Futuristic Autobiographies: Weaving Participant Narratives to Elicit Values around Robots

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ABSTRACT

In this paper, we motivate and introduce Futuristic Autobiographies, a method inspired by design fiction for eliciting values and perspectives on the future of technologies from participants such as users, designers, and researchers. Futuristic autobiographies are the creative work of the researchers and participants. Grounded in empirical and background work, researchers pose several stories involving the participant as a character about a future state with robots. Participants are then asked to weave fictional autobiographies to explain what led to this future state. Via a case study in which futuristic autobiographies were used with 23 roboticists, we detail the process involved in developing and implementing this method. When futuristic autobiographies are employed and carefully crafted from background research, they allow informants to speak for themselves on how their practices and values are intertwined now and in the future. We highlight both the benefits and challenges of futuristic autobiographies as a way to elicit rich stories about values. We argue that futuristic autobiographies are a promising addition to the current qualitative methods toolkit used in HRI.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**;

KEYWORDS

Human-robot interaction; Qualitative methods; Design fiction; Value-sensitive design

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1 INTRODUCTION

Daniel H. Wilson, roboticist and sci-fi author, emphasized an "inextricable link" between robotics and science fiction during his 2015 HRI conference keynote [44]. Science fiction, he argued, allows roboticists to think about "how and when those futures arrive." Further, science fiction offers a vocabulary and vision of future technologies, enabling roboticists and the general public to discuss and debate emerging technologies. In this paper, we share a similar view that fiction can be a valuable way to engage diverse stakeholders of robotics. We propose and provide a case study of the use of *futuristic autobiographies* (FABs) where users and researchers engage in creating future fictional accounts of robots. Augmented with qualitative methods already in use by HRI, FABs provide an expeditious method to gather narratives [18] on the (sometimes subconscious) perspectives and values of roboticists.

FABs draw from design fictions. Sterling defines design fiction as "the deliberate use of diegetic prototypes to suspend disbelief about change" [39]. Diegesis is the constructed world of fiction. Diegetic prototypes are interacted with by characters of the fictional world—they are "real" to that world. Diegetic prototypes, fantastic though they may be in contemporary society, become plausible technologies of the future to the readers of fiction. Readers suspend disbelief and seriously consider the ramifications of the diegetic prototypes in a future, alternate life.

FABs take the concept of diegesis and asks that participants *become diegetic* instead of focusing on the prototype. Presented with a futuristic story about technology involving the participant as an active character (e.g., as a protagonist or antagonist), participants are asked to explain how that story came about. Participants are asked to think about the "past" of futuristic stories; in other words, they are to complete their own, albeit fictional, "autobiography." Used in conjunction with interview-based studies, the results of FABs are amenable to analysis used in qualitative studies such as grounded theory [40].

1.1 Background

FABs arose as a pragmatic response to the methodological challenges of using traditional methods of ethnographic inquiry. In our prior studies [8, 9], we sought to investigate the values of roboticists and how such values were intertwined with the designs and design practices of roboticists. We follow JafariNaimi et al.'s definition of values: "Values serve situations as hypotheses" [21, p.97]. Values play a role as grounds for taking a certain stance (e.g., if it is a problem or not) and actions (e.g., what ways can tackle an issue) in posed situations. We found that directly asking informants about their values in relation to robots led to substandard answers. Based on these studies, we used FABs to interview roboticists expeditiously but with great richness about their values. Our published work [10] describes several findings (e.g., some roboticists think users should adapt to robots) from the use of FABs.

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Using data from that study [10], this paper instead focuses on the *method* of futuristic autobiographies and its utility for HRI. We provide details on how FABs were developed and employed as well as the kinds of autobiographies generated by participants. FABs are shown to be an effective means of eliciting rich narratives that incorporate participants' experiences, practices, and viewpoints. Moreover, these FABs were effective in revealing tensions in values between stakeholders of robotics. We also outline the challenges of FABs and detail future opportunities for refinement and its use in HRI. This paper provides a "behind-the-scenes" look into FABs that can serve as a guide for HRI researchers to create and use FABs to augment interview-based methods in their own studies.

2 RELATED WORK

Design fiction has been fruitfully applied to HCI research. It is used to inform new prototypes [11], to anticipate the future as a conceptual framework [20], to provoke design thinking [43], and as a way for researchers to fictionally propose studies [3, 16] to explore how future users may adopt future technologies [27]. Design fiction importantly provides a speculative space that allows us, as researchers, to understand the implicit future social and political consequences of technology rather than coming to specific solutions [3, 4]. Pargman et al. [30] had pairs of users critique a variety of future scenarios and collaborate to write iterated versions of design fiction. The authors found that design fiction workshops offered users an opportunity to learn their partners' practices and to lead discussions related to specific future agendas (e.g., the sustainable development of information and communications technology).

Our FABs feature some parallels to what Lindley et al. [29] call anticipatory ethnography, especially the study of how audiences interact with or perceive design fiction. However, anticipatory ethnography does not specify methods (as we do) to achieve this agenda. FABs ask informants to go beyond passively consuming fiction and become part of the stories they create.

Most similar to our approach is a research study using a participatory design (PD) fiction writing workshop [31]. This is in contrast to previous approaches where design fiction is created only by researchers. In that work, participants were given a character name and year and asked to invent a story about their domestic lives related to energy consumption. Similar to our goals of examining participants' perspectives through FABs, researchers used design fiction in PD to help participants discuss how their stories of the future might be enabled or prevented. Our FABs, however, can be seen as providing the "end" of a story to which the user is responsible for creating the story that leads to that end. Our prompts are also less open-ended.

Narratives, scenarios, or stories, widely used in HCI and HRI, may be considered cousins to design fiction. As with design fiction, they engage potential stakeholders [45] and elicit feedback about design concepts or prototypes embedded in a presented narrative [26, 32], design workshops, or interviews [5, 30]. With a few exceptions (e.g, [5]), HRI studies employing experimental methods have mostly used scenarios. In one exception, scenario-focused workshops [5] were conducted by Caleb-Solly et al. to evaluate their design for domestic care robots. Older adults and caregivers imagined their interactions with robots through presented scenarios. Older adults were positive about talking to robots while caregivers recommended indirect interactions via sensors.

HRI researchers have long known that fiction and robotics are inexorably intertwined; Sundar [41] notes that robot designers are aware of robots in fiction and its influence on users. Roboticists have examined how fiction has shaped the public's expectations of robots and where such perceptions are misaligned with real robots [36, 41]. Duffy and Zawieska [13] note that the premise of design fiction, the suspension of disbelief alluded to earlier, can lead users to successful interactions with social robots. Designers should consider design fiction as a strategy for bringing about suspension of disbelief. To the best of our knowledge, the use of design fiction as a research method in HRI has been under-investigated.

3 DEVELOPING FUTURISTIC AUTOBIOGRAPHIES

We now provide details about how futuristic autobiographies (FABs) were developed over the course of three prior studies we conducted [8–10] and the rationale for developing FABs. The overall goal of our prior studies was to understand the perspectives and values of roboticists. Such an understanding, we reasoned, could shed light on how ingrained values are reflected in the robots they created.

With this goal in mind, we first analyzed media (robotic podcasts, YouTube channels) and archival sources (oral histories of roboticists collected by the IEEE Robotics and Automation Society) [8, 9]. We found that their design orientations to robots were intimately tied-up with the personal autobiographies of roboticists. We also saw that the values and experiences of veteran roboticists have shaped the face of contemporary robotics. However, since the data was collected with different goals from ours, the data lacked details regarding the values and practices of roboticists. More importantly, we noticed that when value-related or forward-thinking questions (e.g., desirable roles of robots in the future) were directly asked in the archival interviews, roboticists often responded superficially. This spurred us to think of new approaches to effectively elicit rich narratives about the values roboticists held.

Findings and insights from these two studies formed the genesis of the futuristic autobiographies that we employed in our third study [10]. We began by brainstorming around themes we noticed (e.g., sources of inspiration in doing research, what a robot meant to them, expected roles of robots) in the first two studies. We generated approximately 15 futuristic autobiographies, each of which represented a different theme. All futuristic autobiographies were crafted with the intention of conducting them with HRI researchers.

We conducted two pilot studies of our FABs with roboticists on our campus that verified whether our FABs were clear and compelling enough to elicit rich responses. We wanted to see if informants could create FABs on the spot in a reasonable time frame. We fine-tuned FABs according to four criteria: whether the FAB was expeditious, had interesting content, led to an open discussion, and revealed one's values and ethics. We suggest other researchers should strive to meet these criteria should they wish to use FABs. We provide details about our FABs in the next section.

4 FUTURISTIC AUTOBIOGRAPHIES

Futuristic autobiographies involve the presentation of stories, or prompts, created by the researcher which are grounded in background research (e.g., analysis of fieldwork or archival data) that involve the participant as a key character (hence, the autobiographical nature of the exercise). These stories take place in the future, and participants are asked to create an autobiography that describes how these stories came to be. Each story has a set of secondary questions associated with it (e.g., What caused this?). In other words, participants are asked to craft an autobiography that "completes" the story with them as the central character. By putting forward to participants fictional future situations, our method opens "a space for discussion" [14, p.51]. Rather than predicting the future through responses from participants, we were more interested in provoking their imagination on the impacts of future technology, thereby revealing something about current values and technology.

In short, compared to other related methodologies, FABs have two unique facets: its temporal nature and its employment of diegesis. FAB prompts force participants to imagine what brought about one's own biographical story. Most scenario-based approaches ask participants to respond to some aspect of a scenario or to state what happens after the scenario [19]. In moral psychology studies (e.g., [12]), participants were asked to rate scenarios on aspects such as the morality of a scenario or what ethical issues can arise. In information system design studies (e.g., [6]), participants were asked to describe how they would interact with technologies in given scenarios. Our FABs highlight the concept of diegesis, or narrative, where respondents act as "characters." This offers a more persuasive and situation-based way to think about the future of technology and its role in society. Diegesis, a key aspect of design fiction, is unique from other scenario- or narrative-based methods such as user scenarios or persona development [4, 38] in HCI.

Futuristic autobiographies (FABs) also allow participants to consider the ethical and social implication of emerging technology developments rather than focus on their technical possibility. Foregrounding the ethical and moral concerns of envisioned technology over the advancement of technology functionality distinguishes our method from others such as scenarios and personas. Our FABs are also plausible. We represented "mundane facets of life" [17] by using familiar settings (e.g., lab, user experiments) and issues (e.g., government funding, research collaboration) to our participants.

We envision FABs as a novel approach to qualitative studies that augment interview-based studies. This diverges from hypothetical scenarios in experimental studies [12, 15] that often use quantitative approaches to measure participants' responses to scenarios. Our method instead is a value elicitation tool for producing qualitative data which can then be analyzed appropriately (e.g., grounded theory analysis). By analyzing FABs, one can answer research questions about those involved with technology (e.g., designers, developers) that are difficult to ask directly such as: "What values do you hold?" and "How do these values intermingle with your practices?" We have successfully published findings from this approach [10].

Taken as a whole, our method draws from Humanistic HCI methods that blend both critical (design fictions) and social science (interviews) approaches [2]. Our method aligns with Le Dantec et al.'s [24] approach to value-sensitive design, which involves empirical investigations to discover concrete values "within the context of design." Although FABs can be analyzed through any qualitative methodology that examines texts, in this paper, we analyzed FABs from a social constructivist stance [7]. Such a stance acknowledges our position as researchers that roboticists construct a certain reality through their actions and utterances which legitimizes certain forms of robotics, roboticists, robots, and users. While our coding was rigorous and iteratively done through memoing and theorizing, a different sociological perspective may lead to another, equally compelling interpretation of our FAB data. Our perspective here impels researchers (whom occupy a privileged position in technology) to reflect upon their assumptions or biases. In this way, existing design processes or approaches can be examined critically, based on the results of FABs. For example, HRI researchers could be more aware of their views of robot users and become more conscious of their design decisions [10]. We believe this is essential to interacting transparently with users and for the smooth introduction of new technologies.

4.1 Features of Futuristic Autobiographies

Futuristic autobiographies (FABs) augment interview-based studies and have the following features:

Expeditious: We estimated our interviews would last between 30 to 60 minutes. Therefore, we could only allocate 5 to 10 minutes to each story. Futuristic autobiographies are short (~100 words).
Captivating Content: We added elements to make our FABs more interesting to participants. The prompts of FABs contained specific and plausible contexts (e.g., an IEEE robotic society award). Parts of the research process (e.g., setting up research, funding resources, designing robots, and future uses and roles of robots) were also included in the prompts to engage perspectives on their practices.
Open-Ended Discussion: Each FAB was intended to be open-ended enough to elicit rich responses. To avoid straightforward and short responses from participants, the FABs had more than one follow-up question and multiple themes. For example, stories addressing specific models of robots were excluded. Our FABs were ambiguous [37] with some details (e.g., Why does this story happen in 2050 versus 2040?).
Focus on Values and Ethic: FABs sought to evoke and reveal the core values of our participants. For roboticists, FABs targeted tension points on an ethical dimension to trigger stories about technology and values. Based on background research, we found that ethics in robotic research was a hot point in the community.

5 A CASE STUDY OF FABS

We employed futuristic autobiographies (FABs) with 23 HRI researchers (hereafter called roboticists) whose research involved humanoids. Our participants came from a variety of disciplines in robotics—engineering (e.g., mechanics, computer science, robotics), psychology (e.g., education, media psychology), cognitive neuroscience, design (e.g., industrial design), and/or philosophy (e.g., applied ethics)—and occupied different professional positions (faculty, post-docs, and senior Ph.D. students). This diversity of backgrounds reflects the interdisciplinarity of HRI. Full details on the participants are in our past published work [10].

FABs were incorporated into our semi-structured interview protocol and were conducted with individual participants in-person as part of the interview. FABs were introduced to participants with the following prompt: "I'm going to present you with a set of stories about your future with robotics, each of which will be followed by some questions. Feel free to use your imagination in your answers. There's no right or wrong answer." The prompts then were given to participants one-by-one on a piece of paper. The participant was guided to respond and discuss their FABs orally. We asked follow-up questions on aspects (e.g., probing on details and motivations) of their FABs.

Sessions lasted 30-70 minutes and were conducted at multiple sites (a major HRI conference and two university robotic labs). All sessions were audio-recorded and transcribed for analysis. Using a constructivist grounded theory approach [7], all authors individually open-coded transcripts. Our initial research question (what perspectives and values might roboticists have when developing future robots?) evolved throughout the collection and analysis of data. When we reached data saturation in our coding process, our findings illustrated how differently roboticists imagine the current and future robot user [10]. Given the diverse background of researchers doing HRI, the FABs reflected a multitude of different values from one individual to another. Grounded theory allowed us to focus on finding common themes with respect to values across our FABs.

Below, we describe four FABs, the motivation behind each autobiography, and the patterns of responses we received. All quotes have been anonymized (with IDs in the form of PXX). Although six autobiographies in total were created [10], for brevity's sake, we will focus on four (the other two had patterns of responses that overlap with the four we describe).

5.1 FAB 1: Technological Expectations

In 2026, you're writing a daily log of your research. Today you conducted a user experiment with your robot. In one moment during the experiment, you had an experience that gave you goose bumps or caused you to cry out in surprise. What did you write in your log today?

This first FAB sought to have participants articulate what constitutes *surprise* in terms of a technological discipline (i.e., robotics). By revealing what is unexpected or shocking, this FAB could conversely uncover what constituted the *expected*, mundane, or routine in robotics. In this sense, the FAB served as a circuitous route to get what we wanted.

5.1.1 The Unfathomable Surprise. Initially, roboticists answered that they would be startled if they found something unexpected. The very notion of surprise was nearly unfathomable for the roboticists. With respect to the unexpected, they emphasized a strong belief that robots had a transparent mechanism—that is, there is a certain logic and obviousness that precludes surprises with robots. Roboticists emphasized that the output of their research prototypes should be predictable based on the range of inputs. Emotions or consciousnesses were unexpected things—things that were, for the roboticists, mysterious, parts of the human, and outside the scope of input and output or cause and effect, and seemed more random. Thus, this FAB revealed that surprise itself was a rare event, and its occurrence would be miraculous. Conversely, it shows the frame of mind with which roboticists approach research—one that prevents surprises from happening.

Roboticists (P12, 13, 21) described a robot behaving as if it had its own mind or emotions as surprising because such phenomena were not programmed into the robot. P21 said," *[W]e're talking about 10 years in the future, if it'd done something really intelligent that I hadn't programmed, then that would surprise me. If I write some code and then it works, that's not the sort of thing that's going to give me goosebumps or cause any emotional reaction from me.*"

FABs were successful in not only having participants explain surprise but reasons behind surprises—standard practices of research ensure that surprises in designs or prototypes are controlled. "Surprise" in robotics research implies events that contradict the belief of roboticists—that engineering governs how robots work—and anxiety over unintended results by robots (e.g, harming users).

5.1.2 Controlling, Avoiding, and Blaming Surprise. P20 acknowledged that robots did not always work well and could sometimes function beyond their expectations. Yet, he noted that such a case would lead to undesirable results such as accidents in experiments: *"If the robot arm moves too quick, and it's also quite heavy, if it bangs on your head, it can cause injuries. So just some safety issues"* (P20). This FAB revealed a concern with the safety of robots and its relation to predictability and programmability. We see a value judgment that surprises are negative phenomena.

In sum, robots whose inner workings were transparent were valued by roboticists. This *control* was important. P13 said, "*To me, a robot is pretty much a puppet on a string which will react to input. If it does something that you can't foresee, then you don't have control of your machine … I don't think building a self-aware robot is going to happen unless you set about designing it.*" As she remarked, a transparent design mechanism guaranteed that roboticists would have control over them. Otherwise, she said a robot created through obscure, non-transparent design processes could be unpredictable and menacing. The design of robots have little room for "non-scientific" logic such as creativity and fantasy.

Since robots are a "puppet" (P13) for roboticists, users are responsible for surprises. P8 noted that users were unable to cope with malfunctions, "*even though we had told them how to stop the robot in case something goes wrong.*" Roboticists were concerned with users' trust in robots (P1, 2, 3), which deterred them from understanding how the functions of robots (e.g., recording a user's voice) may actually violate privacy. The FAB gives one a perspective on what actors participants feel are *responsible* for technological failures.

This FAB about an emotive response to a designed technology allowed us to see the necessary conditions for surprise to occur. We could understand who was to blame for surprise and what could prevent surprise. Finally, we saw a value judgment on the notion of surprise itself as something to be avoided.

5.2 FAB 2: Broader Societal Tensions in Values

Recently, humanoid robots have been publicly denounced. Meanwhile, you and your robots have received two lawsuits from NGOs (non-governmental organizations) and religious groups for the humanoid robots created by your lab and collaborators. Unfortunately, the situation you are in was predicted by some. The state court is requiring

you to submit documents affirming the honesty and integrity of your robotics lab. What was the cause of this public denouncement?

Studies (e.g., [23, 33]) have shown a gap between roboticists and the public. Roboticists noted that public discourse on science is heavily influenced by science fiction movies, leading to a misunderstanding of robots. One pioneer roboticist noted that "*people have a cellular phone in their pocket and don't have any idea what is inside, and they imagine robotics as a magic field . . . So basically we try to bring people a little bit closer to robotics—and to the true [real] robotics, not the 'true' [unrealistic] robotics that they can see in the newspapers or in the media.*" Spurred by this observation, we developed FABs to examine the larger societal norms and values participants are situated in, and in what ways their designs would impact society (negatively and positively). We sought to understand how society judges particular technological practices as wrong versus right and controversial.

5.2.1 Fairness and Equality between Technologies and Users. This FAB mentioned the value of fairness as core to the design of future robots. We presented a future where backlash from the public would come from users who experienced unfavorable living conditions with robots. This FAB allowed participants to think about a worst-case scenario grounded in their own experiences with users and the popular media about futuristic robots. Participants framed their autobiographies as, "If the current issues and the public perception on robots continue, what kinds of social conflicts would arise?" Responses highlighted clashes in values between users and roboticists. Autobiographies represented how roboticists hoped to shape the future of robots to avoid heading into the direction that robots are used in unintended ways.

P5 noted that robots made to serve certain people or organizations might cause injustices. "*Perhaps serving the commercial interest of their manufacturers where people expect them to treat everyone equally . . . Where they price products differently upon people's pattern of search history or ability to pay . . . I'm imagining that people are expecting that we [are] treated fairly by robots, but it turns out our humanoid robots are always serving a corporate agenda.*".

Inequality of information was an integral part of the FABs created about misunderstandings and public outcry over robots—such as privacy violations by robots (P1, 13, 22) or strong bonds between children and robots. P1 touched on how privacy issues could become part of the public consciousness once people realize that their personal lives might continually be recorded by robots. P13 had a similar concern over robots that interact with older adults.

Finally, autobiographies detailed how robots may replace human roles: "*A robot replacing a preacher, or a robot being used as a true family member, or robot could be used as a sex partner*" (P16). These speculative futures bring up the question: To what extent should we discourage robots to play roles that humans value?

5.3 FAB 3: The Roles of Robots in Society

It is about time you retire. You are soon to be presented with a prestigious award for your contributions to developing "user (human)-friendly humanoid robots." In your honor, the IEEE Robotics Society will purchase your user (human)-friendly humanoid robots and donate them to three different organizations or people of your choice. The recipients of your robots are free to use them as they wish. What do your robot designs look like? Where would you donate your robot designs? Why did you choose these recipients?

5.3.1 Ideal Robots Mirrored Current Social Concerns. In this FAB, participants reflected upon human-friendly robots—how they would be designed, and how such robots would be used in society. By presenting such robots as their final achievement at retirement, we surmised that roboticists might talk about the sort of ideal forms and roles of robots that they have been pursuing for their entire research career. It crucially asks what segment of society such an ideal robot should be designed for.

This FAB had three related questions. First, it asked how they would define a "human-friendly robot." It uses the abstract, ambiguous term "human-friendly" to allow participants free reign to interpret. The responses to this question represented the robot they wish to see in future. Robots were imagined regardless of their technological feasibility. For example, P12 wanted a robot that had an emotional intelligence as much as any other human so that the robot could read human minds: *"A user-friendly robot should understand when it's in our way and when we need it."*

Second, in response to the question of donating robots to others, participants described how robots may resolve current social issues created by existing technologies. P12 mentioned how people have become so absorbed with technology that they have lost their social self. He proposed a robot that redefines the role of a social robot: "*It helps you to be more social for yourself. A social robot does not necessarily mean that the robot needs to be social, but it gives you maybe more time to be social. If I have more time to talk to you and we have more social experience, and the robot just brings us the drinks, it's a social robot in the sense that it gives us time where we can socialize.*" In this sense, the FAB elicited a value that goes against current, deleterious values embedded in technologies. Other responses also demonstrated that robots could be used to disentangle social injustices (e.g., inequality in education and health care services and demanding physical jobs).

Lastly, this FAB gives us a perspective on how roboticists identified technologies that were aligned with their own values. P3 noted, "*I suppose the recipients would be charities that are close to my values and my interests. So maybe, for example, a hacker space.*" P1, who desired to continually advance the robotics field, told us he wanted his research to be open source: "*I would make it open source so that I donate it for everybody . . . the more people who use it, the better it becomes. Yeah, of course, it will help the robotics industry, but it will also be a big help if older people are using these robots.*"

5.4 FAB 4: Popular Public Discourse

In 2030, humanoid robots now play a role in your research lab as full-time researchers. At first, you felt awkward about sharing your workplace with humanoid robots. It took some time to accept them as your work colleagues. Now, you have no problem at all working with humanoid robots. What specific tasks are given to humanoid robots? What process or work do they mainly contribute to? How do they collaborate with others in your research lab?

5.4.1 Future Robots in the Workplace. Human-robot worker interaction has been extensively examined in HRI, particularly on how to introduce robots into a workplace and how to design robots

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capable of smoother interactions with human workers. A public concern is whether future robots will replace human jobs. It is not clear, however, where the dividing line is and who the players are in these debates. This FAB asks roboticists to imagine how robots would work as their colleagues.

Participants' narratives were quite emphatic and adamant, compared to those of other autobiographies. The specific setting (a research lab) and the close time period (2030) made it easier for participants to envision working with robots as collaborators. Interestingly, all participants described a future robot in the workplace as an assistant who would do errands in their lab. Although participants assured that future robots in 2030 would not be trusted to do more complicated or important tasks, their narratives were less imaginative but more specific. For example, according to participants, they would put robots to work on repetitive tasks (e.g., labeling data or copying materials), physically demanding work (e.g., moving and loading heavy items), and trivial tasks (e.g., bringing coffee or organizing messages). This kind of work is based on their views of robots as tools. For example, P18 said, *"Again, my definition of a robot is still that they can interact with us, they will be very close to us, but they will not be us … they must keep the robotic nature. Otherwise, and that could be the awkward thing."* P18 rejected the idea of collaborating with robots on research. P21 agreed, "*I guess I'd treat a humanoid robot … pretty much like a slave.*"

Participants reacted to the public discourse of losing jobs to robots as illogical. P19 stated, "*I think they're a very long way away from that because robots can't do anything really complicated. I get this question from the media as well. They think those robots can make some smart decisions …I just think it's completely speculative. There is no evidence for me that robots can do those things.*"

6 LESSONS LEARNED

We now turn to discussing overall patterns and challenges across the autobiographies our participants created in response to our story prompts. These patterns point to how autobiographies can be fine-tuned for HRI researchers who wish to adapt futuristic autobiographies for their own studies.

6.1 Differing Concepts of Time

Our stories featured various time settings—from the near future (e.g., recently in FAB 2) to the distant future (e.g., 2030 in FAB 4). Interestingly, participants had different interpretations for the same time setting. Ten years was too distant of a future for some to speculate on. For P11, 10 years might as well be 20 years: *"First scenario, 2026. Well, I get the idea. It's too difficult to imagine what I'm gonna be doing…it's like in 20 years."* In contrast, for P1, 10 years was not enough time to see big changes in the robotics field; 20 years was more plausible: *"In 10 years, probably I don't see anything non-predictable. Probably in 20, 25 years…you can try to put any robot, and it comes with a surprising result."*

Giving specific time settings sometimes constrained the imagination of participants. When responding to the year 2030 in FAB 4, participants showed a tendency to think how 14 years would be enough to develop advanced robots, making participants consider the current development of robotics rather than imagining an unfathomable scenario. We found that stories without specific time settings did not impose such constraints for participants. For example, FAB 2 had the public backlash happening "recently," and this allowed participants to focus on the plot of the story rather than consider how likely it would have happened at that time.

6.2 Drawing from the Real World

Wood et al. [45] prompted their participants to respond from the perspective of a third party and to construct their narratives in a whimsical manner. In contrast, the real-world circumstances of our participants grounded their autobiographies. Many autobiographies were influenced by contemporary theories (e.g., uncanny valley) and technological advances. The current state of robots was the baseline for their speculation. For example, one participant drew upon a problem he was facing with his robots (e.g., making too much noise) when voicing an idea about a "human-friendly robot" in the future: *"It would have to be quieter than normal humanoid robots because most of them are quite loud"* (P2). Another participant described future robots by making comparisons to the latest technologies: *"[W]rite a daily log, maybe in 10 years time Google Glasses will be normal … Maybe the robot will have sensor logs or a video log that can say, 'Okay, save this moment,' Kind of like you have dash cams right now in cars."*

Although their autobiographies were meant to be future-oriented, many began by reflecting on their past experiences. Autobiographies drew from research experiences in the past (e.g., mistakes made as Ph.D. students, experiences at RoboCup). For example, P9 touched upon how current funding mechanisms have influenced his own research topics: *"It's a standard problem in our country in research. We've rolled with the punches...Especially when the DARPA Grand Challenge came. People moved their focus as much as they could to addressing those kinds of things."*

By drawing from their personal lives, FABs became more plausible and readily amenable in revealing the values and perspectives of participants. For example, some perspectives on technologies were molded by personal religious beliefs: *"I'm a Hindu, so I believe in life. So there's life in every living being, and in machines, it can never exist"* (P8). By echoing the past and the present, our participants weaved futuristic narratives in an autobiographical manner. Thus, FABs were successful in eliciting values by having participants draw on the present to answer questions about the future.

6.3 The Social, Political, and Ethical

Overall, FABs succeeded in uncovering participants' values and perspectives around robotics. Pointedly, when the narratives of roboticists deviated from the questions asked in autobiography prompts, their social and political agendas were often revealed. For example, P5 brought up the gender inequality issues of robotics in his FAB: "*Also, to try to equalize gender and relationships in the laboratory. Engineering is a very gender[ed] profession. HRI, interestingly, less so than mechanical engineering... It's a problem that women are more welcome to do the touchy-feeling stuff about human beings and values. When it comes to designing the joints or the visual software, then you expect boys.*" Eventually, P5 came back to his main concerns on egalitarian values between user and designer in the design process. Similarly, the value of social justice in education also had a role for future robots: *"I've current[ly] created a robot, but it would*

particularly motivate students of groups that are underrepresented in the highest educational fields. Race-wise or gender-wise… like women in engineering. This robot would have the special ability to motivate and encourage and support those students" (P6). This unfolded not only what social concerns he had (e.g., inequality in education) but also how he would like to address these issues in the future (e.g., inspiring students through a robot). We found that FABs encouraged participants to think about solutions.

Ethical concerns also surfaced in FABs. Child and robot interaction experiments were a major concern for roboticists along with the emotional attachment to robots displayed by children. P1's experience with children illustrated this: "*I was in a short session with children… you already see the children like 10, 20 minutes, the children were already attached, like you leave a pet. They sometimes ask me, I put the robot in the box, 'Okay, but will not the robot be sad? Are you hurting the robot?'* " Grounded in his experiences, P1's FAB provided us with further food for thought—for example, is it ethical to represent a robot as alive to children? This could be considered deception for the sake of an experiment.

7 IMPLEMENTING FABS

Having described how futuristic autobiographies (FABs) proved useful for our own published work on roboticists, we now describe how FABs can be implemented.

7.1 Planning: Eliciting Imagination

Participants' narratives walked a fine line between the real world (the present and the past) and an imaginative world. As mentioned earlier, participants sometimes drew heavily upon their past experiences and current research. Consequently, this sometimes led to responses that lacked imagination, an essential ingredient for our FABs. We believed that providing participants a prompt specifying part of the story would encourage narratives based on their imagination. However, we found that this was not always successful. Perhaps supplementary mechanisms that encouraged participants to steer clear of the reality they are already familiar with could enable the creation of richer, more creative FABs. Speculative design workshops, such as Blythe and Andersen's [4] "magic machine" workshop, might be one solution. In their workshop, participants created a magic machine for their future selves. At the end of the workshop, as a result of the "magic" prompt, nonsensical, impractical, but creative prototypes were created.

7.2 Executing: The Uneasy Writer

Extemporizing futuristic autobiographies was not easy for some participants, even though we insisted that they did not have to be entirely plausible. Some asked us over and over if their responses "made sense." P10 shared many interesting stories but would often follow up with "I'll give it a shot, and you'll tell me if I'm doing it wrong," and "Does that make sense?" For these participants, we reminded them there were no right or wrong answers. After reassurance, participants were generally able to make their FABs.

Despite these successes, participants did face challenges speculating on the future for several reasons. First, some simply had no idea how to imagine the future situation described in the autobiographies. Second, others could not agree with the vision of the future outlined in the FAB prompts. Third and most difficult, some were skeptical about the utility of speculating the future. For the first case, we walked participants through each line of the autobiography prompts by providing details or rephrasing the situations in our prompts. Or, we simply gave the participant a few minutes to think about the FAB prompt; this allowed participants to grasp the method and purpose of the study before proceeding forward.

For the second case, we acknowledged participants' different points of view. For example, one participant did not agree with the premise of FAB 2 (public protests against robots). Upon reading the story, he said that there would be no reason for people to become hostile toward robots in the future since robots are no more than tools. We then transformed the autobiography into straightforward questions such as, "Then why would people feel angry about the robot? Once they feel robots are problematic in our society, they could protest against roboticists or robots. What would be the possible cause of that kind of future situation?" The participant would try to place themselves in that situation. Thus, justifications for disagreement with our prompts provided data on values.

The third case was the most difficult for us to deal with. One participant was skeptical about the utility of speculating about the future. He gave us his frank opinion of FAB 1 (unexpected events in future user experiments): *"I'm not a big fan of predicting [the] future…It barely happens that you would suddenly find something that you didn't even think about, you know? That was very rare. Most of the time you kind of know what to expect or you know the boundary conditions in what to expect."* We had to coax him to follow the exercises throughout the study. He contributed valuable information but nonetheless kept qualifying his responses as "pure speculation": *"I can imagine those things, but that's pure speculation because we have no idea about whether it may or may not become true."* Although this case may be unusual, we leave it to the researcher whether to include such data in their analysis. Such skepticism may contribute an important perspective into the future.

7.3 Wrapping-up: Feedback for FABs

Overall, the FAB exercises were favorably reviewed by participants. They made comments like, "Very good questions, actually. I like them" (P4). We found that participants enjoyed the novelty of FABs. At times, we grappled with maintaining our subjects' interest and engagement throughout the FABs. For example, some participants were not excited about completing a certain FAB compared to others, so we changed the order in which the FAB prompts were presented. Sterling noted, "design fiction plays games with these transitions of the amazing and the boring, the transitions of the believable and the incredible" [39]; design fiction can be fun but can at the same time be boring. Researchers should strike a happy medium to make FABs compelling for informants.

We also recommend setting aside time to receive feedback on FABs from participants. Their comments helped us become aware when prompts were not clear. For example, P17 remarked on the term "human-friendly robot" in FAB 3: *"I actually think it's an emotive term that doesn't really tell [us] anything …I think robots aren't humans' friends, so I think that the word 'friendly' is a bit emotive."* This ambiguity was intentional to prevent limits on participants' imaginations. However, this ambiguity impels us to become more

sensitive to creating a "discursive space" [28] with informants via FABs—a space that comfortably encourages provocative discussion.

7.4 Upgrading Futuristic Autobiographies

We believe futuristic autobiographies (FABs) could be expanded in two ways. First, FAB prompts might be developed by participants themselves rather than the researcher. There may be ways to ask informants to develop FAB prompts or even share FABs that other participants complete. Second, FAB prompts could be customized to incorporate detailed aspects of our participants' lives. For example, in our study, FAB prompts might have referred to the actual robots, labs, or events (past awards from their CVs) of participants.

8 FUTURISTIC AUTOBIOGRAPHIES IN A COLLABORATION TOOLKIT FOR HRI

We believe our method could be of use in collaborative settings. First, our method may be used to collaborate with HRI researchers from varied disciplines. In HRI, collaborations are challenging because they bring together sometimes different conceptual frameworks, methods, and terminologies; this requires "constant renegotiation of conceptual and practical boundaries" [33]. FABs could offer a collaborative space for interdisciplinary robotic teams to start conversations about futuristic settings with robots. We imagine that researchers may use or modify our FAB prompts for their own projects to compare and contrast how collaborators conceptualize robots and users in future settings. They then can focus on narrowing the gaps between the values of stakeholders to prevent conflict and confusion in collaborations.

"Outside-in" design proposed by Šabanović et al. [33] are design guidelines that follow "iterative steps for observation, modeling, and evaluation" across multiple disciplines to produce programmable data for engineers. They quantified simple dyadic nonverbal actions and emotive expressions based on observations of shadow puppet performances and survey data of how people perceived those interactions. Although their methods focused on how human interaction data can be understandably produced by researchers from different disciplines, our methods are more concerned about exposing values to relevant partners in collaborative work. Our method also touches upon broader future agendas including social, political, and ethical concerns.

Similarly, confusion over terminology was discussed as a barrier to collaboration in HRI research [34]. Such work calls for establishing common ground on frequent terms or concepts in HRI studies. For instance, Jung [22] examined how to interpret affective expressions in experimental HRI studies. Our method could be an alternative way to unpack value-related words and the meanings roboticists ascribe to such words. For example, in our study, we identified that surprise (as responses to FAB 1) connotes something that should not have happened in research settings. In this way, our method may bring about the "bridging of disciplinary divides" [33].

Second, our method can be used to co-design [35] with users in the design process. Similar to participatory design, our FABs ask people to become active participants as autobiographical writers. Our method aims to embrace the voices and perspectives of participants. With these same goals, FABs could be used in the initial stages of participatory design and enable designers to explore potential designs or adjust their study designs. As Azenkots et al. [1] found, interviews with participants in the primary stage of participatory design served to generate a range of design ideas. In terms of the "plausibility" of FABs, we see that they could serve as a way to unpack participants' concerns and issues in this initial stage. Lee et al. [25] found that when they discussed users' homes and routines in a participatory design workshop and asked them to imagine a future living with robots, participants were able to specify their needs by adding functions to the robots they wanted in the future. In future work, researchers could use our method to see if it more effectively elicits users' demands on robots.

9 CONCLUSION

In this paper, we have put forth a new method for inquiring about values in interview studies that we call futuristic autobiographies (FABs). FABs are an empirical method to augment semi-structured interview studies. Situated in deep fieldwork and other ethnographic methods, they are fruitful ways to understand values that are ingrained in groups. We see FABs as one way to expeditiously elicit rich autobiographies about values from informants. Rather than ask about current practices or viewpoints, FABs challenge informants to weave narratives *featuring themselves* as a main character. Inevitably, this act of storytelling leads informants to incorporate aspects of their lives—their practices, challenges, experiences, philosophies, etc. Although not easy, from these autobiographies, we can gain insight into the values these informants hold about the technologies they use, design, or theorize. Most significantly, akin to diegetic prototypes in design fiction, FABs create a user who is diegetic [29, 42]. This *diegetic user* is situated in the futuristic autobiographies (often along diegetic prototypes).

This paper has illustrated how FABs elicited values, albeit in different guises. Autobiographies allowed roboticists to discuss values in their own terms. Roboticists were able to—implicitly and explicitly—describe assumptions of their disciplinary practices with technology, values held by non-technologists and other users and their interactions with such values, societal challenges to their work, and future, ideal directions for their technologies in the world. These autobiographies were speculative but, in the tradition of design fiction, entirely plausible and grounded in their own experiences.

Although FABs proved invaluable to our studies on roboticists, it remains to be seen if futuristic autobiographies can be beneficially applied to other domains. However, we believe this method has great promise to augment interview studies that align with value-sensitive design's empirical approach to discovering values. When FABs are carefully crafted from background research, they create rich interviews where informants speak for themselves on how their practices and values are intertwined now and in the future. We hope researchers utilize FABs and account for their strengths and weaknesses so as to suggest further refinements.

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REFERENCES

[1] Shiri Azenkot, Catherine Feng, and Maya Cakmak. 2016. Enabling Building Service Robots to Guide Blind People: A Participatory Design Approach. In *The*

Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16). IEEE Press, Piscataway, NJ, USA, 3–10. http://dl.acm.org/citation.cfm?id=2906831.2906835

[2] Jeffrey Bardzell and Shaowen Bardzell. 2015. Humanistic HCI. *Synthesis Lectures on Human-Centered Informatics* 8, 4 (2015), 1–185.

[3] Mark Blythe. 2017. Research Fiction: Storytelling, Plot and Design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 5400–5411. https://doi.org/10.1145/3025453.3026023

[4] Mark Blythe, Kristina Andersen, Rachel Clarke, and Peter Wright. 2016. Anti-Solutionist Strategies: Seriously Silly Design Fiction. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 4968–4978. https://doi.org/10.1145/2858036.2858482

[5] Praminda Caleb-Solly, Sanja Dogramadzi, David Ellender, Tina Fear, and Herjan van den Heuvel. 2014. A Mixed-method Approach to Evoke Creative and Holistic Thinking About Robots in a Home Environment. In *Proceedings of the 2014 ACM/IEEE International Conference on Human-robot Interaction (HRI '14)*. ACM, New York, NY, USA, 374–381. https://doi.org/10.1145/2559636.2559681

[6] John M Carroll. 2000. *Making use: scenario-based design of human-computer interactions*. MIT press, Cambridge, MA.

[7] Kathy Charmaz. 2014. *Constructing Grounded Theory* (2 ed.). SAGE Publications Ltd, London.

[8] EunJeong Cheon and Norman Makoto Su. 2016. Integrating Roboticist Values into a Design Framework for Humanoid Robots. In *The Human-Robot Interaction Pioneers Workshop, held in conjunction with the Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16)*. IEEE Press, Piscataway, NJ, USA, 603–604. http://dl.acm.org/citation.cfm?id=2906831.2907002

[9] EunJeong Cheon and Norman Makoto Su. 2016. Integrating Roboticist Values into a Value Sensitive Design Framework for Humanoid Robots. In *The Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16)*. IEEE Press, Piscataway, NJ, USA, 375–382. http://dl.acm.org/citation.cfm?id=2906831.2906895

[10] EunJeong Cheon and Norman Makoto Su. 2017. Configuring the User: "Robots Have Needs Too". In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. ACM, New York, NY, USA, 191–206. https://doi.org/10.1145/2998181.2998329

[11] Nazli Cila, Iskander Smit, Elisa Giaccardi, and Ben Kröse. 2017. Products As Agents: Metaphors for Designing the Products of the IoT Age. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 448–459. https://doi.org/10.1145/3025453.3025797

[12] Scott Clifford, Vijeth Iyengar, Roberto Cabeza, and Walter Sinnott-Armstrong. 2015. Moral foundations vignettes: A standardized stimulus database of scenarios based on moral foundations theory. *Behavior research methods* 47, 4 (2015), 1178–1198.

[13] Brian R. Duffy and Karolina Zawieska. 2012. Suspension of disbelief in social robotics. In *2012 IEEE RO-MAN: The 21st IEEE International Symposium on Robot and Human Interactive Communication*. IEEE, Piscataway, NJ, USA, 484–489. https://doi.org/10.1109/ROMAN.2012.6343798

[14] Anthony Dunne and Fiona Raby. 2013. *Speculative everything : design, fiction, and social dreaming*. MIT Press, Cambridge, MA. https://mitpress.mit.edu/books/speculative-everything

[15] Oriel FeldmanHall, Dean Mobbs, Davy Evans, Lucy Hiscox, Lauren Navrady, and Tim Dalgleish. 2012. What we say and what we do: the relationship between real and hypothetical moral choices. *Cognition* 123, 3 (2012), 434–441.

[16] Sarah Grace Fields. 2016. Incorporation of Generational Learning in Familiar Interfaces and Systems: A Design Fiction. In *Proceedings of the 19th International Conference on Supporting Group Work (GROUP '16)*. ACM, New York, NY, USA, 355–361. https://doi.org/10.1145/2957276.2957294

[17] Nick Foster. 2013. The Future Mundane. (2013). www.core77.com/posts/25678/the-future-mundane-25678

[18] Batya Friedman. 2004. Value Sensitive Design. In *Berkshire encyclopedia of human-computer interaction*. Berkshire Pub. Group, Great Barrington, MA, 769–774.

[19] Kentaro Go and John M Carroll. 2004. The blind men and the elephant: Views of scenario-based system design. *interactions* 11, 6 (2004), 44–53.

[20] Ellie Harmon, Chris Bopp, and Amy Voida. 2017. The Design Fictions of Philanthropic IT: Stuck Between an Imperfect Present and an Impossible Future. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 7015–7028. https://doi.org/10.1145/3025453.3025650

[21] Nassim JafariNaimi, Lisa Nathan, and Ian Hargraves. 2015. Values as Hypotheses: Design, Inquiry, and the Service of Values. *Design Issues* 31, 4 (2015), 91–104. https://doi.org/10.1162/DESI_a_00354

[22] Malte F. Jung. 2017. Affective Grounding in Human-Robot Interaction. In *Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction (HRI '17)*. ACM, New York, NY, USA, 263–273. https://doi.org/10.1145/2909824.3020224

[23] Sarah Kriz, Toni D. Ferro, Pallavi Damera, and John R. Porter. 2010. Fictional robots as a data source in HRI research: Exploring the link between science fiction and interactional expectations. In *19th International Symposium in Robot and Human Interactive Communication*. IEEE, Piscataway, NJ, USA, 458–463. https://doi.org/10.1109/ROMAN.2010.5598620

[24] Christopher A. Le Dantec, Erika Shehan Poole, and Susan P. Wyche. 2009. Values As Lived Experience: Evolving Value Sensitive Design in Support of Value Discovery. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '09)*. ACM, New York, NY, USA, 1141–1150. https://doi.org/10.1145/1518701.1518875

[25] Hee Rin Lee, Selma Šabanović, Wan-Ling Chang, Shinichi Nagata, Jennifer Piatt, Casey Bennett, and David Hakken. 2017. Steps Toward Participatory Design of Social Robots: Mutual Learning with Older Adults with Depression. In *Proceedings of the 2017 ACM/IEEE International Conference on Human-Robot Interaction (HRI '17)*. ACM, New York, NY, USA, 244–253. https://doi.org/10.1145/2909824.3020237

[26] Christina Lichtenthäeler, Annika Peters, Sascha Griffiths, and Alexandra Kirsch. 2013. Be a Robot!: Robot Navigation Patterns in a Path Crossing Scenario. In *Proceedings of the 8th ACM/IEEE International Conference on Human-robot Interaction (HRI '13)*. IEEE Press, Piscataway, NJ, USA, 181–182. http://dl.acm.org/citation.cfm?id=2447556.2447627

[27] Joseph Lindley and Paul Coulton. 2016. Pushing the Limits of Design Fiction: The Case For Fictional Research Papers. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 4032–4043. https://doi.org/10.1145/2858036.2858446

[28] Joseph Lindley and Robert Potts. 2014. A Machine Learning: An Example of HCI Prototyping with Design Fiction. In *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational (NordiCHI '14)*. ACM, New York, NY, USA, 1081–1084. https://doi.org/10.1145/2639189.2670281

[29] Joseph Lindley and Dhruv Sharma. 2016. Operationalising Design Fiction for Ethical Computing. *SIGCAS Comput. Soc.* 45, 3 (2016), 79–83. https://doi.org/10.1145/2874239.2874251

[30] Daniel Pargman, Elina Eriksson, Mattias Höjer, Ulrika Gunnarsson Östling, and Luciane Aguiar Borges. 2017. The (Un)Sustainability of Imagined Future Information Societies. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 773–785. https://doi.org/10.1145/3025453.3025858

[31] Sebastian Prost, Elke Mattheiss, and Manfred Tscheligi. 2015. From Awareness to Empowerment: Using Design Fiction to Explore Paths Towards a Sustainable Energy Future. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '15)*. ACM, New York, NY, USA, 1649–1658. https://doi.org/10.1145/2675133.2675281

[32] Paul Robinette, Wenchen Li, Robert Allen, Ayanna M. Howard, and Alan R. Wagner. 2016. Overtrust of Robots in Emergency Evacuation Scenarios. In *The Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16)*. IEEE Press, Piscataway, NJ, USA, 101–108. http://dl.acm.org/citation.cfm?id=2906831.2906851

[33] Selma Šabanović, Eric Meisner, Linnda R Caporael, Volkan Isler, and Jeff Trinkle. 2009. Outside-in design for interdisciplinary HRI research. In *AAAI Spring Symposium: Experimental Design for Real-World Systems*. The AAAI Press, Palo Alto, CA, 41–48.

[34] Selma Šabanovic, Marek P Michalowski, and Linnda R Caporael. 2007. Making Friends: Building Social Robots through Interdisciplinary Collaboration. In *AAAI Spring Symposium: Multidisciplinary Collaboration for Socially Assistive Robotics*. The AAAI Press, Palo Alto, CA, 71–77.

[35] Elizabeth B-N Sanders and Pieter Jan Stappers. 2008. Co-creation and the new landscapes of design. *Co-design* 4, 1 (2008), 5–18.

[36] Eduardo Benitez Sandoval, Omar Mubin, and Mohammad Obaid. 2014. Human robot interaction and fiction: A contradiction. In *International Conference on Social Robotics*. Springer, Cham, Switzerland, 54–63.

[37] Eric Spaulding and Haakon Faste. 2013. Design-driven Narrative: Using Stories to Prototype and Build Immersive Design Worlds. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)*. ACM, New York, NY, USA, 2843–2852. https://doi.org/10.1145/2470654.2481394

[38] Bruce Sterling. 2013. Bruce Sterling - Fantasy prototypes and real disruption - YouTube. (2013). https://www.youtube.com/watch?v=M7KErICTSHU

[39] Bruce Sterling. 2013. Patently untrue: fleshy defibrillators and synchronised baseball are changing the future. *WIRED UK* (2013). http://www.wired.co.uk/article/patently-untrue

[40] Anselm Strauss and Juliet Corbin. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Sage Publications, Thousand Oaks, CA.

[41] S. Shyam Sundar, T. Franklin Waddell, and Eun Hwa Jung. 2016. The Hollywood Robot Syndrome: Media Effects on Older Adults' Attitudes Toward Robots and Adoption Intentions. In *The Eleventh ACM/IEEE International Conference on Human Robot Interaction (HRI '16)*. IEEE Press, Piscataway, NJ, USA, 343–350. http://dl.acm.org/citation.cfm?id=2906831.2906890

[42] Joshua Tanenbaum. 2014. Design Fictional Interactions: Why HCI Should Care About Stories. *interactions* 21, 5 (2014), 22–23. https://doi.org/10.1145/2648414

[43] Joshua Tanenbaum, Karen Tanenbaum, and Ron Wakkary. 2012. Steampunk As Design Fiction. In *Proceedings of the SIGCHI Conference on Human Factors*

in Computing Systems (CHI '12). ACM, New York, NY, USA, 1583–1592. https://doi.org/10.1145/2207676.2208279

[44] Daniel H. Wilson. 2015. Chasing Our Science Fiction Future. In *Proceedings of the Tenth Annual ACM/IEEE International Conference on Human-Robot Interaction (HRI '15)*. ACM, New York, NY, USA, 245–245. https://doi.org/10.1145/2696454.2714390

[45] Matthew Wood, Gavin Wood, and Madeline Balaam. 2017. "They'Re Just Tixel Pits, Man": Disputing the 'Reality' of Virtual Reality Pornography Through the Story Completion Method. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 5439–5451. https://doi.org/10.1145/3025453.3025762