How Design Researchers Interpret Probes

Understanding the Critical Intentions of a Designerly Approach to Research

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ABSTRACT

Since entering the HCI lexicon in the 1990s, Probes have been interpreted and used in divergent ways as a designerly approach to research. While originally positioned as a critique of dominant user-research methods, literature on Probes rarely reflects on such critical dimensions nor explicitly articulates the intents of using Probes as research artifacts. We conducted interviews with 12 design researchers who have worked with Probes within diverse Research through Design projects, exploring direct accounts of how and why Probes are used in practice. Our interviews brought to the fore the critical concerns behind Probe practices in relation to the language of Probing, relationships with participants, and motivations to challenge normative practices. While the pluralistic interpretations of Probes offered by our participants brings challenges, we discuss how making visible the critical motivations of our research opens up new ways of practicing and disseminating Probes.

CCS CONCEPTS

• **Human-centered computing**; • **Interaction design**; • **Interaction design process and methods**;

KEYWORDS

Probes, Research through Design, Cultural Probes, design methods

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1 INTRODUCTION

Probes have become a ubiquitous neologism for design-led approaches to research within the field of HCI. Originally coined as Cultural Probes by Bill Gaver and colleagues in the 1990s, the approach and its language has been interpreted widely since. In their highly influential Interactions magazine article (which as of January 2021 had been cited 2591 times, according to Google Scholar), Gaver et al. reported on how they were inspired by Situationist art techniques in their creation of Cultural Probes as part of a cross-cultural project named "The Presence Project" [31]. They explained their use of "packages of maps, postcards, and other materials [...] designed to provoke inspirational responses from the elderly people in diverse communities" [31, p.22]. These were used as "part of a strategy of pursuing experimental design in a responsive way" [31, p.22], where experimental referred to the exploratory, open-ended aspects of design-oriented HCI research. They saw Probes as embodying the artist-designers' playful, subjective and subversive approach to conducting user research, yet also avoided providing explicit articulations of why and how their Cultural Probes do this [33]. Even in the more detailed publications that provide more context for "The Presence Project" [32], the originators of Probes omitted framing them as a formal methodology. Perhaps as a result of being left open to interpretation, the approach has been widely adopted and resulted in a plethora of derivations. These include: Technology Probes [46], Empathy Probes [65], Informational Probes [20], Mobile Probes [44], Urban Probes [71], Value Probes [91], Design Probes [67], Broken Probes [47], Medium Probes [23], Evaluation Probes [63], Design Fiction Probes [79], Memory Probes [89], Metaphysical Probes [27] among many, many more. While each of these interpretations of Cultural Probes contribute to how we may conceptually understand the approach, Probes lack a definition or an agreed procedure [69] and in the literature might be framed as a collection of designed artifacts, an approach, a technique, a method, methodology, or a meta-method that supports other research methods [38]. Prior work on the *how and why of Probing* provides an entry point for beginners based on the commonalities in the preceding practices and suggests that Probes are typically used in the early phases of the design process (usually referred as the 'fuzzy front end of design') where the questions and the design directions are explored [62, 66–69, 78]. While some individual papers reporting on their use of Probes argue that the Probes can also be useful for latter stages of the design process [41], their focus remains rather on the instrumentalized use of Probes for design outcomes as part of design-led approaches to research than elaborating on how they came to be designed and used as a research tool.

In this paper, we agree that it is important to emphasize the designed nature of Probes and that the ambiguity around what they are serves to generate more open-ended interpretations of them [69]. For that reason, Probes are "not a specific method, but rather a family of approaches that are inspired by and named after the Cultural Probes" [68, p.67], as the plurality of the derivations insinuate. However, the ambiguity around the reporting on Probes as a research tool also serves to make implicit important aspects of their use as part of design-led research practices (something

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that Iivari argues is a concern more broadly with the reporting on design-led research practices in HCI [48]). Sharing how Probes are conceptually framed in individual projects is, we suggest, particularly important within the multi-epistemologies of HCI in order to understand how Probes are used to generate knowledge as part of the research frameworks they're used, as well as what needs to be articulated in their dissemination.

In this paper, we recover some of the prior conceptual and methodological discussions surrounding Probes and locate them in contemporary design-led research in HCI with the intention to push practice in new directions as opposed to locking it down into an off-the-shelf method. We first set out a brief historiography of Probes, discussing the multitude of interpretations that exist on the approach since the original work on Cultural Probes published by Gaver and collaborators [31]. We note how the critical and subversive qualities of Probes are often lost in published work, which is further problematized by a lack of detailed reflexive and reflective accounts of Probe practices in line with [48]. After this, we report on a qualitative study conducted with 12 HCI design researchers where we set out to explore with them why and how they used Probes in their Research through Design (RtD) processes. The interviews draw out explicit and implied critical intentions of our interviewees' Probe practices, where they brought forth concerns around how 'methods' are disseminated and built upon in HCI, how methods influence relationships with research participants, and how they set to use Probes to challenge normative practices in terms of digital technology design.

In discussing our findings, we reflect on how returning to the origins of Probes as a critique of method and practice in HCI highlights the importance of pluralistic and situated interpretations, adoptions and adaptations of the approach. We argue with this must come a greater commitment to the sharing of experiential and often unarticulated aspects of the situated practices of Probing, from which we might develop more nuanced shared understandings of the approach that still accounts for a plurality of epistemic perspectives. In doing this, our goal is not to provide guidance on how to use Probes or bring an absolute and unified definition to what a Probe is. Instead, we contribute new ways of thinking about, working with and disseminating Probes as part of HCI's ongoing interpretation of such situated, practice-based design-led methods.

2 PROBES, METHOD, CRITIQUE

When Gaver et al. [31] introduced their particular understanding of Probes, they set out not to provide specific instructions for a new method but rather to introduce an approach to HCI research "from the traditions of artist-designers rather than the more typical science- and engineering-based approaches" [31, p.24]. In doing so, they positioned Probes "as an alternative to more traditional forms of user research" [32, p.22]. Although their initial motivations behind creating Cultural Probes were somewhat due to having limited resources to conduct more traditional user studies in the context of their enquiry, they were also skeptical about the 'impersonal' aspects of these traditional methods [32]. They believed that the 'controlled' approach to studying users in context through traditional user research methods was limiting the emergence of new possibilities for technology design [32]; in other words, design's concern with *what could be* [81]. They also criticized the "constrained roles" attributed to researchers and participants in the processes that use theory-based methods, and aimed to find a middle ground between what they dichotomized as "researchers as experts" that diagnose and treat "users as patients" and "researchers as servants" in more participatory methods [32, pp.22-23]. They criticized what they considered opposing approaches for bracketing the researcher by fitting them into a set of rules in their striving for 'objectivity', and expressed a desire to "reveal ourselves in the process" [32, p.23]. In contrast, with their prioritization of design inspiration over comprehensive data for user research, they believed the Probes "should be seen as embodying an attitude towards research" that emphasized subjectivity, playfulness, experimentation, and even risk [32, p.24]. In that regard, Cultural Probes had an underlying subversive goal, a critique of the then-traditional approaches to research that led to their creation and introduction.

In the following sections we unpack this concern for critique and subversion in relation to Probes in more detail. First, we discuss the ways in which Probes are often reported on in HCI literature in ways that disconnect them from their epistemological roots, which has led them to be adopted in ways that are counter to its critical intents. Second, we highlight how this is in part a result of a lack of reflexive accounts of how Probes are used in practice by design researcher-practitioners, meaning the critical intents of Probes practices are rarely articulated in published work.

2.1 Probes as a Critique of Method in HCI (and How this is Often Forgotten)

More than two decades after their introduction to the HCI discourse Probes have been adopted and interpreted in a wide-range of ways. As a result, it is argued that they have become "something of an umbrella term in HCI under which a wide selection of objects have been ascribed and where design has become somewhat out of focus" [92, p.3442]. In their work that recognized the rapid adoption of Probes in HCI during the early 21st century, Boehner et al. [10] argued that the original Cultural Probes share a similar misfortune with other dialogic approaches such as participatory design (PD) or ethnography within HCI: being adopted as instrumentalized applications to inform design-oriented research processes, with a disregard for the underlying epistemological commitments of these imported interpretive approaches. They argued that framing Probes as a 'technique' "suggests that they are a means by which data about everyday life might be extracted for the purpose of design, albeit without the conscious interpretive presence of an ethnographic investigator" [10, p.1083]. Graham et al. described Probes as "an amalgam of existing social science methods" that arguably "mark a turn to the personal in HCI and indicate a need for methods that reflect the individual's everyday life in design responses, the need to get beyond the antiseptic general" [38, p.35]. As per the title of their paper, Graham et al. focused on "how Probes work" from a pragmatic perspective [38] rather than how they are understood within the field as an interpretive approach [10]. In being instrumentalized as a technique or an amalgamation in this way, Probes were seen to be misapplied as a form of "discount ethnography" [25, p.548] to substitute deeper qualitative inquiry.

Boehner et al. [10] identified a source of this problem as "a deeper lack of clarity in HCI about the distinctions between positivist and

hermeneutic frameworks"; which also account for the diminution of the political activist agenda of participatory design to a "means of engagement between designers and groups whom CHI traditionally positions as 'users"', and "ethnography's inherently analytic stance" to simple "data gathering" [10, p.1083]. Boehner et al. also argued that the problem somewhat originates from HCI's lack of critical reflection on the "amalgamation of research methods into an interdisciplinary context: a disengagement between methods and their underlying methodology" [10, p.1083]. Similarly, Graham et al. noted HCI's habit of borrowing and adopting methods; however, they also questioned the novelty of Probes as to whether they are "some form of 'departure"' or "simply old methods (and even methodologies) repackaged and to an audience hungry to consume the next trend" [38, p.35].

Ghassan & Blythe argued that although the sense of legitimacy in HCI research is dictated by the science-based positivist camps, the appropriation and reinvention of counter-hegemonic creative approaches such as Probes enable an ongoing flux in HCI research practices, as opposed to rigid, dichotomous frameworks [35]. Indeed, throughout the three 'waves' of HCI [9], the debate around the role of design within the field has expanded from design's initial inclusion as "instrumentalized problem-solving" [72, p.2083] processes with a focus on "engineering usability" until the early 1990s [94, p.1] to discussions around the framing of design-led knowledge [3, 34, 43, 70, 96]. More recent explorations on the role of design within the field include critical reflections on the notion of research contribution in HCI, by research conducted through non-deterministic design practices [1, 7, 22]. Such work not only challenges the mainstream understanding of design in HCI as problem-solving, but also the underlying "solutionist" paradigm [77] that manifests itself in the traditional HCI research scenarios that employ the plot of "overcoming the monster" [8].

In regards to the distinction of creative and methodological engineering design and the hegemonic understandings of design as the latter within the field, it has been argued that "[m]aking room for perspectives from 'outside' of engineering can (and has) allowed the HCI community to ask better questions about technology and society and to take up our designerly practices towards a more diverse range of critical positions" [22, p.1]. Such counter-hegemonic design practices provide a critique of these hegemonic understandings of design as 'problem-solving' by making explicit the critical and subjective intentions to design as 'problem-finding' [26]. As such, with their objective to "subvert or undermine, rather than supplement, traditional HCI methods" [10, p.1080], Probes are part of these counter-hegemonic practices (and, possibly, the most well-known). However, within this shift to problem-finding than problem-solving [64], these critical intentions behind using Probes as part of design-led research are often not reported in papers, possibly because of the post-rationalization of the 'design problem' and the decision-making processes involved in disseminating design-led research in retrospect. Similarly, the messiness of situated practice-based research requires different approaches to research 'dissemination practices' [16] than the predominantly positivist ways of HCI; therefore the validity of Probes as part of design-led research in HCI heavily depends on the explicit articulations of these critical issues implicit to design practice in relation to the science-based research frameworks of HCI. Or put simply, being clear about what they intend to critique, why and how.

2.2 Reflexivity and Explicit Accounts Of Probe Practice

Herbert Simon's conceptual framework for design [81, p.111] revealed that critique is inherent to design practice in its intention to "chang[e] existing situations into preferred ones". However, his framing of design as rational problem-solving and striving for a "science of design" as such [81, p.111] dismissed the design practitioner's subjective judgment and the contingencies in decision-making. As a result, his framework is often presented in contrast to Schön's [80] view of "reflective practice" that emphasize the professional expertise and intuition in the decision-making processes in design practice [45].

Despite the growing interest in re-evaluating 'design judgment' as "a full and equal partner in any intellectual pursuit in design, on par with rational decision making" [70, p.157], Simon's rational problem-solving framework for design tends to still dominate [24]. Consequently, the inherent critique in design in its devising "courses of action aimed at changing existing situations into preferred ones" [81, p.111] is rarely explored in regards to "Who determines the 'courses of action' and whose 'preferred situations' are we to design?" [45, p.40].

Critique is a directed practice, always in relation to something. In that regard, "critique as an attitude and a direction" implies there could be several different attitudes and directions to it; but it also implies that critique cannot be framed as part of rational problem-solving, dismissing the subjective judgment of the practitioner [52, p.215]. This is why Schön [80] offers a more realistic framing of design and practice-based knowing as requiring constant reflexivity by the practitioner. However, in order to obtain validity as a research discipline, this reflexivity needs to happen beyond self-monitoring [6] (i.e., transference and sustainment of design know how through practice-based training) to entail a critique of design [88], like that of Dunne & Raby's Critical Design in articulating what is being criticized about the hegemonic practices of design or that of Daniela Rosner in their "critical fabulations" [77].

Understanding critique as inherent to design practice, and reflexivity as core to articulating and making explicit critique, helps us understand the importance of reflexivity in the context of creating and disseminating Probes. Indeed, Wallace et al. refer to reflexivity as "keeping design at the heart of Probes" [92, p.3442]. However, Boehner et al. observed that the dissemination of Probes often lack this level of reflexivity; deep reporting of how they have been used in practice, explicit articulations of how they generate knowledge as research artifacts in relation to what constitutes knowledge, rigor and validity in design-led research [10]. The need for explicit reflection on how to address the challenges around designing Probes was also noted [61]. This echoes Göransdotter and Redström argument around design research more generally, where they note it often lacks critical and explicit accounts of design methods and processes:

> "Although such accounts sometimes include aspects of design practice and how designers work, much of what practicing designers care about themselves is left aside in these stories, such as constellations

> of design teams, how certain ways of working came about, how they evolved, how methods formed, or what the design processes looked like" [37, p.20].

As a result, they argue, design methods can "appear as if they lack history, as if they are somehow independent of context and exist outside the temporality that otherwise is so important for understanding what people do, their values, and ideas" [37, p.20]. Given that Probes are, typically, custom-designed artifacts and that conducting Probes studies is also a designed process [66], Probes entail "critical metholodogical pluralism" that require explicit reflections on how Probes as a concept are understood, how the specific interpretation relates to the original one and its implications and epistemological commitments [63, p.86]. There are a small number of exceptions to the inarticulation of the critical aspects of Probes however. For instance, Wallace et al.'s [92] reporting on reflective accounts of the creation of the craft-based Design Probes across a multitude of projects make explicit their specific interpretation of Probes and what constitutes knowledge through their Probing practice. However, despite this and increasing abundance of divergent interpretations and uses of Probes in HCI literature, the discourse around Probes still lacks both examples where their conceptual framings are made explicit and examples of situated, experiential accounts of using Probes in practice.

3 RESEARCH DESIGN

Our study was partly motivated by the prevailing literature on Probes within and outside of HCI outlined above, but also by the different experiences of making, utilizing and interpreting Probes we (the authors) have had in previous projects. Two authors of this paper, Sena and John, were familiar with Probes prior to moving into the field of HCI due to their training as designers (in Turkey and Sweden for Sena, and the UK for John), although their experiences of making and working with Probes in practice has been limited before then. Marta trained as a psychologist and became familiar with and used Probes in her research after moving into the field during her PhD. Despite our familiarity with the original work on Probes, and in the case of Sena and John design-led research practices in general, we have each felt it difficult at times to understand the reasonings behind specific uses and materializations of Probes in published literature. We found Probes to be quite mysterious things, not being entirely sure how to make them ourselves, or whether what we had made in the past and called Probes were really Probes at all. However, we started to recognize through conversations with peers locally and at conferences more pluralistic understandings of the approach than often get reported. As such, we were personally motivated to explore the reasonings behind specific uses and materializations of Probes that go unreported in papers. This, along with engaging with the prior work, encouraged us to study this to understand such pluralism and mitigate potential gatekeeping of design research know-how.

We thus designed our study to explore the ways in which HCI design researchers understand Probes and to identify common motivations, intentions and interpretations across diverse Probe practices. We were interested in teasing out explicit articulations of the critical positionings and perspectives those that made and used Probes in their research have on their work. As such, we wished to develop with design researchers reflexive accounts of their work, to share stories of their work which would often not go reported in the publications and other public forms of dissemination that surround their work. In the following we outline the research design in more detail, discussing our participant recruitment approach, what backgrounds our participants came from, and how data was collected and analyzed.

3.1 Participant Recruitment

In order to explore and understand the narratives and motivations of design researchers who utilize Probes in their projects, we set out to recruit researchers who have used Probes in reference to Gaver et al.'s 'Cultural Probes' [31]. Our reasoning for this was partly because of the significance of this original work, the varieties in how it has been understood and expanded on by others, and to provide some common reference point for participants to refer to in interviews. Our planning for recruitment commenced with a search of HCI and design research publications over the last decade which had cited the original Gaver et al. paper [31] and had then reported on the use of 'Probes' within their research over the last decade. We focused on papers that reported on the use of Probes in their projects (i.e., not conceptual papers) and were reported on over the last decade. The latter was, in part, a practical consideration. In the interviews we wished participants to show us some of their materials and documentation of Probes and projects, we assumed more recent work would be more readily available for them to refer to. We also wished to understand what design researchers working within the field of HCI have made of Probes since Boehner et al. [10] highlighted multiple challenges around how Probes are adopted and reported on in HCI literature.

From this, we generated a list of 25 potential participants, whom we contacted each individually via e-mail to invite them to participate in the research and to explain the nature of the research. In some cases, having completed interviews, participants would recommend peers for us to further interview. The above process resulted in the recruitment of 12 design researchers that have used Probes in a broad range of contexts and practices. It's important to note that while this led to a rich and diverse set of project examples, our recruitment strategy led to a self-selecting group of participants, which could be considered a limitation of the work. This meant despite their relative diversity of projects, in the main they held on to the values of ambiguity, subversion, materiality and design as an alternate way of inquiring. We discuss the profile of participants further in the following section.

3.2 Overview of Participants

Although some interviewees did not identify themselves as designers (e.g. P1, P4, P6, P9), they all identified themselves as working in design teams and as 'design researchers' in one form or another, aligned broadly with Research-through-Design [29] as an approach. Most of our participants were based in the European continent and had conducted the majority of their education and professional career within European organizations and institutions. Only one came from non-European background (P1); however, they were still located in the UK at the time of the interview. Some of the projects referred to took place outside European contexts (e.g. P1, P5, P9,

P12). However, they were still funded by councils and bodies within Europe. Despite this, the participants represented great diversity in the types of contexts and situations they had used Probes in. This included, for example, domestic practices (P2, P7, P8), refugee camps (P1), critical heritage (P5, P10), digital jewelry (P3), urban interactions (P6), pedagogy (P11), international development (P9), and data practices (P4, P12). While many of these project contexts were cross-cultural, only some of the interviewees highlighted that in relation to their Probes (P1, P2, P5, P9, P12). All our interviewees were at postgraduate level or above, and all of the Probes they talked about took place either as part of PhD studies (P1, P3, P4, P8, P10, P11) or longer-term collaborative research projects involving multiple stakeholders (P2, P5, P6, P7, P9, P12). While most of the interviewees used Probes in participatory ways, only 4 of them explicitly highlighted their participatory design approach in the interviews (P1, P9, P10, P11).

As we will note in the Findings, the ways in which participants first learned about and came into contact with Probes highly influenced how they interpreted and practiced Probing in their own work. Those that had a design background were more likely to have worked with a Probe 'master' (P2, P3, P7, P8, P9), who is a more experienced design researcher who had used and published on Probes and similar methods extensively in their own work. Many of these participants had adopted many of qualities and sensitives of their master's own approach to Probes. On the other hand, those coming from other disciplinary backgrounds (P1, P4, P5, P6, P9, P12) mostly learned about Probes from published literature, and were able to bring in their disciplinary strengths to their Probe interpretations. See Table 1 (in the following page) for an overview of why and how Probes were used in our interviewees' projects.

3.3 Data Collection

All of the participants were invited to take part in in-depth semi-structured interviews. The interviews were conducted either in-person (P1, P2, P3, P5, P9, P10) or via Skype (P4, P6, P7, P8, P11, P12). Interviews were intended to last approximately an hour, and were organized around a broad set of prompts and topics, each of which scaffolded a discussion between the interviewer and participant about the nature of their practice and the role of Probes and Probing within it. Participants were first asked about their background as a researcher and how they defined Probes. From here the conversation moved onto more specific and reflective questions around their particular use of Probes in a specific project in depth. These questions included: what the project context was; why they chose to use Probes for that particular project; what, how and why design decisions around Probes were made; how the Probes were introduced to participants; and how outcomes were interpreted and influenced future work. Throughout interviews participants were asked to refer to specific instances of Probe use in projects, which often involved the researcher being shown material examples and documentation.

3.4 Data Analysis

All of the interviews were audio-recorded and transcribed verbatim. The transcripts were used as the basis for thematic analysis [13]. Following Braun and Clarke, this involved close reading of transcripts, initial open coding of the data that summarized sentences and statements from participants both semantically and latently, and the sharing of these codes between the research team. Codes were then gathered into initial themes cohering around recurring issues across interviews, which were again evaluated and iterated by the three researchers. These were finalized into five themes, which are presented in the following sections.

4 FINDINGS

Our analysis led to the construction of the following themes around the critical intentions and concerns around Probes: Probes as fuzzy, strange, yet legitimizing; Probes as amplifications of practice and material questions; Probes as manifestations of care for others; Probes as subverting and facilitating small politics.

4.1 Probes as Fuzzy, Strange, Yet Legitimizing

It was clear from the outset that our interviewees brought with them a multitude of interpretations of Probes, often seeing it as a *"fuzzy"* (P11) term lacking clarity and definition. There were multiple instances where the term Probe was interwoven with other terms participants used to express their work, such as *"creative kits"* (P9), *"creative packages"* (P10), *"mediation tools"* (P11), *"dialogical tools"* (P1), and *"object questions"* (P3). Often these terms were used interchangeably with Probes, or at the very least often articulated as *"probe-like"* or, as P7 suggested, *"inspired by Probes"*. Many of the participants referred to the creation of bespoke materials (e.g., P1, P2, P3, P7, P8, P10, P12) that had a high degree of specificity in relation to the context under exploration. In many of these cases, the term "Probe" would often come to be adopted much later in their projects.

The interviews allowed us to explore some of the reasons for this diversity of interpretations. A key factor influencing these interpretations was their early contact with Probes and the ways in which they have become familiar with the approach and learned to apply it in their own work. For some of the interviewees – like P2, P3, P7, P8, P9 – they had worked directly with some of the originators or key authors of Probes. For these participants, it was possible to trace the ways a particular lineage of Probes had influenced how they then created and understood them in their own research practice. P2 mentioned: "*There's this little idea of the authorship through these different Probes"* (P2), while P3 reflected that: *"I see myself being part of those Probes, like my subjective sort of* [...] *stamp is there* [...] *it's very bespoke, very personal to me again and to the other person"* (P3). In these cases, it was also clear that knowledge around the creation and manifestation of Probes came through trial and error and, to some extents, a master-apprentice form of learning. These interviewees had learned mostly through doing, observation of a peer in practice, and small group critique in a design school spirit. All of this reinforced, for them, specific understandings of what Probes are and should be.

Not all participants learned through such relationships, however, and became familiar with Probes from published examples, documentation, and such to develop knowledge and competencies for making Probes.

However, in order to do this, these participants often drew on their existing competencies and backgrounds, which in some cases would come outside of a training in design. P6, for instance, was

Table 1: Overview of participants

Participant	Why did they use Probes?	How did they use Probes?
P1	To create mutual understanding within participatory, experience-centered design, sensitization	Co-designed bespoke Probe materials to facilitate conversations and intervene in the situation on a daily basis.
P2	For design ethnography within critical design, sensitization	Designed bespoke technological artifacts to be deployed in the context after an initial engagement, conducted interview study around the Probe returns.
P3	To explore materials and bodily interactions within craft-based design	Thinking through making the bespoke craft objects, which were then used as part of an enacted workshop performance to think together about these embodied interactions to inform digital jewelry.
P4	To enact a fictional scenario within speculative design	Created Probes as props to engage participants in a fictional world during interview studies.
P5	To elicit alternative perspectives within speculative design	Created task-based Probes to explore material affordances and alternative perspectives on the topic, sent them out to participants and discussed the returns in an interview study.
P6	For playful, spontaneous data collection 'in-the-wild' within speculative design	Created a collaborative storytelling game with tasks to be completed by the participants. The tasks were fit into the narrative to collect geo-localized visual and audio data in a workshop; "*pressure cooking on the kind of probe format*".
P7	To disrupt conventional notions and co-ideation within critical design	Provided participants with a collection of half-finished concept sketches in advance for their completion, discussed the returns in a workshop.
P8	As philosophical objects to disrupt conventional notions within speculative design	Made bespoke task packets for participants to be circulated amongst them. Didn't have an interview for returns.
P9	To solicit opinions on highly precarious situations within participatory design	Co-designed kits with a community for them to probe themselves and left them behind.
P10	To ask multi-sensory questions to solicit opinions within participatory design; sensitization	Created packages with creative tasks; had interviews around the returns; used them throughout the design process as moodboards for immersion and synthesizing ideas
P11	For playful, reflective engagement to facilitate conversations around abstract notions within participatory design	Created an activity to facilitate conversations around another topic; had regular workshop sessions for this activity.
P12	As material grounding to facilitate conversations within critical design	Created a task for participants to fulfill in advance to a performative workshop to facilitate conversations about the topic.

previously a semiotician and anthologist, which influenced how they used Probes. They saw Probes as a form of storytelling that involved *"a little bit of showmanship* [...] *telling a good story is way more important than the material aspect of the thing that I give to somebody in hand"* (P6). Others that had come into design research from more social scientific backgrounds saw Probes as promoting dialogue with their research participants, to provoke reflection from them in new ways, and to gather more diverse forms of empirical data than *"traditional methods"* would allow. The fuzziness and vagueness of Probes in contrast to the conventional understanding of "method as recipe" [58, p.42] clearly enabled interviewees that came from other backgrounds to appropriate them in ways that align with their prior expertise and experience outside of the field of design, while also pushing forward the methods of inquiry they may have been trained in.

It's important to stress, however, that the multitude of interpretations of Probes across the interviewees did not necessarily mean they lacked a criticality around the use of the term. The interviewees would bring the term into more and less into focus in their work as they developed it over time. As noted above, in many cases the term Probe would come to be purposely used only later on in projects, and in some cases only when work became to be written up for publication upon peer-reviewers' request. As P7 recalled, "[we] *never called it a probe in the whole project* [...] *but when we wrote it for* [Anon.]*, we kind of said like 'Okay, this is like obviously inspired by Probes"'* (P7). Similarly, P9 noted that the term may repel as much as evoke interest for those who do not share a design vocabulary:

> *"I tend not to use that vocabulary with participants, it just sounds weird and the word probe is, is kind of quite medical* [...] *they don't necessarily have the same design vocabulary* [or] *the same language vocabulary* [...] *so that kind of misinterpretation can lead to quite a lot of confusion* [and] *not have the desired effect in making people feel comfortable about being involved."*
> – P9

However, at other times, articulating their work as Probes was viewed to bring legitimacy to their approach which, in some context, may be viewed as lacking legitimacy. P9 went on to explain that: "*In certain groups of people you may talk* [of Probes] *because it's a shortcut, right? You know you kind of say 'Oh it's a cultural probe'*

and everybody goes 'Yeah, yeah, I know what you mean' or you use it and people don't know what you mean but they think 'Oh that sounds quite interesting and we'd like to use it' (P9). P6 further reflected that:

> *"Probe is the kind of perfect linguistic trade-off between sounding professional enough that you know what the heck you are doing* [...] *If I go to then say 'Look, it's a game. I make games. And these games are also Probes, data collection tools that I can use to actually understand what people are thinking'. This to my experience is the kind of boundary that I can push."* (P6).

It was clear that while few participants set out to explicitly create Probes, that the language of Probes was useful to adopt and appropriate in relation to articulating the more bespoke and situated work conducted on their projects. Each interviewee had their unique design vocabulary that could not be dissected from their phenomenological being, competencies, and disciplinary training. It was observed that their own vocabulary was in flux, something they were developing and learning, and Probes was a valuable term to anchor their work in relation to others: *"the viewers know what Probes are and there's that sense of it and it's useful to tie to that lineage"* (P4). Indeed, P7 observed that:

> *"Everyone's gonna always develop some variation of the method* [Probes] [...] *I think that's a good sign for the design research community* [...] *it means that 'Okay, we've kind of internalized what a probe was as a community and now we can just develop the one that makes the most sense to the project we're in.'"* (P7)

Drawing on the lexicon of Probes brought legitimacy to their work which was highly contextualized and bespoke and involved a large amount of design activity. With all our participants, it was clear that they had reflected about what a Probe is, as well as the connotations of the word. The term 'Probe' was often used in a retrospective manner when communicating the outcomes of such processes to refer to the becoming of these things. As such the fuzziness of the term, and its openness to interpretation, was both a weakness and a great strength. Probes as a term was seen to be a valued reference point that brought legitimacy to a broad set of approaches and communicated, in general terms, what researchers had set out to do.

4.2 Probes as Amplifications of Practice And Material Questions

Although some participants had backgrounds outside of design, they all placed an emphasis on the 'designerly' aspect of Probes [66] and 'thinking through making' [93]. In doing so, they often referred to an open-ended iterative translation of ideas into materials and vice versa, and placed a great emphasis on the 'practice' of carefully making and materializing them in ways that have been noted in prior work on Probes [68]. Very often, the creation of what would become Probes was not necessarily grounded in any clear objective, research question or aim. The material qualities of Probes were seen to be highly valuable for a multitude of reasons. Several participants referred to how it *"amplified* [their] *tendencies as a designer"* (P7) and *"gives us* [designers] *materials that we're comfortable to use."* (P2), hence they can be fun and rewarding as observed by [66]. It provided a way for some interviewees to ease their way into research: "*making was a way to reassure myself and relying on skills that I'm comfortable with.* [...] *It's a language that talks back to me."* (P10). The creation of Probes themselves clarified, and helped to realize thoughts about the context under exploration as "a knowledge base for further explorations" [68, p.75]: *"I really see a lot of value of spending time and using Probes as a way of synthesizing* [...] *you create something that freezes your perspective or interpretation at that moment."* (P10). This was further echoed by P11, who reflected how they started to see their work as "*thinking Probes"*, stressing *"an interaction between how you materialize something or how you think about it."* Similarly, the commitment to using physical materials, and the literal forming of Probes, would bring to the fore decision-making.

The material qualities of Probes were also critically important in how they engaged research participants in ways that more established methods and approaches would be unable to. Their specific value was seen in the translation of abstract concepts into embodied forms. P10 noted how Probes, in many respects, acted as *"embodied questions* [...] *a question that is translated into material aspect"*. The material qualities of Probes, and often that they were made specifically for a project or in some cases a specific participant, was felt to engage participants more deeply and avoid *"quite generic answers"* (P5) to questions, increasing the 'credibility' [66] and 'sincerity' [33] and the 'specificity' [28 in 69, p.48] of the approach. P3 articulated their way of understanding Probes as *"objects with questions"*, elaborating that: *"they're objects that ask questions* [in] *gentle, imaginative, surprising often ways.* [...] *usually Probes have a written question, but for me, the magic happens when you don't use often a lot of words, but the object itself asks the question* [...] *through the form, the materials."* (P3). This was echoed by P8:

> *"I always thought of them as sort of physical questions, where you're making, in the making of it, you're working through some assumptions and you're kind of giving them to people to complete in, to interact with them in a certain way* [...] *it's not like a questionnaire or anything where very straightforward answer they can give."* – P8

How the materiality of a Probe could forefront questions and issues at the heart of a project was also seen as a way to reveal assumptions and taken-for-granted ideas on the behalf of our interviewees research participants. Our participants also echoed prior work on Probes, which has shown how the making of Probes themselves can build empathy for future participants [59, 68, 92] or help externalize the researchers' own assumptions prior to engagements [69]. This was seen to be especially important in the context of work on digital technologies which are often felt to be underpinned by black-boxes, the functioning of which is often hard to fathom without props. Perhaps in part because of these perceived qualities, Probes would often be talked about as *"tickets to talk"* (P4) and as part of techniques to promote *"dialogue"* and develop a *"shared vocabulary"* (P11) with participants around complex topics. In some cases, the use of Probes to materialize immaterial qualities of technologies and designs was seen as an act to challenge participants to scrutinize the systems they use and the environments they live in.

However, even when carefully considered, the material aspects of Probes can also present some challenges. Several interviewees spoke of the ways in which their Probes at times challenged participants too much, as a result of their unfamiliar nature of posing questions compared to other, more commonly understood forms of research. Probes were sometimes seen as confusing, too abstract, or *"kind of obtuse, slightly complicated"* (P9) for research participants, where the openness of Probes could lead to exploration and uncertainty at the same time [69]. Indeed, several participants reflected on how the material qualities of Probes needed to be considered with careful consideration for the specific contexts within which they would be used [69]. For example, P1, who worked in refugee camps, pointed out to how materiality *"needs to be familiar, also needs to be something that they can relate to and see how it connects to our research, and also connects to their lives and understanding of lives"* in order to avoid creating barriers in between with their participants. As we will explain next, the considered labor in the creation of Probes was often a result of wanting to do good for participants and demonstrating that, and considered a worthwhile investment. As opposed to the understanding of method in linear terms to rationally solve a problem and reach closure, the reflective practice of materializing ideas and vice versa, was instead seen to be an exploratory and problematizing process that was based on creating difference and divergence [64], and this was reflected in how our interviewees spoke of their process of making Probes.

4.3 Probes as Manifestations of Care for Others

Building on the concerns around the careful and considered materialization of their Probes, interviewees also sought to challenge some of the taken for granted dichotomies between researchers, designers and participants in HCI Research. This came through in particular through demonstrating sensitivity to people's lives and signifying reciprocity. For instance, after a set of initial visits to their participants' homes, P2 explained how they designed their Probes to make them *"fit in that space"* in a way that was *"highly curated* [with] *a lot of sensitivity to colors and design"*. Beyond demonstrating thoughtfulness, it was an attempt to build relationships with participants: *"the Probes are a way of expressing a design intent and a design professionalism* [...] *they clue the participants into the kind of people that we are and give us a way of demonstrating, like building a relationship with the people as well, and demonstrating care and deliberacy."* (P2). P2 further noted that the care is inherent in working to provide a unique experience through bespoke and customized artifacts: *"the process of having something bespoke designed for you, and then having that delivered and experiencing that is pretty amazing actually"*. Many interviewees would frequently speak about how their participants would react positively to Probes, and refer to the care and thought that had gone into their production. P5 noted how *"people were explicit about the fact that they liked these objects"*. P10 reflected on how the considered creation of Probes would leave a *"good impression"*: *"I remember one saying, 'Oh, you could have not bothered, you could have just done a questionnaire but no, you went into a lot of trouble'. And I think that really demonstrated my motivation, the effort I put in making those things for them."* (P10).

P10 went on to also refer to the importance of carefully created Probes in building trust and rapport with their participants, especially for projects conducted over extended periods of time. This was echoed by P11, who explained the act of handing over a probe was *"like giving a gift to someone more even than you're trying to get data yourself for your research"* (P11). Probes also often left behind an awareness and care for a cause; P8, for instance, explained how their participants' reported enduring recollections of their work every time they witnessed food waste, even years after their engagement with their Probes to explore the non-intentional food waste at home. By demonstrating care, it was also felt participants might be more inclined to reciprocate care back. P5 noted how their research participants appeared to feel it was *"necessary"* to show that *"care that had gone into fulfilling them and spending time and then taking the time to talk to us"*. At the same time, as P8 discussed at length in their interview, the materiality of Probes and their carefully thought through creation reflected the willingness and effort to *"give something of your own"*, to make participants not feel that they *"have to give me everything, instead of the designer putting something back"* as they may in *"very researchy"* modes of engaging like questionnaires (P8).

This is not to say all interviewees supported this idea that the creation of carefully realized, highly polished, Probe materials was a signifier of care. P1 reflected that such designerly statements of care may also be viewed as an unintentional display of privilege and distance the researcher from their participants. In P1's context, where they were working with various marginalized communities and within refugee camps, care needed to be demonstrated by using familiar materials that *"are not saying* [we are] *being lazy"* but *"don't have so much inherent value in the material"*. They further reflected:

> "[in one case] *it looked very refined and then participants in the camp were really hesitant on passing it around. They were hesitant with the children grabbing them and ripping them apart, so the formality of it, kind of in the material, the way that it looked, I think, wasn't the best* [...] *They need to be very comfortable with the materials that they use, in the way that they express themselves, or else, again, it's me coming in with assumptions of what's the best way to design.*" – P1

There were also cases where this messiness of the situated practice of Probing blurred the boundaries between the researcher and the researched in challenging ways. P1 referred to the ongoing negotiations around *"consenting and re-consenting and re-consenting"* to make sure both their participants and they as the researcher were comfortable with their personal involvement in each other's lives and boundary management during the research process. They reflected that "*we don't report* [this] *much in HCI* [...] *when we are doing this type of work*".

These examples overall demonstrate how Probes enable care through reciprocity by humanizing not only the participants [38] but also the researcher, therefore subverting the idea of the researcher as a detached, neutral observer. Furthermore, as noted for P8 and some other interviewees like P7, there were other inherently subversive aspects of care, which was to challenge the existing hegemonic practices and preconceptions about a range of issues related to conducting design-led research, in contrast with the normative stance of the researcher. This is explained further in the following theme.

4.4 Probes as Subverting and Facilitating Small Politics

Whether using Probes to explore futures or to find alternative framings for a contemporary design situation, subversion was a key common concern for all participants. For some, subversion was overt in the topic of inquiry. For example, P8 used Probes to *"disrupt* [...] *stereotypical ideas of what a home is"*. Others were more explicit about using them to disrupt the trajectory of the present towards alternative futures, acknowledging their potential deviancy from the original Gaver et al. [31] work. For instance, P4 used Probes as an entry point to an open-ended, unfinished design fiction. When distinguishing their sense of Probing from others, they hinted at the temporal qualities of Probes:

> *"these are not Probes in the Gaver sense* [...] *these artefacts are design proposals really of a sort, framed in a particular way, but actually for me, they are mostly about the ticket to talk thing, they're mostly about being something to talk about and making that conversation easier,* [...] *I think the Gaver style of Probes relies on inspiration from what's around you but* [...] *when you're trying to get participants to think* [in a] *future-oriented way, you know, you have to pull them further."* – P4

Although their work was very different to P4's, P9 made a similar point about the future-orientation and interventionist qualities of Probes:

> *"there's two aspects that design is working to achieve* [in the project] *facilitating these conversations with young people through Probes around their understanding of demolitions and what it means to them, and how they resist the* [Anon.] *occupation, and then we will take these kind of artifacts and use them to reimagine policy for the* [Anon.] *government and how they allocate aid* [...] *it's much more about kind of future thinking than it is about how do we understand what is there now. It's about how we reimagine* [Anon.] *policy."* – P9

One critical aspect alluded to by P9 here is the value of Probes and creative activities is in enabling participants to open up and engage in dialogues that involve subversion without necessarily opening them up to potential dangers. Continuing their example, P9 went on to explain the significance of this in their work:

> *"The strength of doing this is that because, if you try and ask somebody about politics within* [Anon.], *they either open up too much* [...] *or they won't say anything at all* [...] *this is obviously about the challenges of the political situation, without being political with a big P, it's like small politics,* [...] *it allows people some space to talk about politics, but in a safe way.* [...] *we put the* [Probes] *on the table, and people are immediately wanting to engage with them and are intrigued about what is in them and what the questions are."* – P9

There is an indication in the examples above that reflects how design research dealing with the world *as it ought to be* subverts the hegemonic notion of research, which is about studying the world *as it is* [81]. This was especially important for P1 and P9, in part because their work involved working with marginalized, yet super-surveilled [73], communities like refugees in camps or habitants of a conflict zone. P1 explained how they engaged in a process where their participants collaborated with them in selecting the methods of enquiry for the project. They noted how: "*they did have the option of an interview and a focus group that they're like 'Oh we've never done this method before'* [...] *they afterwards told me, 'Oh people always come here and interview us and leave'. Whereas when you start using design materials, you're actually, you're, you're making a longer-term commitment."* They went on to also explain that later into the research, one of their participants recounted to them how "*'If someone comes here to just interview us and leave, we're saying no'.* (P1). In this regard, not only designing, but also conducting design research is doing *"small politics"* as described by P9, especially if aiming to engage people in the process in their own contexts. Indeed, P1 further reflected that: "[For me] *It's all about creating shared understandings of what the research is, what the data is, of each other* [...] *the most natural things to do then, is, if you're trying to create a shared understanding, it's actually share the decisions regarding what to do."* (P1).

The examples shared by P1 and P9 were the most explicitly politically charged contexts shared with us by interviewees, but this is not to say such "*small politics*" and the creation of resources for did not exist elsewhere. For instance, in P2's work the notion of Probes being a resource for action was subtle; the Probes were to enable ways for their participants to reflect on and reconsider their experiences of their home. P10 was also involved in *"small politics"* by giving voice to their participants through a manifesto that embodied their collective Probe returns and could be used as part of future advocacy activities. Similarly, P5 explained how a key component of their work was on eliciting alternative understandings from marginalized communities on cross-cultural heritage and sharing these back. They reflected that the legacy of their work, for them, is *"to think about,* [...] *what are our responsibilities towards this kind of material beyond just explaining people what we're going to do with it and going through ethics procedures and being upfront?"* . Again, this reinforced a view that for our interviewees Probes, and the wider projects they contribute to, aim to draw out oft-ignored narratives and concerns about matters that concern research participants, and challenge the taken for granted view that research is 'done' to people by researchers, who own the intellectual property.

When asked about the challenges to working with Probes, it became clear that the issues around legitimacy were not resulting from Probes themselves, but from the higher-level issues around fitting such counter-hegemonic design-led research practices within the field of HCI. P8 emphasized that *"the reflexivity is so ingrained in the whole probe approach that it's, kind of, really forgiving"* in regards to framing the rich (referring to *"the wide focus and the diverse and subjective ways in which the people have expressed themselves"* [68, p.76]), yet fragmented and somewhat deemed invalid data they provide. P12 similarly expressed:

> *"I think these challenges* [issues of legitimacy] *don't come from the Probes* [...] *that challenge comes from this kind of scientific domination, or the domination of scientific quantitative research that has in the past*

> *always been presented as more valid* [...] *and qualitative research is deemed valid in certain, sort of very regimented ways if it's done almost scientifically, and also art-led research is considered valid in certain ways but not always and there's very often this notion that it has to be validated in terms of how it will be evaluated* [...] *And so I believe that the limitations really rests in these frameworks of what is valid, if that makes sense."* – P12

What comes through the interviews is a level of sophistication in how the design researcher participants understood their Probes and the roles their materials were playing in relation to the existing practices and enabling people to move towards future situations. Indeed, perhaps at odds with how Probes are often reported on in the literature, there was a clear purpose and intentionality in the creation of Probes beyond cheaply gathering data from participants.

5 DISCUSSION

With this study we set out to unpack how design researchers interpret Probes. Through talking to a divergent group of design researchers, we have come to see a plurality of critical meanings, interpretations and understandings of how they are used in research and practice. In the following we unpack these insights further in relation to prior work on Probes and debates around the nature of practice-based design research in HCI.

5.1 Valuing the Fuzziness of Probes

It was very apparent that our interviewees embraced the fuzziness of Probes in diverse ways of defining and using Probes in their RtD activities, in line with Gaver's skepticism to formalize them as a methodology [32]. Probes have come to be known for their ambiguous qualities that draw their participants into open-ended, and sometimes purposely ill-defined, activities; but our analysis revealed that Probes as an umbrella term has also become a metaphor for critique within the RtD approach. This is not only because of their historical significance as a particular critique of method in HCI, but also because of their openness to interpretation as a metaphor [55], almost like a "Rorschach test, revealing their uptakers' perspectives and preoccupations" [10, p.1082]. Designers are said to be "educated to work with ambiguous topics, with incomplete knowledge, and to look for new ways to approach existing issues" [68, p.73], often working with metaphors as a creative tool [5]. Trained designers often value this versatility and openness to interpretation rather than completely disregard them as an 'ill-legitimate' approach to research. Our findings also emphasized that the ambiguity around Probes as a concept is *made into* a problem in HCI rather than actually posing a problem for design researchers. By framing the original Cultural Probes as a critique of 'method' in HCI and emphasizing the practices of critique enabled by the Probes, we imply that attempts to formalize or police Probes would strip them off their intended critique and the reflective practice of interpreting them. As Butler reminds us, "critique is always a critique *of* some instituted practice, discourse, episteme, institution, and loses it loses its character the moment in which it is abstracted from its operation and made to stand alone as a purely generalizable practice" [emphasis in original] [14]. Instead, similar to Reeves and Beck's review of how HCI talks about the phenomenon of interaction, we believe that the explicit articulations of the divergent concepts of Probes could create "a site of productive conflict" [74, p.144], and in doing so, perhaps "bridging gaps between increasingly disparate HCI communities" [74, p.150] and the fragmented nature of their knowledge production within HCI [40].

The ambiguity surrounding the lexicon of Probes was seen to be especially valuable when trying to develop creative methods that were specific to a particular design situation or context, but still ensuring there was legitimacy to the approach taken. Wary of the concerns around the epistemological consistency of Probes, we asked our interviewees to make explicit how they interpret "*the powerful metaphor of the 'probe'*" [63, p.86; italics in original], and found out that they had indeed critically reflected on the implications and epistemological commitments of their interpretation of the Probes for their practice. They were critical and cautious of not using Probes as shortcut substitutions for deep qualitative and ethnographic work, but instead emphasized the supplementary, catalyzing or enchanting qualities of Probes for such work. This demonstrated, to us, that there was an ongoing sense that the fuzziness of Probes can still lead to issues such as Dourish's claimed "discount ethnography" [25, p.548], and that design researchers were prepared to defend and articulate how their work was not such.

Furthermore, the fuzziness and fluidity of how Probes are defined also, ironically, meant design researchers suffered at the hand of some policing of the term. Beyond what we reported in the Findings, we saw cases where our participants had set out to not create Probes, yet peer-reviewers in the research community demanded these be located within its discourse for publication. Boehner et al. [10] noted the dangers inherent in the reinvention of Probes as method within HCI [35], where a community commonly accepts the validity of 'Cultural Probes' as a taken-for-granted method, without critically scrutinizing how it deviates from them in essential ways. While the creation and utilization of Probes in projects comes with certain values and positions that should cohere, their manifestation and materialization may be very diverse as our interviews revealed. In simple terms, the citation of the original work, and the brief locations of one's own approach in relation to that, should not be used as a self-referential proxy to legitimize the method. As P9 pointed out, this has an impact on the "*currency*" of the word. To enforce citation and reference when not appropriate is to fit the approach into the rigid and highly regimented knowledge systems that still pervade HCI; and in doing so, it makes less legitimate the situated, contextual and provisional nature of knowledge from RtD [34] and which seems to be so valued by the participants in our study. Our findings show how the hegemonic uptake of methods is "subject to circulations, negotiations and frictions as well as individual and collective aspirations" [2, p.481]. As such, the ongoing conversations about Probes as a design-led approach to research should include explicit discussions of the power struggles and complexities around conducting design-led research in HCI [48], reflections on design's processional character and relevance to scientific research as "a means to critically reflect on HCI's practice" [86, p.66]; or as we refer to it, its intended critique. Our findings emphasized the designed nature of Probes and also how they were implemented as part of designed, even staged processes that had a

significant impact on how they worked. By reporting on the critical motivations to use and cite Probes, as well as the reflective practice of making them as in the example of [12], the latent critique in the original Probes and its increasingly divergent interpretations may be turned into a productive discussion about the normative conceptions of method, research, and 'user' within HCI. Wary of the concerns around "theoretical hygiene" [82, p.2 in 5, p.493], tracing and documenting design processes as well as outcomes [53] can make this valued approach more accessible for the wider community of HCI and work against the gatekeeping of design research know-how.

5.2 Humanizing Research through Probes

Building on the above, the literature on Probes have referred to their potential for "humanis[ing] the participants" [38, p.33]. Our findings emphasized that Probes aim at expanding or pushing the boundaries of a 'user' rather than accurate representation of them [41] or of design specifications [68]. This was echoed in the way Probes were used by our interviewees to disrupt stereotypes and critique conventions around a given design situation. As highlighted by [51, p.156], the value of Probes lay in their capability to initiate personal conversations around its object of inquiry, as opposed to presenting a prescriptive 'method'. As such, Probe artifacts are "not solutions to any problem", but "rather a way of soliciting further reflection providing a situated ticket to talk" [15, p.435]. The majority of our interviewees had follow-up interviews with their participants in order to discuss what could be otherwise obscure in the Probe returns [62, 69] and to support design empathy [68]. This enabled *humanizing* participants on a deeper level than the abstracted analysis of Probe returns as "[s]orting through masses of maps, cards, and photographs" in the original work [31, p.27 in 68, p.68]. Because these dialogical sense-making processes between the research stakeholders through Probes is performative, "the way of *practicing* these dialogues matters" [36, p.314; emphasis in original]. As mentioned by our participants, the structure and staging of these interviews following Probe returns could be investigated further in terms of individual and collective sense-making and how this influences the way Probes are designed and made to work, as mentioned by a few of our interviewees.

As our findings have shown, the situated practice of Probing makes it a dialogical process that *humanizes* the researcher (or the research team) as well. Design's processional character also requires making visible the unfolding contingencies involved in the situated practice [86], especially for the Probing process that could go "almost on its own, going beyond designers' or researchers' control" [69, p.37]. Historically in how studies are reported in HCI, the humanity of the researcher is either taken-for-granted (as part of the humanistic approaches acknowledging and embracing subjectivity) or neglected on purpose (to legitimize the research to make it look objective). As part of the strategies and considerations to make Probes work [69, 92], our interviewees mentioned the *informal* interactions within their research team as well as with their participants, echoing [42]. Although *informal*, these pre-Probing engagements were central to the small politics of design research in terms of building rapport, expressing intent, setting boundaries and managing expectations from the research and the stakeholders involved in the research. Given the exploratory, non-deterministic and drifting nature of design [54], these *humanizing* engagements that are often neglected in the dissemination of Probes had an influence on the success of Probes. While this was not an explicit concern for some of our interviewees, it was especially a concern for those that worked with Probes in sensitive contexts with complex dynamics of research and the people and stakeholders involved. Gaver was explicit in how they wanted to reveal themselves in the process [32], but their revelation was more related to authorship within the aesthetic accountability [54] of their artist-designer tradition. On the other hand, we observe that our interviewees appropriated Probes to enhance participant empowerment in the Probing process on a range of levels (P1, P5, P9, P10, P11), which were negotiated through often unreported *informal* engagements throughout the process.

The humanizing qualities of Probes have been previously reported to enable remote research without the researcher being present in their context of inquiry at all times [83], providing a feeling of researcher's presence for the participants and vice versa when returned [66, 68]. It has been argued that the lack of researcher presence requires further reflection on the researchers' accountability and subjectivity in the research process [63] in order to understand "the way that the designer's authority is subtle and nuanced" in comparison to more overt expressions of authority [18, p.440]. Our findings accentuated the designed nature of Probes and how the decisions around the materiality of Probes were made with extra care and attention for these subtle expressions of authority, especially in cross-cultural, historically or socio-politically charged settings (P1, P2, P5, P8, P9). Although these considerations are not always reported in depth, acknowledging and reflecting on these subjectivities are important even when the Probes may be used for design inspiration than information [83].

Like in social sciences, reflexivity brings to the fore the human factors involved in the research process; however Probes "embody a different set of sensibilities from most other social research methods" [11, p.185] which brings forth different forms of reflexivity and humanization. However, as identified by Taylor et al. [87], the experiences, emotional responses and lived accounts and motivations of design researchers are often missing from the narratives of research papers. Our participants' accounts of their projects articulated how their dispositions were not just critical in how their Probes manifest materially, but also in how they situated their Probes in relation to the lineage of prior Probes research and adapted these for their own expertise, interests and disciplinary strengths. To avoid accounts of such disposition also neglects the "*small politics*" of design (as P9 expressed it) in studying *what ought to be* than *as is* [81]. Moreover, the bracketing out of the researcher as the detached, objective researcher or limiting the presence of them [16] promotes a realist tone in reporting [76], reinforces certain ideas in HCI like scientism [34, 95], and therefore raises doubts about the legitimacy of such humanistic approaches to and accounts of design-led research [87]. This is particularly important for the reporting on Probes, which were "purposefully against scientism" [69, p.34].

Not only because of involving participants in the Probing process, but also because of the inherent critique in design practice as to *what should be* [81], Probes blur the boundaries between the researcher and the researched, and the fundamental ontological demarcation of research as the controlled study of the world *as*

it is, positioning the "*small politics*" of research perhaps closer to activism than imagined (as alluded to by P1, P5, P9, P10). As a result, matters of care [4] that are especially important for emotionally charged or socio-politically complex situations are not reported enough. Indeed, we saw in some instances the great tensions that come about between caring too much about the research in order to engage in the bigger politics of situation and a concern with coercing participants into the 'burden' of Probes as opposed to the small politics of caring for the participants. The blurring of these boundaries require constant, iterative reflection on and re-negotiation of these boundaries, and in that way, Probes become a 'burden' on the researcher as much as their participants. Revealing the researcher in the process [32], but also *humanizing* them, is critical in understanding the tensions around situated, 'real world' practices of Probing, as opposed to bracketing the researcher in theory-based, abstract methods.

5.3 Probes as Relating, Questioning, and Owning

Although they did not originate in participatory design tradition, Probes are increasingly used for their qualities as 'boundary objects' [84, 85] as part of participatory design practices [49, 50]. This is often implied in how Probes are referred to as a facilitator for co-exploring with non-designers [68], "as a way of structuring open questions and reflections" [17, p.2519], and "as a bridge between designer and participant to enable alternative modes of discovery in design research practices" [21, p.699]. While all our interviewees cared for their participants and found ways to include their participants in design processes through the use of Probes, there were very different understandings and framings of what constituted 'genuine participation' [75]. In [39], Gaver reflects on the ways Probes unsettle the typical relational dynamic between researchers and researched; they force researchers to reveal something of themselves to participants, and they involve activities that are playful and rewarding, giving back to volunteers as much as researchers take. These were all concerns that the design researchers we interviewed had as well. By authoring Probes in a way that spoke to their research imperatives and sensitivities as a design researcher, they wished to share a bit of themselves to their participants. This was done to build relationships with participants, to gear them into where the researchers are coming from, and suggest a degree of reciprocal engagement and mutual learning. Through these, our participants saw Probes as unsettling the traditional dynamic in HCI where participants are treated as subjects, studied by researchers. Where that happens, issues around "reflection and learning processes as well as communication of the probing aims and results" become important [68, p.74].

Yet to a degree, it was notable how in some ways Probes were described by some of our participants as reinforcing some of the traditional divisions between researcher and subject in HCI. While care and consideration was given in the creation of Probe materials, they were still seen as questions to prompt a participant in order to study them without accounting for the political legacy of the Situationists [57]. Herein, the designer is still positioned as the expert, even if great care was shown to deliberately disrupt the expectations around expertise [31]. While this was explicit in the way P3 referred to their Probes as "*object questions*" (P3), it was implicit across many of the other interviewees (e.g., P2, P10).

On the other hand, some adopted a very strong participatory approach where the designer took on the position of a facilitator than an expert. These were also made explicit in the way our interviewees talked about their Probes as "*dialogical tools*" (P1), or "*mediation tools*" (P11), and also how they referred to their participants as "*research partners*" (P11). They also mentioned the reciprocal and dialogical exchanges that went beyond the Probing stages of the research; where Probe materials were used not only to promote reflections on and articulations of anxieties and aspirations for the future (as noted by Gaver [32]), but to scaffold future action among groups "from personal attitudes to long-term collaboration" [68, p.77].

This is not to be critical of our participants that set out to not be participatory; indeed, these participants often articulated a critical stance against such work or challenged the value of such work in their specific context in order to avoid 'the tyranny' of participation [19] where Probes could turn into an obligation [60]. Rather, we highlight here the increasingly blurred boundaries of HCI work grounded in the artist-designer tradition, and that the dichotomy posed by Gaver [32] around the role of the designer as expert or servant is increasingly less clear. The making of Probes includes "vague guesses of what there could be today and speculations on future possibilities" [68, p.74], inherently aiming to critique and intervene in the existing situation without being overtly political. Both come with politics and subversion at the heart, it's the nature of how participation is configured [90] and degree of control participants have over owning and actioning knowledge that differs and its dissemination. As tangible representations of their intended subversion, Probes make the otherwise invisible *small politics* by creating situations [47] similar to 'breaching experiments' [30] and "allow a place and a time to make space for exploration" [68, p.76]. The debate around Probes in HCI proves that that design's inherent critique has not "run out of steam" [56, p.225].

6 CONCLUSION

In this paper we have set out to understand the ways Probes, as a contested approach to research in HCI, are interpreted, used and made sense of by design researchers in contemporary RtD. While there has been much debate surrounding Probes in the design research literature, there has been a lack of work focused on experiential accounts of Probes in practice. Through our interviews with a diverse group of 12 design researchers, we have examined some of the motivations for using Probes in HCI projects, how design researchers engage in the material production of Probes, and how these have then been used to scaffold research participant engagement. Our participants highlighted that while there continues to be a lack of a clear definition of Probes in the field, the flexibility and fuzziness of the term enables it to be adapted and repurposed in ways that brings legitimacy to design-led research. We highlighted key qualities of Probes that are often either taken-for-granted or under-articulated, including the ways they manifest care for participants and subvert traditional notions of research in HCI. As well as highlighting the legitimacy of Probes and design-led research

in the field, we revealed ongoing challenges in how we report on Probes. Crucial aspects of the reflective practice of making and implementing Probes is often omitted, as is researcher reflexivity in situated practice of making and utilizing Probes. We intend this work to stimulate further research on the small politics and subversive nature of Probes, and hope to initiate a new lines of HCI enquiry and scholarship that reports on the often neglected details of how Probes are conceptualized, made, shared and understood by researchers.

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