Responsible & Inclusive Cards

An Online Card Tool to Promote Critical Reflection in Technology Industry Work Practices

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ABSTRACT

Societal implications of technology are often considered after public deployment. However, broader impacts ought to be considered during the onset and throughout development to reduce potential for harmful uses, biases, and exclusions. There is a need for tools and frameworks that help technologists become more aware of broader contexts of their work and engage in more responsible and inclusive practices. In this paper, we introduce an online card tool containing questions to scaffold critical reflection about projects' impacts on society, business, and research. We present the iterative design of the Responsible & Inclusive Cards and findings from five workshops (n=21 participants) with teams distributed across a multinational technology corporation, as well as interviews with people with disabilities to assess gameplay and mental models. We found the tool promoted discussions about challenging topics, reduced power gaps through democratized turn-taking, and enabled participants to identify concrete areas to improve their practice.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI); HCI design and evaluation methods; User studies.

KEYWORDS

Card Tools, Responsible Innovation, Reflection-in-Action, Critical Reflection, Ethics, Research Through Design

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1 INTRODUCTION

Schön describes how practitioners can become locked in a view of themselves as technical experts, deeming reflection and deliberation about the social components of their work as unnecessary. However, by engaging in reflection-in-action, practitioners can surface, criticize, and update tacit understandings that have developed over the course of their specialized practice [36]. Although there is an abundance of tools and frameworks to facilitate reflective practice in the public and nonprofit sectors, tools and frameworks aimed at reflective practice for technologists working in industry are sparse [20, 24, 34]. This could be due to several reasons, including the challenges of navigating often conflicting business incentives, organizational structures and timelines, research values, and societal considerations. There is a significant need for developing and evaluating technology industry-specific tools and frameworks to facilitate reflective practice and responsible and inclusive innovation [20, 26, 34], while keeping in mind the tensions and potential trade-offs that exist in doing such work in such settings.

Cards are a versatile approach for facilitating conversations, collaboration, reflection, action, and idea generation in multiple contexts [9, 18, 21, 35]. There is an abundance of physical cards designed to facilitate reflective and reflexive exercises. However, many were created with either academic audiences or public consumers in mind, and there is a lack of card tools aimed at supporting technologists across functional and cross-functional, remote and hybrid teams in industry to engage in critical reflection [39] and reflection-in-action [36]. Existing card tools' content often does not include relevant business considerations, incentives, and tradeoffs that intersect with everyday research and development processes in corporate tech spaces. This gap may limit technologists' ability to sufficiently act on the considerations elicited during discussion, particularly in instances where an issue is identified but the underlying infrastructure, company culture, or available resources cannot easily support mitigation efforts or necessary changes. Moreover, many existing decks are organized categorically, with little to no underlying process to walk people through different concepts and ideas, some of which might require more forethought or awareness prior to response or action. This additional disciplinary context is important within tech industry settings, as technologists with deep specializations in STEM fields or business may not have the disciplinary knowledge or experience to meaningfully engage with certain kinds of sociohistorical considerations on their own [38]. Likewise, scientific practice (whether in academia, healthcare, government, or industry) has deeply entrenched and enforced implicit and explicit hierarchies (e.g., tenured faculty to adjunct faculty, principal investigators to graduate students, attending or chief physicians to medical students, c-suite executives to staff members or visiting fellows, etc.). These organizational hierarchies influence group interactions and associated power dynamics [11, 28, 30], sometimes creating environments or situations where those in higher positions of power or seniority dominate conversations, making some people less comfortable sharing their ideas or simply reducing opportunities for open and balanced dialogue. Our investigation attempts to address these unmet needs and specific gaps in critical reflection cards.

In this paper, we describe our Research through Design of a prototype called Responsible & Inclusive (R&I) Cards, a computer-based card tool to help technologists think more critically about the contexts and impacts of their work, with the end goal of helping them engage in more responsible and inclusive practice. The R&I Cards tool consists of guiding question [13] cards that draw on our Responsible and Inclusive framework and broadly attend to the sociohistorical contexts of creation and use of technology; the power dynamics between self, business, and societal stakeholders; the social impacts of technology on various communities across past, present, and future dimensions; and the practical decisions that imbue technological artifacts with cultural values. Through automated turn-taking and an underlying thematic and level-of-depth structure, the tool assigns questions to participants, who are then given the option to answer, pass, or open the floor for discussion with other participants. We walk through our iterative design of six versions of the R&I Cards tool and present findings from workshops with distributed teams of technologists at a technology corporation (n=21 participants) who evaluated the prototype. Additionally, we discuss findings from two interviews with people with disabilities (one blind participant and one participant on the autism spectrum) to assess the tool's accessibility in terms of gameplay and user interface (UI) elements.

Our motivations for designing the R&I Cards tool were to (1) encourage technologists to think about the impacts of their work, particularly on society; (2) help technologists identify gaps in technology design, research methods, and business practices, or re-evaluate normative assumptions about a project's scope or stakeholder needs; and (3) support technologists as they take initial actions to improve their project or proactively mitigate potentially negative consequences. The research question guiding our investigation was: *How can we design a card tool to support technologists to critically reflect on the larger contexts and broader impacts of their work?*

Our initial observations suggest that the R&I Cards tool offers a promising interface and opportunity for reflection on the scientific, business, and social implications of technical projects, with successful adaptability across different contexts and groups. We argue that the R&I Cards tool offers at least three contributions to the larger card methodology space and Human-Computer Interaction (HCI) field:

- By enabling an automatic, cyclical, and non-weighted card assignment to different participants, the tool prioritizes and incentivizes everyone to share their opinions during play, momentarily reducing some of the hierarchical imbalances that can happen in corporate interactions.
- By allowing participants to choose the level of depth at which they want to begin play and subsequently presenting questions of increasing complexity, the tool counters differences in familiarity with responsible and inclusive topics across teams, geographies, or project niches.
- Finally, by attending to business stakeholders and incentives, as well as corporate organizational practices, the tool promotes discussions about the unique tensions that technologists working in corporate settings need to navigate to engage in responsible and inclusive practices.

2 RELATED WORK

2.1 Critical Reflection Cards

Within academic research settings, critical reflection cards have been created and utilized in multiple technology- and data-relevant domains. For example, the Biotech Ethics Cards are critical reflection cards to scaffold children's reflection processes on the potential impacts of biowearables [29]. Designed to support critical making, the Biotech Ethics Cards consist of 12 cards divided into concept cards and their corresponding reflection card meant to prompt children's' reflection on the possible impacts of technical decisions when building biowearables. Mixed Reality Game Cards present multiple ideation cards, including 18 questions designed to encourage reflection and provoke discussion around the idea generation of mixed reality game ideas [42]. Inspired by Mixed Reality Game Cards, Card Mapper describes how usage data can enable reflection when designing and assessing cards [15].

Other cards have emerged in industry that focus, generally, on the designer and design process. For example, Envisioning Cards are used to attend to human values and long-term consequences of technology during their design [18]. Envisioning Cards is comprised of 28 themed cards, each of which attend to one of four envisioning criteria including stakeholders, time, value, and pervasiveness. Another tool that uses value sensitive design and design fiction is Judgment Call, designed for use in industry product teams to surface ethical artificial intelligence (AI) concerns [5]. Judgment Call uses seven principles for responsible AI to support exploration of ethical considerations from the perspectives of multiple stakeholders. Legal Card proposes an approach using ideation cards to explore European data protection regulations, assessed with 4 groups of designers [27]. The Artefact Group's Tarot Cards of Tech consists of 12 cards containing provocations for designers around scale and disruption, usage, and equity and access. IDEO's Method Cards are intended to inspire designers to explore new design approaches and to create their own.

While these previous works are important undertakings to support the development of responsible and inclusive technology, there is a need for tools that support technologists working across functional and cross-functional teams in industry to engage in critical reflection, regardless of familiarity with responsible and inclusive topics and across various stages of technology innovation. Because critical reflection can surface the unconscious values, attitudes, and assumptions influencing technologists' practice, as well as invite new ways of experiencing the world, we designed the R&I Cards tool to incrementally walk technologists through how their decision-making processes impact (1) themselves and their immediate team members (self); (2) their company and larger industry (business); and importantly (3) end users, communities across the world, and governmental and non-governmental entities (society). This is accomplished through our tool's unique and stratified underlying thematic and level-of-depth structure, which expands upon the suit structure traditionally used in other decks. There is also a need for tools to support technologists' deeper engagement with business considerations, incentive structures, and tensions in a more open, balanced, and less hierarchical way. Our R&I Cards tool attempts to address these important gaps in the card methodology space.

2.2 Techno-Scientific Practice

Science and Technology Studies (STS) scholars have explored the values and assumptions informing techno-scientific practice, with a specific focus on how they reflect and affect social structures and power dynamics [6, 23]. For example, case studies on genomics [41], bioprospecting [40], data collection [33], and astronomy [22] have revealed the extent to which 19$^{\text{th}}$-century settler colonial logics of extraction and universality persist in present day research and development practices, with severe implications for the indigenous communities whose lands, ways of knowing, and sovereignty continue to be exploited and contested. Cultural norms that prioritize profitability, efficiency, and productivity, without regard to environmental and social impacts, have also been shown to increase global conditions of precarity, especially for social groups or communities that have been historically denied economic, political, and epistemic decision-making power and resources [32, 45].

Because these scientific notions and values can circulate unconsciously and get reinforced structurally, this represents an opportunity to use cards as conduits for critical reflection, as well as for collaborative learning and accountability. Informed by STS literature and existing governance systems for innovations such as the EU's Responsible Research and Innovation (RRI) framework [20, 24], we prioritized within the R&I Cards tool questions that deliberately focus on historical contexts, diverse perspectives, and impacts to communities that have been previously harmed by technology. Additionally, throughout the framing of the tool's guiding questions, we sought to (1) promote notions of equitable access, autonomy, and sovereignty; (2) emphasize the importance of participatory engagements with impacted communities; and (3) demonstrate the value of incorporating diverse perspectives, modes of expertise, backgrounds, and lived experiences—including but not limited to race, ethnicity, gender, sexual orientation, socioeconomic status, ability, religion, and age—into all stages of technology development and deployment. We recognize that the work of critical reflection must be accompanied by other mechanisms that advance systemic and industry-wide transformation.

3 RESPONSIBLE & INCLUSIVE CARDS

3.1 Broader Framework for Responsible & Inclusive Technology

Our R&I framework, which serves as the basis for the R&I Cards tool's questions, was developed as part of our team's broader research initiative. The framework consists of questions, core concepts, and historical case-studies that provide scaffolding for tools, resources, and methods being developed, tested, and deployed by our team.

By Responsible and Inclusive Technology, we refer to the research and development practices, the technological artifacts, and the corporate structures that uphold proactive accountability, meaningfully attend to and engage with diverse perspectives, and are ultimately centered around societal impact. The motivation for using the term *inclusive* to name the framework and the tool resides in the fact that our initiative aims at promoting equitable access and autonomy, fostering participatory design [16], and incorporating diverse perspectives, expertise, backgrounds, and experiences. Hence, inclusion is considered in two perspectives: (1) the design process of the tool which included diverse stakeholders and provides adequate accessibility, and (2) the questions that prompted technologists to think about inclusion in their practices. For example, one of the questions present in the tool asks: "Of the stakeholders with least decision-making power, which ones would be most impacted by your work?"

A high-level schematic of the framework applied to the card tool is shown in Figure 1. Briefly, the framework (Figure 1a) is organized across 4 broad topical themes (Figure 1b): history, stakeholders, impact & outcomes, and practices & actions. Within each theme, questions and concepts guide a team l to reflect on elements that underlie a responsible and inclusive mindset. Additionally, each theme consistently probes participants to consider 3 driving forces within the tech industry—self, business, and society. The framework themes form the basis of tool's notion of card suits (Figure 1b-c). To accommodate differences in knowledge or needs, we organized each theme (suit) into 4 levels of knowledge depth. These levels formed the card tool's notion of phases, which include getting started, information gathering, getting specific, and call to action (numbered 1-4 in Figure 1). The getting started phase covers general questions about a project's aims, scope, and methods; the information gathering phase has questions that require some historical knowledge about the technologies underlying the project and a willingness to reflect on the project's potential negative impacts; the getting specific phase introduces equity & justice vocabulary and expands upon past, present, and future harms of technology; and the call to action phase covers opportunities for prevention or mitigation of harms. Players have the option to play by suits, phases, or both.

The framework's guiding questions utilized by the R&I Cards were iteratively developed by our team based on observations of 10 previous internal exploratory workshops, as well as feedback and internal group discussions. The wording of the questions was updated to have more inclusive language, better concept specificity, and overall sentence simplicity and clarity. Additionally, the structure of the questions (around suits and phases) was introduced after

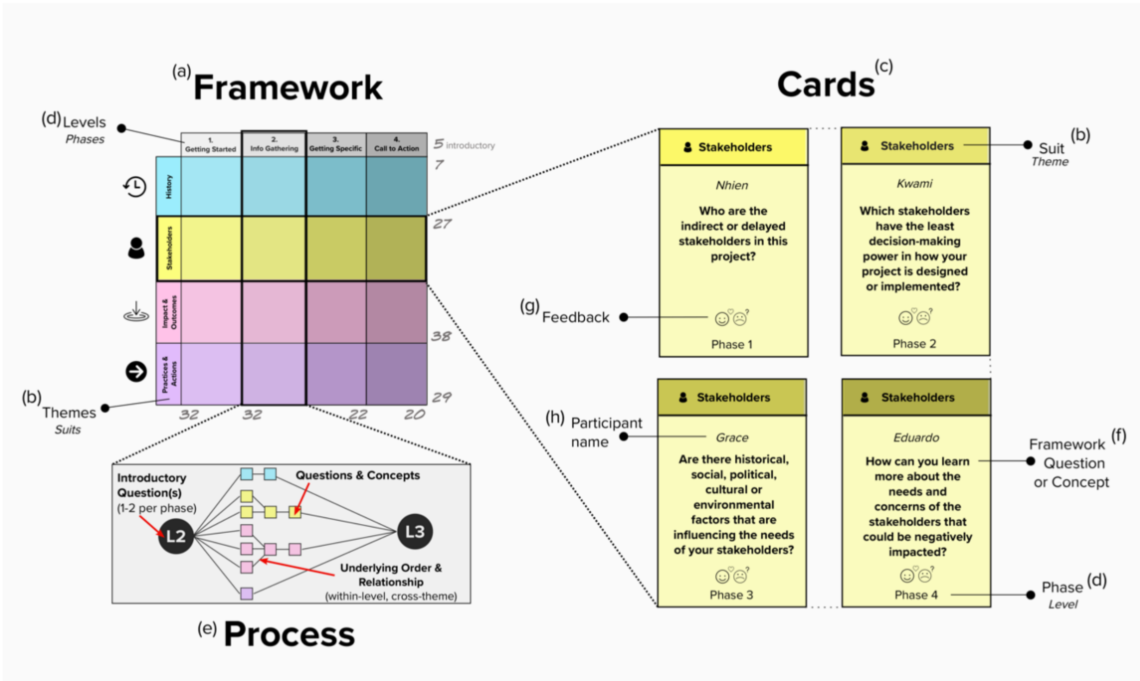

Figure 1: Overview of the underlying (a) R&I framework applied to R&I cards and examples of associated cards and tool components, including: (b) framework themes [card suits], (c) card format, (d) framework layer of depth [card phases], (e) underlying framework process [card order], (f) framework content [card question or concept], (g) opportunities for feedback, and (h) the name of the participant assigned to a given card during play.

initial exploratory workshops (as described below) revealed some questions required prior thought and discussion. To provide an accessible starting point, we created introductory questions that would be applicable to any of the 4 suits within each phase (black circles in Figure 1e). We also explored dependencies between questions, which led us to present some questions in a predefined order and others randomly (example shown in Figure 1e). The resulting questions and structure ensured that, regardless of how participants engaged in play (by suits or phases), they could have an initial question to center their reflections and be able to tie together what they incrementally learned, all while preserving some elements of randomness characteristic of card tools.

The current version has 106 questions in it, divided across all four suits and four phases; numbers at the end of each row or column in Figure 1a show the number of questions/cards across each suit or phase, respectively, including introductory questions that began each phase. Examples of guiding questions from one suit/theme (Stakeholders) sampled across the different phases/layers of depth (1-4) are shown in Figure 1f. Additional examples of card content can be found throughout our Discussion.

3.2 Motivations for Using an Online Format

While physical card tools have a short history when compared to other interaction design tools [1], this is even more true for online or app-based card tools. Despite their effectiveness, few attempts have been made to digitize cards [10]. In one example, Ayobi et al. used a website to present their visual cards for identifying mental health needs of ethnic minorities and to gather participants' initial perceptions of the design and aesthetics of the cards [4]. However, the implementation of digital support for cards through computer-based tools remains a relatively unexplored area compared to their physical counterparts [21]. We were interested in how an online format could be used not only to present the cards, but also to *play* the cards. We were interested in the myriad of interaction affordances that could be supported through the implementation of the R&I Cards in an online format.

Chiefly, we aimed to create a card tool that could be scalable and accessible to as many technologists as possible and would account for the geographical distribution of teams and time zone differences; this need is particularly important for multinational tech companies that may need to think about and discuss issues or instantiate change across a diversity of contexts and cultures. This is also especially critical as more technology teams are transitioning to hybrid and remote formats, particularly after the COVID-19 pandemic.

Additionally, we wanted to reduce power gaps and prevent uncomfortable encounters that we previously observed in other internal workshops, many of which were related to hierarchical relationships between executives, managers, and employees, as well as junior and senior researchers. The process of turn taking using cards has been shown to enable all members of a group to participate regardless of knowledge, expertise, and seniority within the group [14, 17]. We expected offloading facilitation tasks to a

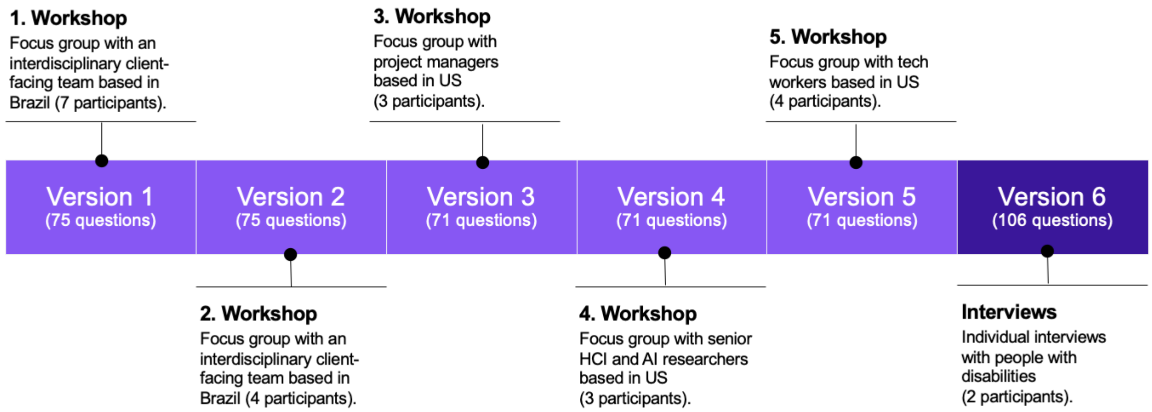

Figure 2: Timeline of R&I Cards workshops and versions.

computer-based system might enable less hierarchical and more democratic participation.

Lastly, our team was iteratively developing the guiding questions and broader framework for Responsible & Inclusive Technology that formed the basis of the R&I Cards tool, a process that still continues today as we learn more about different teams' needs and contexts of creation and use of technology. A weakness of physical cards is that changes to the cards require reprinting, and it can be time-consuming to create such high-fidelity physical prototypes [14]. We believed that an online format could afford us the flexibility to continue iterating on and improving our cards, questions, and overall system, as well as provide ways to gather feedback with relative ease, using reaction buttons, behavioral metrics, and other interactions.

4 METHODS

We used a Research through Design approach [44] to iteratively design and evaluate the R&I Cards tool. Research through Design is a research paradigm in HCI focused on making things that improve or transform the current state of the world [31]. We conducted five workshops with distributed teams at a large technology company to iteratively design and evaluate the R&I Cards, observing participants' interactions with the tool and guiding questions. The technology company where the study took place is a multinational corporation with a few hundred thousand employees worldwide that plays an active role in the sectors of cloud and AI. In an additional phase, we performed two interviews with people with disabilities to assess the tool's accessibility in terms of gameplay, user interface elements, and content. Figure 2 shows the project timeline in terms of workshops and interviews performed.

4.1 Participants and Recruitment

A total of 21 participants took part in our workshops. The largest team consisted of 7 participants while the smallest team consisted of 3 participants. We recruited participants using a combination of convenience sampling and by posting a call for volunteers in the company-wide messaging application. Three teams were geographically based in the United States and two teams were geographically based in Brazil. All user studies were conducted in English, with a few instances where participants based in Brazil spoke in Portuguese when they preferred to express their opinions in Portuguese. In these instances, a member of our research team who is fluent in Portuguese translated participant quotes to English. After the first phase of the study, we aimed to gather more feedback on the accessibility of the tool. Thus, we supplemented our workshops with two individual interviews with one blind participant and one participant on the autism spectrum who are a part of an internal community of technologists interested in accessibility and who volunteered to participate in our study; they were the only volunteers contacting us while this study took place.

4.2 Procedure

We conducted each workshop using a videoconferencing platform. All remote sessions occurred during the COVID-19 pandemic. Each session lasted approximately 1 hour in total with a 45-minute group activity playing the card tool and a 15-minute focus group debriefing. Prior to the group activity, we asked for one volunteer to take on the role of "Card Shuffler" or "Card Dealer" throughout the session. This participant would be responsible for controlling the shared screen, interacting with the user interface, and drawing cards when the team was ready to move forward. We employed an unstructured observational method for the group activity whereby participants would use the tool in a self-directed manner with little to no intervention from the research team. Participants were invited to think-aloud, put observations in the chat, or verbalize their thoughts throughout the group activity. We conducted a focus group after the group activity to gauge participants' immediate reactions and attitudes towards the R&I Cards, as well as gain a better understanding of whether the card tool supported participants to critically reflect on elements of their work. First, participants were invited to share their initial thoughts about the activity. Participants were then invited to share whether they learned anything new from the activity. Participants discussed their opinions and provided suggestions about the tool. Although each team shared many ideas for improvement, changes to be implemented in the following version were prioritized according to what was most fundamental to gameplay but also the most feasible given the short turn-around time between workshops.

In an additional phase aimed at assessing the R&I Cards tool's initial accessibility, we conducted unstructured individual interviews with two participants with disabilities. Each session lasted approximately 1 hour in total with participants interacting with the tool for 45 minutes followed by a 15-minute debriefing. Participants were also invited to think-aloud while interacting with the tool. No personal information was collected, and participants were referred to using their initials throughout the study. All data collected has been anonymized in this paper to protect participants' privacy. Participants were given the opportunity to withdraw at any time from our study. Participants did not receive any compensation for their participation.

To go through all question cards would have required multiple hours of play, which would have been infeasible for a 1-hour session, so we made the R&I Cards available to teams and individuals if they wanted to continue using it on their own after the session. We expand upon this further in our Limitations section.

4.3 Data Collection and Analysis

The workshops and interviews were audio and video recorded with explicit verbal or written consent from all participants. During the evaluations, members of the research team additionally took typed notes to refer back to on the perceived strengths and weaknesses of each version, which were used to guide the changes made between the versions. The workshops and interviews were then transcribed in full for analysis. The team conducted qualitative thematic analysis on the perceived benefits and tensions of the R&I Cards tool following the guidelines described by Braun and Clarke [8]. The benefits and tensions were specifically evaluated within the context of the tool's usability and effectiveness at supporting participants to critically reflect on the impacts of their work. We first present the iterative Research through Design of our tool and then discuss these recurring themes across the data relating to the benefits and tensions of the tool in our Discussion section.

4.4 Researchers' Positionality

The importance of engaging in reflexivity and being aware of one's positionality and subjectivity in qualitative research cannot be overstated. We attempt to articulate our identities and positions in relation to the world here. At the time of this study, all authors are or were a part of [team redacted] as a part of [organization redacted]. Author 1 is a non-white, North African woman and researcher at a university. Her primary research interests lie in participatory design and Human-Computer Interaction, and her methodological and epistemic lens is influenced by decolonization discourse and local and indigenous knowledge. Author 2 is a Latin, male, able-bodied researcher for a tech company. His primary research background is Human-Computer Interaction. His methodological and epistemic lens is influenced by universal design, socioeconomic diversity, and UI personalization. Author 3 is a white woman and researcher at a tech company. Her background is in pain neuroscience and bioethics, and her research is influenced by patient-centered care practices and design, as well as feminist and critical disability theory. Author 4 is a non-binary, non-white, Latinx researcher at a tech company. Their background is in the history of science and STS, with a specific focus on gender, race, and Global South dynamics.

5 DESIGN AND EVALUATION

In this section, we describe the design of each version of the R&I Cards tool, making note of its distinguishing affordances. We present a screenshot of the first version of the tool as well as the fifth, more stable version. We note changes made between each version—some minor and others major—largely driven by participant feedback and our team's observations and discussion. These changes had important implications on the tool's ability to support things like egalitarianism, meaningful dialogue, and eliciting participants' critical reflections on responsible and inclusive technology design and development. Then, we present findings emerging from each version's respective workshop, summarizing participants' experiences and feedback using the tool.

5.1 Version 1

5.1.1 Design. Version 1 of the R&I Cards was a barebones version where questions were presented in an unstructured format. Players and questions could be sampled with replacement. Version 1 consisted of two pages including a landing page (Figure 3a) and a gameplay page (Figure 3b). The landing page contained a short introduction to the tool (Figure 3c), a section to add and view participants (Figure 3d), a "Play Game" button (Figure 3e), and an optional link to download the guiding questions as a PDF (Figure 3f). Once the volunteering "Card Shuffler" entered the names or initials of participants and clicked "Play Game," participants would be taken to the gameplay page. The gameplay page consisted of a player card (Figure 3g), a question card (Figure 3h), a shuffle button (Figure 3i), and a short description on how to play (Figure 3j). The "Card Shuffler" would click the shuffle button to randomize both the player card and the question card in tandem. Whoever the player card landed on would then try their best to respond to the question they were matched with. Other participants were welcome to also respond to the question after the selected player.

5.1.2 Evaluation. We evaluated Version 1 of the tool with an interdisciplinary, client-focused design team in Brazil consisting of 7 participants. The team successfully got through and discussed 8 cards from the deck during the group activity.

In the evaluation of Version 1 of the R&I Cards, we observed how the tool promoted the participation of all members of the team, generated excitement and comfort towards sometimes difficult topics, and was a novel format compared to what participants were used to with Mural, a digital workspace they use for Design Thinking sessions. One participant appreciated how the card-based format and shuffling helped level the playing field, contrasting it with their typical activities in Mural where "*people do not have voice because they don't know how to write comments or move cards.*" Another participant remarked how the tool helped to facilitate discussion about challenging topics,

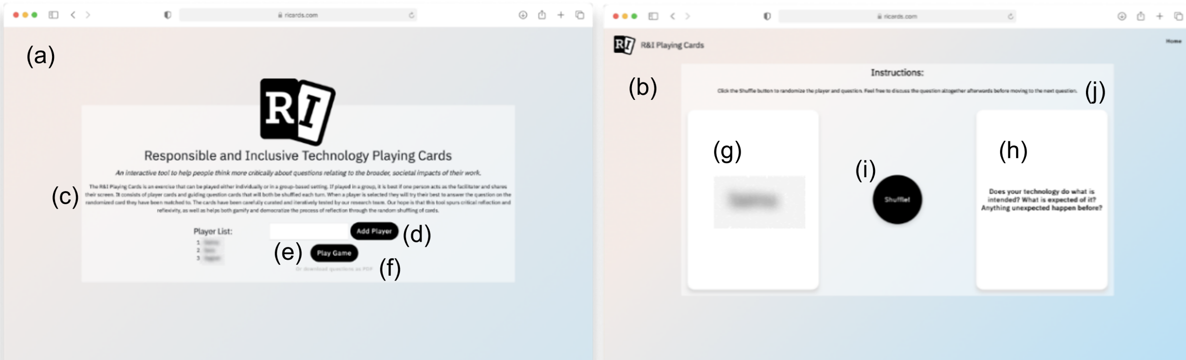

Figure 3: First version of the R&I Cards tool prototype. Changes between versions 1-2 were minimal.

> "I like the idea to have a game to discuss everything because it's possible for everyone to talk, it's possible to have something that is soft, it's comfortable, because maybe we have some difficult ideas or topics."

The tool also revealed opportunities for participants to make their practice more inclusive, such as the need to localize PowerPoints for clients and to make links to external sources accessible with Sign Language translators, "W*e have audiences who don't understand the PowerPoints we have in English. . .now we will translate [them].*"

However, a key issue with Version 1 was that the playing team encountered repeated player cards and question cards. This made us reconsider shuffling mechanics so that one participant would not be called on more than others and questions would not be repeated.

5.2 Version 2

5.2.1 Design. Similar to Version 1, Version 2 presented questions in an unstructured format. However, Version 2 looped through players without replacement. Except for the short description of the tool (which was removed based on feedback from the first workshop), basic styling, and added icons to question cards, all elements remained the same between versions. These icons represented the 3 driving forces from our framework—self, business, and society—and were meant to remind participants throughout gameplay of different value considerations.

5.2.2 Evaluation. Version 2 of the tool was evaluated with an interdisciplinary, client-focused team based in Brazil. The team consisted of 4 participants. The team successfully got through and discussed 6 cards during the group activity.

Version 2 generated an engaging discussion where most participants reflected on questions even though they were not matched to it. Upon discussing stakeholders and realizing that they themselves are stakeholders of their technology, one participant remarked: "*'I've never thought about my role like that.*" This demonstrates how the cards helped participants engage in reflexivity about their roles in technology creation.

However, in Version 2 there was confusion from players about the objectives of the R&I Cards tool, how to respond to questions, and the overall intuitiveness of the tool. First, participants were unsure at the beginning whether to respond to questions verbally or in writing as there were no longer instructions explaining what to do. Participants also felt that the questions lacked grounding in a particular topic or problem, with one participant remarking, "*With this question, I don't understand the specific problem.*" Participants also found some questions challenging to respond to as some questions seemed to build on other ideas that had not yet been discussed or thought about. This made us reconsider the unstructured, unordered format of the guiding questions and whether we should instead introduce more structure and context.

5.3 Version 3

5.3.1 Design. Version 3 differed from Versions 1 and 2 in several ways. Primarily, we changed the R&I Cards tool to a single-page application and introduced card suits and phases to add more structure and order to the questions. Version 3 consisted of one page that combined the landing page and gameplay page of previous versions into one. This version consisted of a collapsible set of instructions (Figure 4a); a section to add and view participants as well as whose turn it is (Figure 4b); a dropdown for selecting a "Game mode" (phases or suits) (Figure 4c); a "Draw card" button (Figure 4d); a "Skip card" button (Figure 4e); a progress indicator to allow participants to see how far along they are in a deck (Figure 4f); and a reversible question card (Figure 4g). Clicking "Draw card" proceeds to the next card in the deck as well the next player. Clicking "Skip card" advances the card but remains on the same player. The question card included a label for which suit the card belonged to, a label for which phase the card belonged to, and an optional mechanism to rate the current guiding question card using emojis.

5.3.2 Evaluation. Version 3 of the tool was evaluated with a team of project managers based in the United States. The team consisted of 3 participants in total. The team successfully got through and discussed 4 cards in the "Phase 1: Getting Started" deck. We gave this team and following teams the flexibility to select their preferred game mode(s) to try.

Participants found the R&I Cards beneficial for starting conversations, stating "*In the sense of generating the discussion, and getting the team to think, generally I think it'll be good.*" It gave them an opportunity to discuss things they normally would not have the

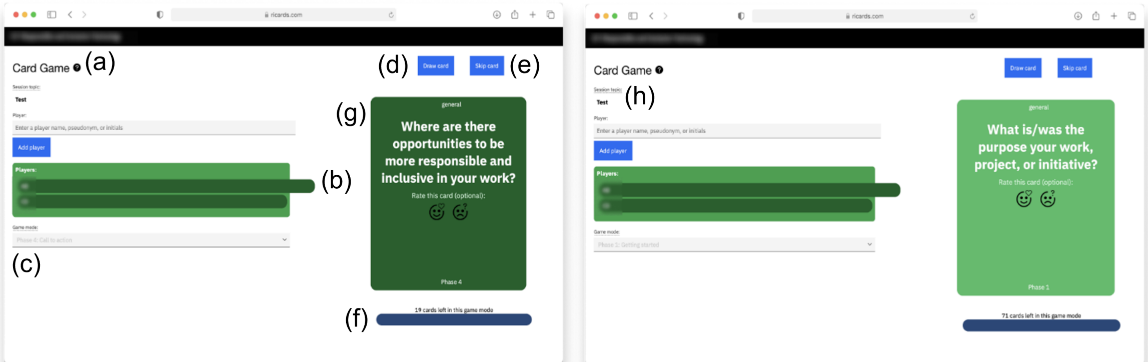

Figure 4: Fifth version of the R&I Cards tool prototype. Changes between versions 3-5 were minimal.

chance to: "*I really like discussing these questions and even in thinking about project management tools, there's not a lot of space in a typical meeting to discuss the ethics of that.*" They also found the tool useful for team building, stating "*I definitely learned a lot more about the people I work with, which was great.*"

However, a key issue of Version 3 was that participants felt that the interface was overly complex for what the tool was trying to accomplish, especially with regards to the instructions, interface elements, and "Game mode." For example, one participant noted,

> "I'm wondering if there should be a place to type in what you're talking about so that we ground it because the questions kind of zoom in and out and it's like are we talking about this one tool? Are we talking about everything we do as project managers? Are we talking about the industry? Without having that on the screen or present, I think it's easy to get confused about the scope."

5.4 Version 4

5.4.1 Design. Version 4 had shorter instructions, a space for players to input and reference their session topic (Figure 4h), and the number of cards remaining in a deck. Based on feedback from the previous workshop, we incorporated a single-line text input field where teams could type in their topic of focus for the session (e.g., technology, opportunity, use case, or anything everyone is working on together) to use as reference throughout the activity and to ground their conversations. Otherwise, all elements of the prototype remained the same between Versions 3 and 4.

5.4.2 Evaluation. We evaluated the fourth version of the tool with a team of senior researchers currently focusing on HCI and AI based in the United States. The team consisted of 3 participants in total, each of whom have experience with leadership roles (ranging from 23 to 32 years of experience) across one or more large technology corporations. The team successfully got through and discussed 13 cards in the "Phase 1: Getting Started" deck.

Participants saw the cards as "*prompts to kind of make ourselves stop in the middle of what we're doing and think.*" They appreciated the flexibility, malleability, and open-endedness of the tool and guiding questions, stating "*because each project is different, the people on the project will know it when they see it.*"

However, in Version 4 participants were confused about the task at hand and the "Game mode." Only when they got to the sixth question in "Phase 1: Getting Started" did participants realize that they had misinterpreted the instructions. As it turns out, all three participants had interpreted "Phase" as meaning phases in the game, rather than the intended meaning of phases in their project. Participants also wanted the ability to move forward and backward between question cards, different styling of the cards and their labels, and less cards in general. Other empirical studies have similarly found that participants prefer there to be fewer cards [3, 19] and that too many cards can be overwhelming and hinder reflection [7, 12].

5.5 Version 5

5.5.1 Design. Version 5 of the R&I Cards was also similar to Version 3-4 with the exception of a few stylistic changes. Keeping in mind that participants could continue playing on their own after the session, this version also included a logging mechanism to register usage data (e.g., mouse and keyboard interaction and explicit feedback using the positive and negative feedback emojis), as recommended for remote and self-learning setups in [15].

5.5.2 Evaluation. The fifth version was evaluated with a team of technologists focusing on accessibility based in the United States. The team consisted of 4 participants in total. The team successfully got through and discussed 5 cards in the "Phase 1: Getting Started" deck, as well as 4 cards in the "Stakeholders" deck.

Unlike in the last workshop, participants interacting with Version 5 noticed the phases and suits before playing and demonstrated they understood the intended meaning by asking "*Oh, where are we at? In the project?*" Participants found the tool effective given the short amount of time they got to engage with it,

> "We only looked at stakeholders and it did help us a lot to think about who our stakeholders are and the different kinds of stakeholders that we have and what their needs might be. Pretty effective for the short amount of time that we spent on it."

The team brainstormed opportunities to make their project more participatory by involving users. This is exemplified in an exchange between two participants where one asked "*Is there an option for people to pick if they want to be contacted?*" to which another responded, "*Yeah, we can add more questions to [our system]. And that could be one of the fields and say, 'hey, can we follow up with you, enter your contact information in here.*"' Lastly, participants appreciated the open-endedness of terms, leaving words like "impact" open to their interpretation,

> "This card prompted us to discuss 3 or 4 different measures of it, or types of impacts. So, I thought that's kind of cool. And that I read it initially as [another participant] read it and then I come to find out there's these 2 or 3 other things I should be considering. So, if we had a Mural board open, or we were taking notes, this would have been kind of cool to capture."

Because this team specializes in accessibility, they provided constructive feedback regarding the accessibility of Version 5 of the R&I Cards. For example, one participant asked, "*I wonder how, if you were a blind person looking at this, you would know whose turn it is*," referencing the purely visual difference to indicate a change in turns. Other than accessibility, participants suggested incorporating a timer into the tool so that players can know how much time has elapsed per question and to pace themselves. The tool was envisioned, designed, and developed from its first version having accessibility in mind. Additional information we obtained from this evaluation led us to invite assistive technology users for individual sessions consisting of interaction with the tool, interviews, and debriefing.

5.6 Version 6

5.6.1 Design. Version 6 included additional accessibility features, timekeeping, and ways of favoriting cards. Version 6 is accessible via keyboard-only navigation and also provides player-card context while read by screen readers.

In terms of timekeeping, our initial intention was to give flexibility and agency to participants to decide how long they wanted to discuss questions. However, participants from previous workshops were uncertain how long to spend on questions. One participant mentioned, "I can be quick here because I'm taking too long." Based on these findings, we have implemented a configurable accessible timer that can be increased or decreased in duration per question. Previous work has also shown the importance of timekeeping, such as Friedman and Hendry's Envisioning Cards, which come with a 3-minute timer to facilitate meaningful use in a limited time [18].

The additional implemented features in Version 6 aimed at providing more flexibility to the cards, allowing favoriting and printing cards. We now provide ways to make the R&I Cards participatory by enabling players to provide feedback and personalizing questions to further use. In their "Building Utopia" Afrofuturism cards, Bray and Harrington incorporated a blank deck of cards that could be filled in by participants for forecasting equitable futures [9]. Friedman and Hendry's Envisioning Cards also have "create your own" cards for each of their four envisioning criteria [18]. These changes implemented in Version 6 were based on findings from the fourth workshop, where one participant mentioned,

> "There is also an opportunity to learn about new concepts by encouraging people to create their own cards. It could be good for people to put those newly created cards into a shared repository, so that they could learn from other teams."

One could imagine teams creating or adapting cards for various purposes. Hence, Version 6 allows players to customize existing questions, favorite them, and print the favorited cards, in an effort to close the loop with physicality and allow the game to be repurposed in new contexts, as advocated in [15]. These features allow multiple possibilities in terms of how and where discussion promoted by the R&I Cards could be beneficial, e.g., (1) during sprint planning while prioritizing tasks or decomposing epics, (2) by attaching a question to a task as a rationale, or (3) as a part of Design Thinking workshops to promote democratized turn-taking discussion about a project before exploring *to-be* scenarios in a way to envision solutions in a responsible and inclusive way.

5.6.2 Evaluation. The sixth version was evaluated with two technologists with disabilities, both based in Brazil. In this step of our research, the goal was twofold: first, to assess accessibility with the help of assistive technology users; and second, to test the tool with a single player. The first interview (P6.1) was performed with a participant who self-identified as being on the autism spectrum and having Attention-Deficit/Hyperactivity Disorder. The second interview (P6.2) was performed with a blind participant interacting with the tool using their real setup, including NVDA screen reader and usual reading speed.

Participants were able to identify the tool's overall goals and found it easy to use. However, P6.1 suggested shortening questions, avoiding lists of similar terms, and presenting only one question per card. On one occasion, P6.1 said that "*I'll skip because there are two questions.*" Later, P6.1 suggested a good length for questions: "*I think that 4-5 lines is a good size for questions.*" P6.1 also pointed out that open-ended questions can be a problem for people on the spectrum and that providing images or contexts to the questions could improve the overall playability. P6.2 found the overall game accessibility adequate. When first interacting with the tool, P6.2 said "*It is not ignoring HTML semantics. . . This helps a lot*!" When thinking out loud, P6.2 reported their mental model of the game explaining the form for entering player names, buttons for drawing/skipping cards, the timer, and feedback features. Finally, this assessment provided us with input on how to simplify questions, split complex questions into follow up cards, and improve the accessibility of the tool.

6 DISCUSSION

6.1 Engaging Technologists in Responsible and Inclusive Technology

In this paper, we reported the iterative Research through Design and evaluation of the R&I Cards tool with technologists involved in various aspects and stages of technology innovation, from research and development to management and client engagement. Overall, we saw moments in every workshop where the tool enabled technologists to reflect and discuss larger contexts and impacts of their work, and we identify multiple benefits as well as tensions of the R&I Cards, described below.

6.1.1 Benefits: Moving from Ideation Cards to Critical Thinking and Inclusive Praxis. **Encouraging Meaningful Dialogue:** R&I Cards promoted low-stakes discussions about challenging topics. Cards have been shown to relieve pressure from participants and enable expression of personal experience [2, 14]. They have also been shown to make serious topics approachable, especially by deferring responsibility of questioning from people to cards [5, 14]. Our participants saw the R&I Cards as a good way to discuss difficult topics and ideas. One participant noted how "*it's been hard for me to communicate certain things, and this is helping to bring out a lot of that*." Likewise, the cards enabled the ability (both the time and forum) to discuss issues and share ideas, in a way that appeared to feel comfortable for people who may have had different opinions or backgrounds. For example, one player felt confident enough to share a potentially contentious opinion, saying "*I do not see a diversity issue here,*" which was subsequently discussed. It also allowed players to learn more about their colleague's personal experiences or thoughts; after listening to a fellow co-worker's response, a participant commented "*I did not know you had this opinion*." In particular, the association of cards with an overall 'game feel' made one player remark that the meeting felt *"soft"* and "*comfortable*" despite discussing difficult ideas or topics. To this end, we extend prior empirical findings demonstrating how cards allow participants to express their experiences and ideas more openly and feel secure and comfortable in their exchanges [5, 14, 25].

Promoting Egalitarianism: R&I Cards helped reduce momentary power gaps through democratized turn-taking. In a participant's words, the R&I Cards helped to "*level the playing field*." Urquhart et al. have argued that collaborative card-based methods can help democratize ethical deliberation and discussions [14]. By having the tool automatically match participants to questions, it eliminated the tendency for more senior technologists or managers to begin the discussion, steer the topics, or interject. Instead, all members of a team had the opportunity to participate equally with this method of card assignment, which is important in a setting that can be rife with these kinds of power gaps between leaders and staff. We observed this to be especially true in Workshop 1 that consisted of interns as well as senior level employees, where someone shared that the tool made it "*possible for everyone to talk.*" The tool also included technologists in a way that other top-down or corporate governance-based approaches to responsible conduct may not. One player in Workshop 3 remarked, "*I think on our team, we also struggle to generate awareness and engagement with data privacy regulation and best practices. So, it's kind of inspiring...to see this model of engagement with questions that's kind of collaborative, rather than, like, read the rules.*"

Detecting Gaps and Growth Opportunities: R&I Cards enabled participants to identify concrete areas for improving their practice. In reflective practice, both reflection and action ought to occur concurrently [36]. As Sengers et al. noted, critical reflection on unconscious values embedded in computing should be prioritized in technology design in order to identify potential blind spots and reveal new design spaces [37]. One of our goals was to encourage technologists to take action to improve their projects and mitigate potentially negative impacts. A participant in Workshop 5 brought up the issue of redundancy in their larger system of website contacts and how that could be particularly confusing for people with different abilities. Another person responded,

> "We have to be aware that many of the places that we send them, might send them back to our page...and we're going to be sending people around in circles." She later continued, "When we send these people off into the wild, they're working with people who don't understand as much as we do about this person's user experience. So those impacted will end up having to explain themselves again and again. You'll have a deaf person being given a phone number and a blind person being given an image with no explanation. There should be people...who understand accessibility."

They later agreed that this would be a problem the group would surface to the larger team and work to fix.

In all five workshops, participants identified and discussed gaps and opportunities for increasing responsible and inclusive action in their current projects and practices.

Eliciting Important Elements of Responsible and Inclusive Technology Innovation: Through play and discussion of the R&I framework content, the card tool supported engagement with critical aspects of technology design and deployment that are necessary for more meaningful positive impacts within research, business, and especially society. There was evidence that participants' conceptualizations of both stakeholders and impacts were enriched or expanded, and that the tool provoked discussions about inclusion broadly speaking. In particular, the cards evoked stakeholder groups and needs beyond business-to-business (B2B) considerations, which can often stop at immediate business benefactors of a project or product. For example, in Workshop 2, when talking about stakeholder conflicts, the group realized that they, too, could be considered stakeholders, with one person remarking "*I've never thought about my role like that,*" and another commenting, "*Not only the clients are stakeholders—inside [our company], we have stakeholders as well.*" In another workshop, a player mentioned "*Our clients' clients,*" indicating attention to downstream consumers and end users. During an exchange in Version 4, participants deliberated on how the team would define stakeholders for their projects, asking whether they are "*ultimate users," "[people] doing the project together," or "something broader?"* One participant took a very expansive approach which they shared with the group, touching on other various concepts that the R&I Cards had already introduced. "*A stakeholder...is anybody who...was implicated in 'the thing,' and the thing might be technology, it might be a party in this collectively held 'thing.' They're all stakeholders. Some of them...are direct stakeholders, they touch the thing. Some of them are indirect stakeholders. They don't touch it. But either way, their knowledge is important, or they suffer downstream consequences.*"

Likewise, the topic of inclusion was discussed in all 5 workshops. These moments touched on specific design decisions, inaccessibility, and lack of knowledge about different impacted users or communities, as well as more nuanced considerations that began getting at stakeholder intersectionality. In Workshop 1, for example, the team brought up differential starting needs and identities of participants, and how all of those should be considered.

> "We are used to having supporting materials, meetings, and everything in English, and we are used to dealing with technology, and this is fine in our little bubble. But what about engagement sessions we have [with] a client that is 18 years old that lives in the US and was born with a cellphone in their hand, [versus] a 75-year-old man who was fully Brazilian and never traveled outside."

Inclusion was also discussed in reference to teammates' and collaborators' backgrounds and skills. One player commented, "*I think we are a very diverse team in terms of skills, but we will always have missing voices, we can always have someone different, we can always improve this*." In contrast, another player acknowledged the lack of racial and ethnic diversity but felt "*like we have people with the right professional diversity in this project*." In Workshop 4, participants talked about the difficulties of doing internal research due to lack of gender diversity in the population they were studying, mostly software engineers, and they struggled to obtain a representative or balanced sample. They also talked about other aspects of diversity within their subject pool. "*What we were able to achieve is to get software engineers from a variety of kinds of engineering work*," and, "*We tried to get geographical diversity, but we also weren't used to [working in] the middle of the night. So that cut out the Indian sub-continent pretty thoroughly*."

Reflecting on Corporate Context and Influence: Throughout our framework, we have questions which encourage reflection on how business values, legal considerations, public relations, internal and external policies, and corporate infrastructures influence research projects and technologies. For example, we have cards that ask players to compare and contrast incentives between stakeholders in different spheres (e.g., "What are the motivations behind this project for you and your team? What are the motivations behind this project for business stakeholders?") and to discuss "unavoidable tensions or tradeoffs" between these different stakeholders. Cards also ask players to consider "how the project has been framed by your organization's communications team, as well as the media?" to get people thinking about larger corporate narratives and their translation into society. Although many of these framework questions were not answered by teams as they occurred in later card phases (a point we return to in the Limitations section), exposure to earlier cards still resulted in many teams discussing barriers and tensions of doing responsible or inclusive work within a corporate environment. In Workshop 1, the team discussed a lack of resources in terms of time and support for different expertise, as well as concurrent pressure to produce. One participant noted that developers faced "*a lack of time to learn things that were in our study backlog*" and another person mentioned even though diverse expertise was welcome, it was "*a challenge to manage non-technical people*" because they needed more time to understand the details. The result of this was that they had to "*leave aside much of the complexity of the software in order to deliver [a product] in time*." They acknowledged that this negatively impacted them in the future and was a problem they called "technical debt." In Workshop 5, teammates discussed barriers related to B2B models, particularly the consequences of technologists not getting to directly interact with customers, consumers, or end users of the products they develop.

> "I think the thing that I'm sort of coming away with from our conversation related to the project is this whole um, difficulty that we have of getting the data that we want to base these decisions on and, like, getting the ability to talk to our users and find out really who they are and why they're coming is a challenge for us. We're having to rely on little scraps of information when we happen to meet somebody, or come across somebody indirectly who was coming to this page."

Other industry-related reflections that the tool surfaced included stakeholder priorities being shaped by clients or funding, making a profit at the expense of overlooking inclusion, overly complex processes and tools, a lack of attention or scrutiny due to outcomes being internally used instead of publicly deployed, and difficulties in measuring impact and success of projects when the pathway to implementation was quite long.

While we did not follow-up with participants after workshops, we saw evidence that the tool provided technologists practical value, as well as indications that the tool and insights gleaned had the potential to be used more broadly in the future. For instance, a participant in Version 3 responsible for larger enterprise-wide tool enablement, commented on how useful the card content could be for larger strategy and planning meetings in the future, saying, "*I want to take these [questions]...as we're planning a project, it can be tactical [and] linked to how we hit this target....we do 10 cards for 30 minutes, 3 people, lightning round with, like, thoughts on this or that. And it kind of just jogs these bigger picture questions. I feel like that could be great*." Another participant in Version 4 expressed interest in using the card content and underlying API for their larger research team, asking permission for "*a subset of questions...to reuse or repurpose for our inquiries*." While we acknowledge that our study was unable to assess whether teams applied what they learned from the discussion to their projects, we think there was genuine interest in re-use of the tool and many concrete examples for adoption that have implications for local, team-level practice as well as more global, enterprise-level processes. We revisit the R&I Card tool's potential in our Future Directions.

6.1.2 Tensions in Design: Striking a Balance Between Structured or Open Functionality. **Too Many Instructions Versus Not Enough Instructions**: Yoon et al. argue that usage guidelines are no less important than the cards themselves [1, 43] and have great influence on the usefulness of cards. How much instruction to provide participants was one tension in the Research through Design of the R&I Cards tool. In our first workshop, one participant stated, "there is a lot of text to introduce the game." After removing the text, participants in the second workshop wished there were more instructions up front to clarify the intentions and objectives of the tool and cards. This cycle continued in the next three versions where providing too much instruction detracted from the activity and providing too little instruction led to participants' confusion on what to do. Aarts et al. distinguish between two types of methodologies of use of cards: ones containing specific instructions, and ones with suggestions of use [1]. To address this tension, we speculate that providing suggestions for use rather than specific instructions may be a promising approach to take instead. One participant also suggested having a walkthrough of the interface prior to playing that points to each part of the interface and explains its affordances.

Specificity Versus Deliberate Vagueness: The importance of providing the opportunity to appropriate design cards to different purposes has also been discussed in previous work [43]. We purposefully kept questions and key words open to interpretation so that the R&I Cards could be used by technologists with varying needs, goals, and expertise. Some participants liked this vagueness. For example, one participant stated, "*Some of them were a little bit vague, but also lent themselves for good discussion. But I think it really depends on where the team is at and whether you want to have a broader discussion or a very focused discussion.*" Additionally, some participants appreciated how we did not define certain terms like indirect and direct stakeholders and impacts. For example, one participant liked how another participant defined "impact" in their own words and tied it back to their selected topic. However, while some participants liked the open-endedness of questions and key words, other participants wished we had provided more definitions, examples, or images. For example, one participant remarked, "*I think we're back to one of the problems of diversity as an abstract word. What kind of diversity?*" One participant suggested "*I was wondering if there's a way to have a little further information on key terms somewhere. You'd click to get a little bit more of a definition of what the key term was.*" We will continue exploring ways of balancing this important tension.

6.2 Limitations

While the R&I Cards represents one tangible way for technologists in industry to consider and critically reflect on the various socio-technical factors that influence decisions about technology development and deployment, there are limitations inherent to the tool and its focus on critical and self-reflection as a catalyst for change.

Scope: For teams to cover the entire R&I framework and questions, they would need to engage with a total of 106 questions, which would take several hours. While our participants appreciated the effectiveness of the tool given the short amount of time they engaged with it, this is a key consideration as teams may not have the top-down support to pause other work and prioritize critical reflection. Unlocking the full benefits of the tool is therefore dependent on broader institutional or company-wide incentive structures that value responsible and inclusive innovation. A related limitation is that the intended users of the card tool (i.e., teams of technologists) may not have the decision-making power or ability to act upon the issues or concerns that emerge during critical reflection. This means that in some instances the card tool will help increase awareness, without necessarily affecting concrete action plans and mitigation strategies at levels and scales beyond individuals' or teams' spheres of influence.

Usefulness and Usability: Teams may want to use the card tool for very different reasons and in different contexts, which may influence their interpretations of the content and resulting dialogue, as well as how and why they interact with the tool itself. For example, technologists might be interested in documenting their dialogue for a future paper or grant submission, but the card tool currently does not have an interface to capture notes or responses (a point we address in Future Directions). Business developers may want to promote using the tool in client discussions to help improve future contracts or work projects but may not know where is appropriate to begin given the client's unique needs or market niche (e.g., what suit or what level to start on, how long to play, etc.). Depending on where and by whom the card tool is used, there are also language and cultural factors that may influence the tool's use. One player asked, "*Can I discuss this in [my mother tongue]?*" which emphasizes the importance of translating the questions into different languages in the future so that it is easier for teams across different geographical locations to discuss topics more comfortably and intuitively.

All of these limitations also had an effect on our research study, findings, and Research through Design process. Because of the length and organization of the tool along with time constraints, we never got to evaluate all R&I framework questions during the workshops. This means that teams who elected to start on level 1 or 2 of the deck likely did not interact with cards probing issues of inclusion, history, or power more deeply (in levels 3 and 4). For example, one of our later framework questions asks "When reflecting on outcomes vs. impact, do you think it is possible to have a successful project but ultimately cause negative impact? Why?" To sufficiently answer this question requires players to have already identified potential impacts and both defined and differentiated success, outcome, and impact in the initial phases. Other examples of cards that teams did not interact with include "What are the political and legal implications of your project?", "What are some socio-historical factors that may affect how your technology is designed or built?", "Are there communities that historically or currently don't engage with the technologies and research related to your project?", and "How can you increase engagement with stakeholders that could be negatively impacted?" We were thus limited in our ability to assess the effectiveness of going through the entire framework. Additionally, because the workshops with participants focused on their discussions and use of the tool, our knowledge about what was done afterwards, i.e., if they continued to use it or how increased awareness and new insights led to tangible outcomes, is limited.

7 FUTURE DIRECTIONS

There are a number of areas where we can expand upon and strengthen this research, as well as improve the tool functionality and content. First, we need to evaluate the immediate and long-term impacts of completing the framework in its entirety, which will require diverse research methods and a focus on a multiplicity of stakeholders. Second, while our current research was informed by teams across a broad range of departments and project types, an effort at piloting the tool within specific research or work processes would inform us about its potential utility and scalability within everyday practice. As mentioned previously, this might look like embedding the card tool into volunteering teams' sprint plans, strategy meetings, or design thinking sessions to see how the content or dialogue impacts ongoing and future planning or project design. Third, additional guidance and tool flexibility may be required to be more effective. For example, many workshop teams expressed wanting the ability to take notes or record during the session, a functionality we did not implement due to concerns about privacy or need-to-know information. In lieu of this, we created a 'primer' or best practices guide that helps teams better prepare for discussion by encouraging them to document insights via a shared workspace and orients them toward the interface's 'save card function.' Additionally, although the tool does have built-in flexibility so that users can select and later switch into any suit or phase, the sheer number of cards and the underlying card structure could potentially limit a team's ability to hone-in on specific questions they might find most relevant for a given project or situation. To address this, we have developed an optional 'core deck' with a reduced set of cards that might be more feasible on its own, and we have begun exploring ways for users to select specific questions and build their own card decks. Finally, given that the R&I Cards tool was envisioned with continuous collaboration in mind, we want to create more opportunities to share and iterate upon our framework—for example, as a set of guiding questions in GitHub that would allow people to suggest changes directly to the questions used in the tool. In the past, only 6 of 32 decks were made available to the public for viewing, downloading, and using in Aarts et al.'s review of design cards [1]. Given the far-reaching potential of the R&I Cards tool and ultimate vision of our team, we believe making our tool open to the community will help to increase its inclusiveness and accessibility. We also intend to translate the framework content and questions into different languages to improve interpretation and discussion.

8 CONCLUSION

While many cards were developed to support design phases, we know relatively little about how they impact research and innovation processes in the tech industry. It is crucial to create tools and frameworks to support technologists to critically reflect on the larger contexts and broader impacts of their work in order to become more responsible and inclusive in their practice. In this paper, we described the Research through Design of the R&I Cards, an online card tool that takes participants through different topics such as intentions, methods, stakeholders, impacts, and past actions. We observed how the R&I Cards promoted discussions about difficult topics and ideas, egalitarianism through structured and democratized turn-taking, and reflection on gaps and opportunities for increasing responsible and inclusive action in technologists' current practice.

Our tool and its respective framework content (i.e., card questions, suits, and phases) offer materials and prompts that promote reflection on critical intersections, potential opportunities, and common challenges between research needs, business incentives, and societal issues, all while attending to historical considerations, diverse stakeholders, notions of impact, and on-going praxis. These considerations are also embedded within the framework process (underlying card ordering and structure), where phases were designed to enable self-paced learning and, importantly, a gradual layering and intersection of knowledge depth and accumulation to support future action, no matter the starting background or disciplinary expertise of the players. This same design choice also allowed for necessary adaptability in terms of topic and time, so that players could engage with the tool (start their play) according to their research or business need, previous and existing work, and any time constraints they may have—they could select mode of engagement by any phase or any suit. Finally, the tool implemented automatic assignment and turn-taking to different players to temporarily counter hierarchical imbalances and power dynamics within corporate discussions and interactions, eliminating the requirement for a designated facilitator and providing everyone with both the chance to respond and the decision to answer, skip, or open the discussion.

It is our hope that the R&I Cards tool contributes to the broader discussion of how to create technology that is more accountable, responsible, and inclusive, and imbues members of the technology industry to engage in more critical reflection. Ultimately, we hope the R&I Cards tool and its respective framework and guiding questions can become one of many resources that help transform technology industry practices, outcomes, and culture.

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