsibility [20, 29, 31, 42].

Within this context, the initial aim of the workshop was to validate the framework and acquire more insights using the design of smart technology for the pour-over coffee experience as a case study. To this end, a group of designers, engineers, and coffee enthusiasts were recruited to collaboratively engage in the workshop's design activities. According to the original setup, the workshop was initially structured according to the design framework, beginning with a deep understanding of context, tasks, and user needs, which then informed the creation of user personas, journey maps, and design blueprints. This groundwork facilitated a technical investigation to select appropriate technologies, comparing the strengths of humans and machines in perception, cognition, and execution to identify opportunities for complementing, substituting, or enhancing each other. Designers and engineers then defined a collaboration model, determining whether tasks should be human-led, machine-led, or a hybrid approach. This model guided the design solutions, with a human-machine comparison conducted before finalizing the design to ensure effective collaboration.

However, while we recognize that fostering collaboration between design and engineering experts can effectively integrate AI into design processes to create satisfying technology-enhanced user experiences— which is a core assumption of the broader project— we questioned whether this UCD model adequately engages non-experts. Despite the framework's robust tools and techniques for dissecting user experiences and considering technological configurations, non-experts typically participate only in the initial stages, assisting designers in identifying and defining key problems. This designer-led paradigm may risk obscuring user values in the design process, potentially leading to unsatisfactory user experiences.

Crucially, it was unclear how the coffee enthusiasts in our workshop, positioned as passive participants, perceived these potential issues and whether their voices were genuinely acknowledged by the designers. To address this concern, we implemented a unique participatory configuration, configuring the coffee enthusiasts as evaluators within the design process. This approach aimed to elicit reflective insights into smart technology design, user participation, and the

broader implications of a designer-led design paradigm. Details on the specific setup of the workshop and participant information will be elaborated in the Method section.

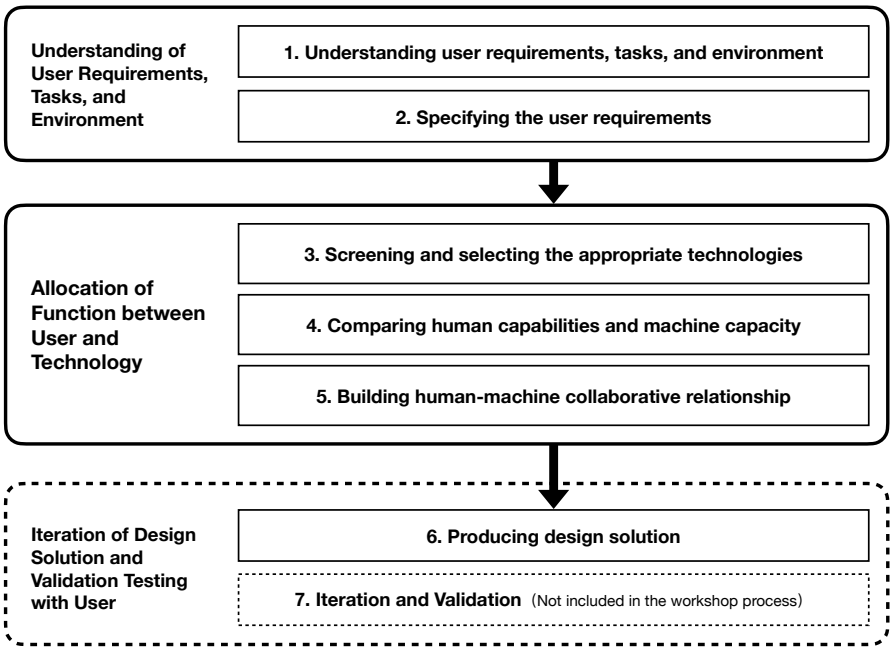

Fig. 1. Smart kitchen supportive system design framework.

3.2 Pour-Over Coffee Experience as Context

While there are many alternatives to manual pour-over coffee brewing on the market, dedicated enthusiasts continue to choose this method, highlighting the value of hands-on participation for this group of coffee lovers. Pour-over coffee offers a unique and compelling context for exploring intelligence-augmented opportunities due to its highly structured process, rich user values, and critical engagement of its enthusiasts. These attributes make it an ideal case study for investigating how technology can be designed to enhance user experiences while respecting and integrating deeply held values from people.

Firstly, the process of making pour-over coffee is inherently decomposable into a series of distinct, quantifiable steps, each contributing to the final quality of the brew. This stepwise nature, which includes precise control over variables such as water temperature, pour rate, and brewing time, provides ample opportunities for smart technology to intervene and optimize. The ability to fine-tune these parameters through algorithms not only enhances the consistency and quality of the brew but also allows for a more personalized coffee experience tailored to the user's preferences.

Moreover, pour-over coffee enthusiasts often possess a deep understanding and appreciation of the brewing process, which is reflective of their personal values and preferences. These values influence their choices of brewing techniques, equipment, and even the type of beans used. The diversity of these preferences indicates a broad spectrum of underlying

Fig. 2. Pour-over coffee making in the workshop.

values, making pour-over coffee a rich context for exploring how personal values can be effectively integrated into the design of smart technology. This richness also makes it an excellent domain for examining how smart technologies can cater to individual user needs while enhancing the overall user experience.

Finally, the strong commitment of pour-over coffee enthusiasts to their brewing rituals fosters a critical and reflective attitude towards any technological interventions. This criticality ensures that any smart technology introduced into the process is rigorously evaluated not just for its functionality, but for how well it aligns with and supports the user's values and the integrity of the brewing experience. This reflective stance is invaluable for a study focused on user participation and value integration in technology, as it provides deep insights into how technology can either support or undermine the user experience.

4 Method

Building on prior work of bringing people's voices into the examination of designer-led design paradigms in designing smart technologies, we identified two key challenges: 1) evaluations by non-experts often focus solely on design outcomes, without the opportunity to engage deeply with the design process itself; and 2) respect for design authority and self-doubt regarding people's own expertise can lead to inhibition in expressing critical feedback. As such, we designed a participatory evaluation [22, 45, 70, 71] and specifically implemented it for the coffee enthusiasts who participated in the two-day participatory design workshop related to the design of smart technology for the pour-over coffee experience. The coffee enthusiasts served dual roles as both participants and evaluators within the design process, which means they not only reflected on their interactions with the team members within the user-centred design process but also observed, recorded, and examined how the designers and engineers interpreted the raw data around them, defined key problems, and generated design prototypes. This feedback enabled us to investigate how end-user values were considered—or potentially overlooked—throughout the design process. We were interested in motivating discussions on both technical and experiential aspects of design by prioritizing deep engagement and the active inclusion of non-expert voices.

4.1 Workshop Planning

The two-day workshop was held in a university design studio, with all participants attending in person. The workshop was divided into two sessions, one held on each day. Below, we outline the planning and structure of the workshop, focusing specifically on the roles and performances of designers, engineers, and coffee enthusiasts (See Figure 4). In particular, we will separately explain the configuration assigned to experts (designers and engineers) and non-experts

Fig. 3. Pour-over coffee workshop.

(coffee enthusiasts) to highlight the special participatory evaluation we designed to capture critical feedback from participants throughout the design process.

4.1.1 Design Practice in the Workshop.

The goal of Session 1 was for each group to explore how technology could enhance the pour-over coffee experience using a user-centred design process. Before the session began, there was a 15-minute ice-breaking activity. Each of the five coffee enthusiasts brought their coffee beans and equipment for pour-over coffee, and they brewed the coffee themselves while thinking aloud. As they brewed, group members engaged in casual conversation, helping to establish rapport with each other. Although this activity was not considered part of the formal UCD framework, it served as a sensitization process [69] for the group members, encouraging them to focus on the intricacies of the pour-over coffee process, identify initial design entry points, and foster communication and collaboration with other team members.

During the formal design practice, each group followed a user-centred design framework (see Figure 4), with different tasks and materials provided for the designers, engineers, and coffee enthusiasts. In the user research phase, designers and engineers focused on understanding key user information to identify design opportunities and user preferences. The discussions covered various aspects of the coffee enthusiasts' daily coffee-making habits, brewing scenarios, and equipment preferences. To ensure comprehensive research outcomes, designers were encouraged to use design tools and techniques during their inquiries. In three of the groups, coffee enthusiasts were asked to brew another round of coffee, with one designer even attempting the brewing process themselves. Following the user research, designers and engineers entered a collaborative phase, where they used guided processes and techniques within the design framework to analyze user data collaboratively identify design opportunities and define key issues. By the end of the day's activities, each group developed an initial design concept as a preliminary outcome, which they continued to refine and perfect outside of the workshop in preparation for the next day's presentation. During Session 2 on the second day, each group's designer and engineer presented their design outcomes, followed by a Q&A session. The outcomes covered the design background, user analysis, technical feasibility, and prototypes.

4.1.2 Participatory Evaluation within the Design Process - Configuring Co ee Enthusiasts as Evaluators.

Before the workshop began, all coffee enthusiasts were informed that they would undertake a specific action during the design process: to identify any areas they found problematic, particularly those related to their participation in design and interactions with groupmates. The researchers explained a rationale behind this setup, highlighting the aim of addressing latent issues commonly found in user-centred design, thus directing their attention toward these areas. Participants were encouraged to offer critical and provocative feedback to ensure their genuine perspectives were captured. A workbook (see Figure 5) was also provided to help frame their concerns within the broader context of the user-centred design process. Notably, the primary goal of this configuration was to uncover potential issues rather than directly

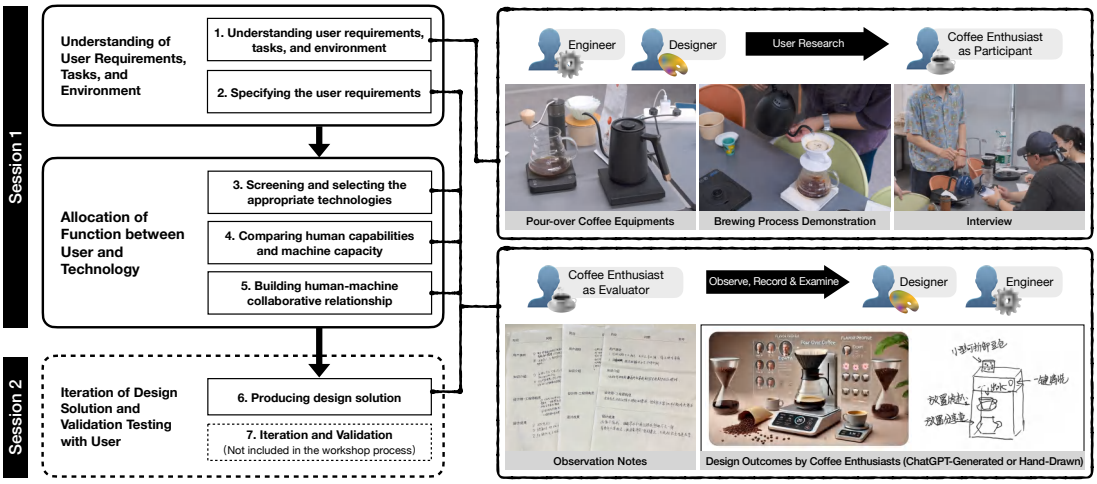

Fig. 4. Workshop planning within the design framework.

influence the design outcome. Thus, the assessments and critiques were conducted privately; while engaging with designers and engineers, participants also silently observed, reflected, and recorded their thoughts throughout various phases, including the analysis, design agenda development, identification of key issues, concept creation, and final design presentation. These insights were later shared during individual post-workshop interviews. In fact, the designers and engineers were not unaware of the special role assigned to the coffee enthusiasts. They had provided informed consent before the workshop, acknowledging that coffee enthusiasts would observe and document their feedback to aid reflection on the design framework. This ensured their evaluation did not involve any element of deception and prevented potential ethical issues commonly associated with participatory research.

Furthermore, during the second session, coffee enthusiasts participated in a design activity alongside the researchers. They were invited to use traditional tools, such as paper and pens or generative AI, to sketch or depict their concepts regarding how intelligent enhancement capabilities could improve their manual coffee brewing experience. The emphasis was placed on concept communication over visual clarity to express their values and needs. This encouraged a shift in their role from users to designers, as they actively contributed by materializing expectations that diverged from the professional designers' concepts, reinforcing their needs and expanding upon previous critiques of design.

4.1.3 Follow up interview.

After Sessions 1 and 2, semi-structured interviews (20-30 minutes) were conducted with each coffee enthusiast. Over the course of the two interview days, the materials generated from the design activities were reviewed, including workbooks where critiques were documented, data generated from discussions among the designers and engineers, notes from various design tools such as user journey maps, and slides from the final design reports. These materials effectively aided the enthusiasts in recalling and identifying the issues of concern, often serving as tangible evidence to support their critiques. As the interviews progressed, the discussions expanded to encompass their daily coffee-making experiences, needs, differing values regarding coffee, and perspectives on the potential role of intelligence-augmented capabilities. Additionally, the ideas presented during the participatory design session were

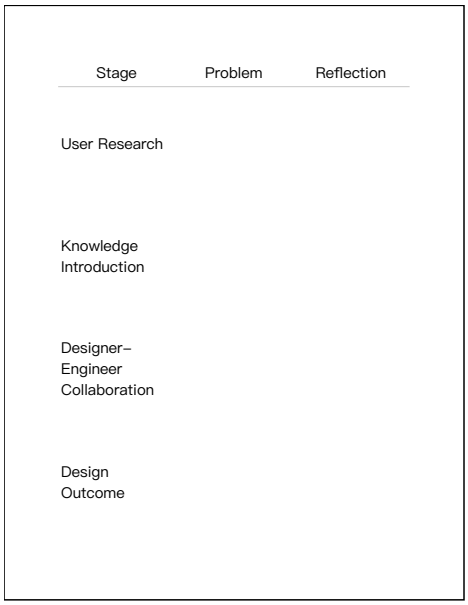

Fig. 5. Printed workbook for coffee enthusiasts.

reviewed, facilitating further understanding of the distinctions between their considerations of needs, values, and technological interventions and those of the experts.

4.2 Participant

A total of 15 participants were selected in the workshop to represent three distinct roles: designers, engineers, and pour-over coffee enthusiasts, with three participants in each group (see Tables 1 and 2). The participants were recruited through an online questionnaire as part of a larger workshop initiative that validated the UCD-based design framework using the design of smart technology for the pour-over coffee experience as a case study. Interestingly, the motivations for participation varied among the different roles. Designers and engineers were primarily driven by a desire to explore how smart technologies and new design methods could enhance the pour-over coffee experience, reflecting their professional interest in improving user experience with technology. In contrast, coffee enthusiasts, while curious about new technological approaches, often expressed a degree of skepticism regarding the potential of smart technologies to genuinely enhance their coffee-making practices. This mix of curiosity and skepticism among enthusiasts provided a rich ground for exploring reflective perspectives on the role of technology in coffee brewing.

In terms of the actual recruitment, the selected participants brought a diverse range of backgrounds and expertise to the workshop. Designers had formal education in interaction design or smart product design, with a solid understanding of human-centred design processes. Engineers possessed foundational knowledge in human-computer interaction, with specializations across disciplines such as computer science, microelectronics, and mechanical engineering, reflecting the interdisciplinary nature of smart technology development. Coffee enthusiasts were chosen for their strong interest in speciality coffee and hands-on experience with pour-over brewing techniques. The selection criteria for coffee

Table 1. Details of designers and engineers.

Role	Field of Expertise	Years of Experience
Designer	Interaction Design	3 years
Designer	Digital Media	3 years
Designer	Interaction Design	6 years
Designer	Interaction Design	4 years
Designer	Industrial Design	7 years
Engineer	Computer Science	7.5 years
Engineer	Computer Science	4 years
Engineer	Mechanical Engineering	5 years
Engineer	Microelectronics Science and Engineering	8 years
Engineer	Mechanical Engineering	4 years

Table 2. Details of coffee enthusiasts.

Name	Years of Coffee Experience	Field of Expertise
Michael	6 years	Materials Science
James	1 year	Finance
David	2.5 years	Automotive Engineering
John	3.5 years	Human Factors
William	2 years	Chemistry

enthusiasts emphasized diversity in expertise, with participants ranging from novices with less than a year of experience to seasoned brewers with over six years of practice. This range was intended to capture a broad spectrum of user insights, from those reflecting initial interactions with pour-over coffee equipment to those shaped by long-term engagement.

It is important to note that in the Findings and Discussion sections, the term "participants" specifically refers to the coffee enthusiasts who took part in the workshop, not the designers or engineers, to emphasize the non-expert perspective in the research.

4.3 Data and Analysis

The qualitative data covered in the study included audio recordings of interviews between designers, engineers, and coffee enthusiasts, as well as the enthusiasts' workshop workbooks, design concepts, presentation recordings, and follow-up interviews after Sessions 1 and 2. The researchers also observed and recorded notes during the workshops. All participants signed informed consent forms prior to the workshop. We employed reflexive thematic analysis [14] with inductive methods. Specifically, we reflected on our positionality as designers and researchers and how our biases might influence the interpretation of data from inexperienced participants. This reflexive approach allowed us to examine power dynamics and identify overlooked user values in the design process. Open coding was conducted in two cycles, with four researchers collaborating to generate the final analytical results. Our focus was on how the coffee enthusiasts expressed their values related to coffee, the critiques they offered on various design aspects and their significance, their views on the design outcomes in light of these critiques, and their perspectives on how intelligence-augmented capabilities could enhance their manual coffee brewing experience, along with their actual reflections on this potential integration.

5 Findings

5.1 The Ritual and Personalization of Pour-Over Coffee: Varied Perspectives

While coffee is a common beverage in modern society, for pour-over coffee enthusiasts, the process transcends the mere need for ca eine (Michael, William) in their daily lives. During the design workshops and individual interviews, our participants eagerly shared intricate details of their daily pour-over coffee routines, ranging from their preferred grind size to their agitation techniques aimed at optimizing coffee extraction. Despite the process being more cumbersome compared to purchasing or brewing instant coffee, participants consistently expressed a deep sense of pleasure. For instance, David disclosed that he essentially makes co ee every day and thoroughly enjoys the connection with it (David). He further elaborated on the ritualistic aspects of making coffee, such as hand-pouring hot water over coffee grounds, describing it as a way to feel a dopamine hit (David) in his daily life.

However, as the interviews with researchers delved deeper, differences emerged in what participants valued most in their pour-over experiences. Some participants described themselves as results-oriented, where all efforts were focused on achieving a satisfying cup, with the brewing process seen merely as a means to that end. Michael, for example, emphasized the avor of the nal product as a primary value: For me, it's about having a full avor with no negative notes and a suitable strength (Michael). He expressed a preference for consistency in flavor, which led him to use standardized techniques and equipment with only slight variations. Similarly, John succinctly noted, What matters most is that it tastes good; I don't have to make it myself, but it must taste good (John).

In contrast, other participants highlight the brewing process as integral to the pour-over experience. While flavor remained important, they insisted the act of making coffee often holds deeper significance. John shared his philosophy during an interview with one of the authors: The brewing re ects my thoughts, and this sense of control is even more enjoyable… since I don't consider my drink as just a beverage, but something infused with my understanding. (John) This perspective positions coffee-making as a way to practice and express one's coffee aesthetics. John recounted his experiences collaborating with fellow enthusiasts to purchase and even roast beans, underscoring his belief that engaging more with the upstream process is essential to upholding your aesthetic (John).

As such, when a provocative question— Do you think the process of making pour-over co ee could be partially replaced by machines?—was posed during individual interviews, participants' responses varied widely. William, for instance, highlighted that his priorities shaped his preferences: The making is why I became a pour-over lover; otherwise, I'd be an espresso fan… If I cared more about time, I would fully automate it. Like most of the fully automatic machines we see today are for espresso because it's reliable (William). Similarly, John referred to the latest definitions of pour-over coffee to express his resistance to technology as an alternative: The user experience is explicitly included in the de nition. That aligns with mine… I mean, your co ee experience starts from the time when you choose the methods and select the beans it's a complete experiential process (John).

However, other participants also voiced openness to the idea of AI playing a more involved role in pour-over. For example, Michael welcomed the idea that the system indeed helped him achieve the best possible flavor. He then explained why such a system aligned with his expectations: Since I drink co ee every day, I'm not going to focus on the process every single time it's mainly about the result (Michael). These conversations around personal preferences and differing opinions on technological intervention often expanded into deeper and broader discussions—touching on their diverse lifestyles, experiential knowledge, and the varied values they attach to their pour-over coffee experiences.

5.2 Reflective Critiques: Evaluating Design Process

Throughout the workshop, participants were not only engaged in collaborative activities with designers and engineers as per the design framework but were also distinctly positioned as evaluators and critics. Their role involved identifying potentially unreasonable details in the dialogues and records generated by their team members, which they were instructed to note quietly in their workbooks. Given their distinct background from that of designers, participants were encouraged to assess the designs based on their own experiences, values, and needs, rather than from a designer's perspective. This led to a significant amount of questioning, reflection, and critique towards both the designers and the design process, which in turn enriched the conversations with reflective insights.

Our participants reported various issues with how they were involved in the design process. All of them told the workshop assistants that their engagement was primarily by *"being consulted"* during the initial stages of the study. Group discussions in the workshop typically began with designers asking the participants to demonstrate their pour-over coffee-making process with their own equipment. However, these sessions often quickly developed into designer-led, question-and-answer formats. For example, William described what happened in his group: *"(the designer) always kept asking me if there were any discomforts when I was making… perhaps she was thinking about what kind of device could solve my problems."* (William). This indicates that the control of the session remained firmly in the hands of the designer as the focus was being driven by the designer's assumptions rather than the participants' insights. The participants critiqued the designers' assumptions about what issues were most important in the pour-over. In one instance, Michael was asked by the designer if his coffee grinder was unstable and prone to toppling. Although Michael clarified that this was rarely an issue, the designer continued fiddling with the grinder until it eventually did fall, seemingly validating her assumption. Michael complained that: *"She might take the problem she sees as the user's problem, but it's really not."* (Michael).

Such misunderstandings raised concerns about the potential impact on the design outcomes: *"They focus on things that don't truly impact the experience, so they might end up designing based on pseudo-needs."* (John). Interestingly, some participants chose to respond to the designers' relentless questioning by expressing needs that aligned with the designers' expectations. However, they later confided to the research assistants that they did not consider these needs particularly important: *"Some issues may occasionally seem annoying, like when the coffee grounds collapse, but I wouldn't call that a pain point because it doesn't significantly impact the result I care most about."* (William). David even attempted to challenge the designers' mindset to exert more influence over the final product: *"I had to constantly emphasize my needs, my needs, and make them drop some of their fancy ideas or the pain points they imagined I had."* (David).

Moreover, participants increasingly shifted their critique toward the design tools and techniques employed during the workshop. For example, James found the design tools and frameworks presented to be *"too abstract"* to grasp, suggesting that participants might struggle to comprehend or engage with these configurations as intuitively as designers do. James also noticed that his user journey map labelled each sub-process of his coffee-making experience with either "positive" or "negative" emotional experiences by the designer, leading him to question the relevance of focusing on emotions in this context: *"They kept asking me about emotions, but I feel that during the brewing process, my emotions don't fluctuate much."* (James). Similarly, Michael believed that the significance of emotions in his experience might have been exaggerated and misinterpreted by the designers:

> *"I don't think the emotional experience is necessarily negative… It always seemed like they had this binary view of emotions as if everything had to be either good or bad, but it should be a neutral, emotionless activity… For instance, when I wet the filter paper, it's not purely negative. If it's done perfectly, I might*

> *even feel happy. - it could vary depending on the outcome, or there might be no emotion involved at all when measuring something."* (Michael)

5.3 Exposing the Disconnect in Technology and User Value

After watching their group's final design presentation, participants shared their thoughts on the concepts and prototypes with the researchers. Initially, they typically showed polite agreement with the efforts of other team members. However, when encouraged to offer critical feedback, doubts began to surface regarding whether and how technology should be integrated into their pour-over coffee experience.

For example, Group 1 developed a flavor controller that utilized data from various sensors, including smell and vision, to train algorithms governing the brewing process. Michael expressed skepticism about this feature's value: *"When it comes to coffee, human judgment is still more important. Sometimes data alone can't determine whether a cup of coffee is good, so ultimately, human feedback remains the most crucial tool."* (Michael). He also critiqued another feature—a big data-based coffee bean recommendation—by highlighting the designers' lack of experience, joking, *"It's obvious they don't understand how users typically buy coffee."* (Michael). He then shared more knowledge about the coffee bean market and product iteration with the researchers, speculating on potential blind spots of the designers. He then leveraged his knowledge of the coffee bean market and product iterations to demonstrate specific flaws in the designers' understanding, highlighting why such a envision from the design would be nonsense for user experience.

Similarly, William felt that the data-driven features in their group's design showed insufficient consideration of some of his inputs: *"Although they have asked me the parameters that most affect the final result, they didn't consider why users would care about those parameters. It's because human skills are limited and we can't directly measure the coffee's concentration and extraction rate. So, users focus on what they can control, like extraction time, viscosity, and water temperature, to influence the final outcome."* (William). These critical reflections were frequently paired with participants' constructive suggestions on how AI could be better utilized in the design process, grounded in their deep knowledge and hands-on experience with pour-over coffee. For instance, William then added deeper insights into where data should be focused on to better extract flavour: *"Machines can replace humans in measuring extraction rate and concentration, as they can do it directly. So, this is what machines should be doing... rather than taking on tasks that humans can't perform."* (William). As such, the participants' extensive understanding of the coffee-making process, combined with their accumulated experience, enabled them to present diverse and practical perspectives on how technology could genuinely enhance the coffee-making experience

While all the participants demonstrated distinct and deeply-held values associated with their pour-over coffee experience, they consistently reported that these values were inadequately represented in the design. Although they felt they had ample time to express their needs and values to the designers and engineers, issues of incomplete understanding, outright misunderstandings, or entanglement of their priorities with the designers' assumptions persisted. For example, after reviewing the final design prototype and his user persona, James identified significant discrepancies with his input, realizing that some of the values he emphasized as crucial to his pour-over coffee experience were not fully understood: *"At least, the needs and pain points they've written don't reflect what I consider important."* (James). John expressed dissatisfaction with the design outcome, possibly due to a key aspect of his brewing process being misunderstood:

> *"I think there's a misinterpretation here. They might think I enjoy the brewing process itself, but what I wanted to emphasise is that I consider it a way to express my thoughts… That's also why I don't want to be replaced by smart products."* (John).

Additionally, the entanglement of values between the designers and enthusiasts became evident in some unexpected features. Michael humorously referred to a color-changing carafe designed by the team as a ash of inspiration : Carafes are usually made of clear glass, and adding a color-changing feature seems unnecessary. You generally don't need to check the liquid level during the actual pour-over process. And this feature might not even be aesthetically pleasing. (Michael). He saw these superfluous features as a clear example of the designers' inclination to create a solution in search of a problem(Michael). While he understood the occasional creative impulse from designers, he also candidly rejected the imposition of the designers' values on the user: Users shouldn't have to pay for these they won't use. (Michael). John speculated that the root cause of this issue lay in the unequal control over the design process: I'd say the control's not really in the user's hands."... The designers might adopt some ideas from me, like considering the need for easy cleaning, but they'll also expand on my original needs and add some of their own interpretations.(John). Since participants were primarily consulted rather than actively engaged in the design process, they were left in a position where they had to accept a subtle imposition and the resulting conflict between their own needs and the designers' interpretations.

5.4 From Consultation to Control: Embedding needs and values.

At the end of the individual interviews, these coffee enthusiasts were encouraged to use pen and paper or generative AI tools to illustrate ideas on how smart technology might assist them at various stages of their pour-over coffee experience. Although the participants seemed to be merely consulted during the design process, they reported that the workshop discussions and observations continuously prompted them to think about potential design solutions. This reflection is captured in Michael's comment: ... I've considered. When their questions got to me, I also thought about how I would design it, but I can't guarantee whether it would be feasible.(Michael)

Since the participants had limited design experience, there was some trepidation about how to accurately create the features or artefacts they envisioned when they began drawing or generating images. Interestingly, these "unsatisfactory" drawings and AI-generated images often motivated participants to more clearly articulate what they truly valued. For instance, a conversation took place between William and the researcher while reviewing several AI-generated images of smart devices made by him:

> William: I asked ChatGPT to generate an image, but the drawing is quite... (examining the image) because I wanted to see the extraction status during brewing. It could collect data on the current extraction rate although it might not be possible now, but I'm imagining if there were something that could measure how much the co ee has been extracted or indicate to me when the extraction is just right, that would be great. So, something like that...This part might show the measurements or the weight on top, and here could be the extraction curve or something, but it's probably drawn too abstractly...
>
> Researcher: No worries, the visual representation doesn't matter as much. Just tell me what you want as a product.
>
> William: Yeah, it's mainly about representing these quantitative indicators. And if it's smart enough, it could use my nal feedback, which I could input via voice or text, to o er suggestions or even make the adjustments directly. That would be good.

Their images and descriptions served as an outlet for our participants, explicitly or implicitly embedding their needs and values. John, who had the most extensive experience with pour-over coffee making, revealed that he couldn't imagine any needs related to brewing co ee that a smart product could fulfill(John). Consequently, he highlighted

the cleanliness of his coffee-making workspace as a core need and sketched simple elements to express potential technological designs, such as a sink with ultrasonic cleaning technology, a built-in pour-over device, and a conveyor-style replaceable countertop. Notably, he frequently referenced problems with the designers' outcomes, emphasizing the aspects he prioritized in his own design. Additionally, he repeatedly referred to his daily coffee-making routines and habits during his explanation, to better demonstrate why certain aspects were important to him. Although there were no generative materials to create prototypes at this stage, their words and generated images supported their voice of what was crucial to their experience and how they hoped technology could be utilized to enhance their well-being.

6 Discussion

This study builds on the growing body of HCI research that emphasizes the significance of configuring user participation in designing smart technology [21, 39, 83, 87]. Our findings suggest that the diverse values and experiences of people significantly influence their attitudes toward how a technology-augmented capability could improve their user experience. Meanwhile, there were bottom-up perspectives from people showing the problematic nature of the incorporation of people's values in a user-centred design paradigm, which led to unsuccessful technical design. Guided by these insights, we reflect on 1) how the transmission of user values within top-down, designer-led design paradigms become problematic; 2) share implications of configuring people as evaluators in the design process, and how their critiques foster reflective thinking in technological design; and 3) discuss the role of people as "experts of their own experiences" in supporting a participatory turn in smart technology design and advocating for the democratization of technology and the enhancement of human well-being.

6.1 Why people's value is excluded

This study was initiated due to a long-standing concern related to user participation in HCI [6, 30, 49, 83]: whether UCD processes are truly capable of ensuring that people's values are effectively integrated into the decision-making of technology design. Our findings indicate that almost all participants voiced criticisms questioning the user-centred paradigm in this regard, suggesting the design agenda often fails to reflect their values. These resonate with numerous cautionary examples in the HCI literature, where, despite claims of being user-centred, some intelligent experience designs still exhibit a notable disconnect from the values of the user groups they are intended to serve [3, 21, 32]. Some existing explanations [43, 53] have often attributed such dissatisfaction to individual preferences rather than acknowledging potential flaws within the design process itself. However, by allowing participants to directly observe and evaluate the design process, our research reveals how critical aspects of their pour-over coffee experience were systematically excluded from the final design. The key issues identified were related to the modes of participation, top-down interpretation, and the exercise of dominion rather than agency by designers.

6.1.1 The modes of participation.

Our findings suggest that low levels of participation in the design process pose significant risks to the expression of participants' values. The participants in our workshops perceived themselves to be engaging in purposeful, investigational dialogues, which were typically directed towards areas deemed valuable by the designers. While such an approach has involved people in a design process and did somewhat alter designers' preconceptions, the designer-dominated agenda of the interviews was criticized as overlooking what was really important from people's perspectives. Even when some so-called "needs" were expressed within the pre-constructed framework, it was often disclosed these voices did not reflect real aspects of the pour-over coffee process that were expected to be changed but were instead to fulfil their role as 'consulted' individuals.

Vines et al. [82] highlight the danger of participants telling researchers what they want to hear in participatory design and qualitative methods, which prevents designers from truly understanding people's values. To address this, they advocate encouraging user critiques as a form of meaningful participation that influences the final direction of technology implementation. We support this power of critique, as it clearly brought to the fore participants' values in coffee making during the workshops. Further to say, we support providing participants with more participatory tools for building dynamic, responsive spaces between designers and users, as seen in the workshop's use of pen-and-paper and AI-generated tools. Consistent with many studies that have explored the use of participatory and co-design techniques for motivating active participation in technology design, planning and agenda setting, we suggest that designers employ these tools and techniques to identify "boundary objects" [72] between designers and participants, which emphasizes the contrast between the perspectives as a trigger to challenge different perceptions or provoke discussions on value differences.

6.1.2 Top-down interpretation

Second, a top-down misinterpretation by designers could lead to problematic value transmission. Our participants reported a range of inappropriate understandings regarding what they valued in their pour-over coffee experience, including trivial considerations being wrongly elevated to critical user needs, the oversimplification of emotions into binary categories in user journey maps, irrelevant user personas, unexamined and unmet design expectations, and the misinterpretation of key pleasurable aspects of the experience. Whilst user-centred approaches often treat the interpretation of participants' input as open-ended without absolute right or wrong, the discrepancies voiced by our participants themselves between their intended meanings and the designers' interpretations suggest that there are indeed issues in value transfer. However, rather than attributing this to an individual designer's unconscious bias or selective emphasis, we caution against the potential crisis brought about by the design process itself—where nuanced designer-determined interpretations in design may systematically exclude genuine user values. Notably, in the individual interview, one of our participants suggested reconfiguring the design process with a new 'verification stage' to ensure that the key themes identified by designers match the meanings intended by participants. This implies the significance of multi-layered involvements which allows people to actively engage in the decision-making and control of the design direction [83]. Additionally, as noted clearly by feminist HCI studies [7] , some commonly used design techniques and tools carry inherent semiotic meanings and design discourses. These often represent a "design-style" sensemaking [77] and metaphorical understanding of people's behaviors, experiences, and values. While the advantages of these tools in UCD are widely recognized, as they effectively connect the impressions of target user groups with design and development teams, we urge designers to use these tools reflexively [4] by considering the disharmony between the metaphorical stances these tools imply and the sensemaking processes of the target groups they aim to serve.

6.1.3 The exercise of dominion

We recognize that the deeper cause of the loss of participant value in design outcomes often lies in top-down power dynamics, where designers exert dominion rather than foster the participants' design agency. Design agency, as emphasized in participatory design and design ethics research, refers to the capacity of participants to actively shape the design process and decisions, rather than being passively subject to the designer's control [24]. While UCD has evolved beyond earlier paradigms in engineering and applied arts, which relied heavily on the designer's personal experiences and agency to generate effective insights [18] , a critical issue remains: designers often exert disproportionate control over defining the design problems and shaping the interpretation of participants and their needs. Our findings are replete with critiques on this, where participants expressed sentiments such as,

"I wanted/thought this, but the designer gave me/thought that", highlighting the inherent conflict related to design authority and power dynamics.

Indeed, the designers often necessitate a degree of authority, where they are responsible for upholding higher-level directives from" corporations', research teams', and government agencies' priorities, mandates, and resources" [21]. Within UCD, designers usually initiate and direct a project, which is crucial in applying professional knowledge, advancing design projects within established frameworks, and meeting commercial project agendas. However, this dominant configuration often, whether through explicit actions or subtle influences, deepens the disadvantage of participants within the power dynamics between them and the designers. As such, our participants attempted to influence the direction of technological design by emphasizing their needs or critically engaging with the design artifacts. However, despite these efforts, the final design outcomes still fell short. This implies that UCD often fails to truly share design authority with users at the outcome level, leading to a dilemma between adhering to agenda-driven goals and creating designs that genuinely reflect what is considered good or appropriate by the participants.

Despite emphasizing UCD's disadvantages in power distribution, we do not intend to advocate for replacing UCD with pure co-design in design practice, considering the lack of resources and the impracticality involved. However, we still call for a rethinking of the designer's role in UCD, aligning it more closely with participatory and co-design approaches that promote greater power-sharing at every stage of design. The implicit benefits of this approach are more likely to result in technology that fundamentally enhances people's well-being. This perspective resonates with Xue et al.'s concerns [88] regarding the power dynamics in domestic technology design, emphasizing the need for pragmatic design participation. They advocate for designers to act as facilitators of collaborative platforms within system design, empowering stakeholders to take on active roles and thereby mitigating the marginalizing effects that can arise from a designer-dominating approach to technology use.

6.2 Critique, and People as Evaluator in Design

Despite their lack of formal design knowledge or experience, our participants were empowered to critically question every aspect of the design process, offering a wide range of bottom-up perspectives that challenged the status quo. These include exposing their involvement as a form of pseudo-participation [19], where people are marginalized in decision-making due to designer-led configurations. Participants also argued that their perspectives were subtly marginalized as some design motivations were based on underlying assumptions of the designers rather than the priorities revealed by the participants, highlighting how technical designers may, consciously or unconsciously, prioritize their concerns over the core values expressed by participants [21]. Furthermore, participants questioned the interpretation of their data, repeatedly challenging established theories, techniques, and resources prevalent in traditional UCD by asking whether emotions really mattered in their experience, whether personas accurately reflected their reality, and whether user journeys truly captured their understanding of the pour-over coffee process. Additionally, concerns were raised regarding the adoption, appropriateness, usability, and ethical implications of technology and smart features, with some participants even fundamentally questioning the necessity of AI interventions in enhancing the coffee-making experience. They used their own experiences as examples to encourage researchers to rethink or offer constructive suggestions. In summary, our findings indicate that participants had profound and unique insights into how technology could enhance their pour-over coffee experience, positioning them as rational actors—neither advocating for techno-utopianism nor subscribing to techno-conservatism [9]. However, this perspective also led them to a more pragmatic critique of how technology often fails to align with the needs and values they expressed.

We interpret the participants' engagement in critically assessing the design process during the workshop as a unique form of participatory evaluation—participants acting as evaluators within design rather than merely for design. That means people take action not only through evaluating the final system but also by deeply engaging with the design process. While HCI is familiar with involving non-experts in the evaluation phase of technological design, most existing work in the field explores how to empower people by engaging them with pre-existing design resources or artefacts to counteract marginalization [22]. However, in our research context, the participants continuously observed how they were integrated into and being interpreted within the design process, thus using this as a basis for evaluating the design. This approach allowed participants to precisely pinpoint the stages where design issues originated, which is crucial given the biases identified early in the process. One perspective supporting this in HCI literature is abandoning the narrow view of technology as production. Dourish [23] argues that "technology… is a site for social and cultural production; it provides occasions for enacting cultural and social meaning." This implies that the goal of evaluating a technological design should not be limited to assessing the functionality and materiality of a product, but rather to exploring how the meanings associated with the technology are constructed so as to uncover the gaps between designers and participants as actors in conveying needs, implementing values, and envisioning the future of technology.

Furthermore, rather than relying on input from designers or experts, this approach inherently advocates for participation in design [13] by actively involving non-designers in assessing how their data and identities are interpreted and understood within the design process. These critiques allowed participants to voice their concerns and identify design issues, which aligns with the longstanding concerns of Scandinavian design tradition [54] and the broader discourse on technology design. Interestingly, many of these critiques and evaluations emerged spontaneously from the participants themselves rather than motivated by the workshop assistants. Indeed, despite being encouraged to share opinions during tasks and interviews, participants demonstrated an unexpected acuity in identifying issues in challenging the presumed legitimacy of the tools and techniques trusted by designers. This transformative action reveals that the tensions surrounding user participation, design authority, and value transmission between participants and designers are indeed prominent in design practices, with these critiques serving as a tangible and thought-provoking indicator of such conflicts.

Reflection on Configuring People as Evaluators

Nevertheless, it is notable that participants' critiques were often unrestrained and could at times become playful, emotional, or even biased, which suggests that researchers and designers must carefully consider how to interpret the feedback received. As such, rather than taking semantic aspects of participants' comments on the design process or artefacts, we also argue that researchers should reflect on the underlying experiential factors, contextual influences, needs, and values related to the participants. Another challenge lies in the fact that UCD practices often involve broader user groups and design processes that are lengthy and iterative [68] , which can differ significantly from the focused and controlled setting of our workshop. Despite these differences, our research emphasizes the importance of integrating critique as a valuable resource within designer-led design processes. By embedding critique, designers can more effectively capture the authentic voices of users. This raises an essential question: Who should be responsible for initiating such critiques? Addressing this invites a deeper reflection on the often subtle and hidden differences between the inherent design thinking of professionals and the lived experiences of users. These differences highlight the need to carefully consider how technology is created to truly align with and enhance the user experience.

Moreover, earlier participatory evaluation studies [45] have suggested that the expertise of evaluators should be ensured. However, we suggest a different perspective that this inherently conflicts with the principles of a bottom-up

evaluation paradigm. While it is understandable that evaluators need a certain level of knowledge to ensure their feedback is pragmatic and constructive, this requirement may selectively include individuals whose thinking aligns with the researchers' expectation of evaluation, which hinders the inclusiveness of technology. This leads to a deeper discussion on who defines the standards for evaluating the impact of technology on well-being. Our findings indicate that evaluators do indeed need expertise—but not in design or technology, but rather in experiential knowledge. We advocate for incorporating individuals as experts of their own experiences into technological designs as a way to ensure meaningful participation while acknowledging the agency of designers and researchers. In the next section, we will discuss how individuals as 'experts of their own experiences' can support responsible AI design and advance the values of technology democratization.

6.3 People as Experts of Their Experiences in Designing Smart Technology

Our findings indicate that, by actively contributing reflections within the technology design process, non-experts can challenge the forms in which smart technologies are designed into systems and advocate for these technologies to genuinely enhance well-being. We emphasize the critical importance of recognizing people as "experts of their own experiences" in technology design [63] —a concept widely acknowledged in co-design and participatory design literature. This concept typically means that personal experiences are regarded as situated expertise because the individuals' work or lives are directly impacted by technological change [12]. Clearly, the five pour-over coffee enthusiasts involved in this study are passionate about the practice. Specifically, their understanding of the socio-technical interplay within their coffee-making routines, regardless of their varying levels of expertise, enables them to articulate how their acceptance or rejection of intelligence-augmented power as a proxy in the coffee-making process is influenced by their specific scenarios, values, and needs. Even though these participants are not experts in AI technology, as experts in their own experiences, they possess insights that are more relevant to how to implement smart technology than those of designers and engineers.

Our study provides valuable experiences and insights into how participants' experiences resonated with some of the HCI community's concerns, demonstrating the potential to steer technological implementation toward enhancing well-being alongside user-centred design loops. For example, the participants were wary of AI technology's power to replace human judgment and behaviour in coffee making, questioning whether dominant techno-solutionist narratives of efficiency and productivity [10] are truly essential in experience-focused technology design, as this could diminish the enjoyment found in manual processes and experiential thinking. Similarly, they rejected formalistic approaches to enable AI, arguing that instead of focusing on measurable data like extraction time and water temperature, more attention should be paid to less perceptible metrics such as extraction rate, which users cannot directly sense. This highlights the valuable insights participants can offer in addressing how AI can extend human capabilities and how technology might assist in this process [86, 87], which supports a pragmatic approach to technological innovation. Additionally, the participants readily identified and discussed the privacy and ethical risks associated with sensing technologies, reflecting widespread concerns about pervasive surveillance [34, 75]. While this study did not require design teams to develop fully functional prototypes, the expertise of participants as 'experts of their own experience' can help define what is acceptable or problematic in AI technology, becoming part of an iterative design process alongside the efforts of designers.

Involving people as "experts of their experiences" in design signifies a shift in perspective: moving from researching them to seeking their advice. The implication is that designers and researchers may need to relinquish an inherent "arrogance" derived from their professional expertise or belief in their ability to decipher and sense make the situation.

Indeed, it is not uncommon in HCI to include technical experts or industry insiders to gain their insights [37, 51, 76]. However, it is clear that in such contexts researchers typically refrain from imposing top-down interpretations or deconstructing authoritative viewpoints, but rather consider how best to express experts' experience in relation to technology design, as emphasized in co-design studies [16] that highlight knowledge exchange among interdisciplinary experts. Therefore, we call for reconsidering the forms of participation within this concept. In our study, participants were explicitly invited to act as evaluators of technology design and sought feedback on what they perceived as problematic in the design process, how they viewed the designed smart features, and even engaged in generating concepts themselves, and thus demonstrated a possible way to include people with their own experiences in the design of smart technologies. Meanwhile, it is important to consider the impact of this role shift on participants, as they might be unaccustomed to exercising agency in design, having long been in a weaker position in the power dynamics of design. In response, we suggest drawing inspiration from co-design techniques [36, 59] as a possible way to for building capabilities with people. However, it should be pointed out that, as discussed earlier, smart technology design cannot fully escape the top-down design paradigm and be entirely replaced by co-design. Vines et al. [83] emphasize the importance of accounting for the agency of designers and researchers, even within democratic and humanistic principles. This requires a balance between the pragmatic insights which user participation can offer in technology design and the authority designers hold in actual implementation.

Additionally, we call for rethinking user-centred technology design under the vision of technology democratization, with a broader focus on the inclusivity of people. While our participants do not belong to traditionally marginalized groups as defined by HCI, our research highlights how people's experiences and values were commonly excluded in the configuration of technology. The participants' critiques were not passively solicited for research purposes but naturally stemmed from the inherent skepticism people often have when faced with new technologies that could alter their lives. They demonstrated a strong willingness to express their views, especially when informed that they could act as evaluators of how technology interventions impact their experiences. This eagerness stems from their longstanding dissatisfaction with certain smart products encountered in their coffee-making career, where they felt their needs were not adequately represented. As such, we advocate for recognizing the potential exclusion and marginalization that expert-driven processes can create, and for treating people's experiences as a valuable resource to address these issues. As feminist technoscience studies [64] have pointed out, 'knowledge is intertwined with power and participation, and it is not always self-evident how valuable knowledge is constituted in IT design, or who possesses this knowledge.' Although the participation from other stakeholders in a design process cannot fully bridge the gap between 'envisioned use' and 'actual use,' [25] we still encourage technology designers to reconsider the distribution of power in design. By treating people's experiences as resources within the design process, we can leverage the diverse, dynamic, and complex life experiences of people to influence the agenda for technological development. This is crucial for uncovering opportunities and addressing challenges in 'designing for the future experiences of people, communities, and cultures.' [63]

7 Limitation

In reflecting on our study, it is important to acknowledge that the small number of participants involved in the workshop were likely more motivated to engage than others, as they were specifically attracted by the recruitment questionnaire. This may have influenced their level of participation compared to a broader population. Additionally, while generating positive design outcomes in designing smart technology was a significant aspect of this work, our primary objective was not to explore the ultimate feedback on these design outcomes. Future research should aim to involve a larger,

more grounded and diverse community in design practices, ensuring that a wider range of perspectives becomes an integral part of the technological design process.

8 Conclusion

This study has contributed to the ongoing discourse in HCI by amplifying the voices and perspectives of participants, revealing the inherent issues in designer-led approaches, and demonstrating how user values are often lost in the design of smart technologies. Methodologically, we introduced a participatory evaluation approach, positioning people as evaluators within the design process, which offered new insights into integrating user feedback more effectively. Our findings underscore the importance of recognizing people as "experts of their own experiences" within UCD processes, supporting the design of technologies that genuinely enhance human well-being. Furthermore, our research engages with the participatory shift in technology design, advocating for a more democratized approach that places human well-being at the center of technological innovation, thus responding to broader calls for technology that serves the greater good.

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