

Speculative Design in HCI: A Methodological Investigation into Research Practice, Process, and Quality

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M.Sc. Ronda Ringfort-Felner

Erstgutachter: Prof. Dr. Marc Hassenzahl

Zweitgutachterin: Prof. Dr. Sarah Diefenbach

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*For my husband, our two little ones, and
all who supported and encouraged me along the way.*

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Neuhaus, R., Laschke, M., Ringfort-Felner, R., & Hassenzahl, M. (2025). Endlessly Patient, Never Judgmental, or Flexibly Opinionated: Imagining a Future of Meaningful Conversations With Technology. *Proceedings of the 28th International Academic Mindtrek Conference*, 53–67. <https://doi.org/10.1145/3757980.3758001>

Moreover, the following publication is relevant to the topic of this thesis:

Dörrenbächer, J., Laschke, M., Löffler, D., Ringfort, R., Großkopp, S., & Hassenzahl, M. (2020). Exploring Utopia. A Positive Approach to Design Fiction. Workshop “Understanding the Past, Present, and Future of Design Fictions. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–6. <https://doi.org/10.48550/arXiv.2105.10186>

Abstract

Speculative design has become a prominent approach in Human–Computer Interaction (HCI) for exploring not-yet-existing technologies and their ethical and societal implications. Yet, despite its growing use, it remains a contested research approach, often criticized for lacking methodological rigor. Positioned between art and academia, it is more a research stance than a method. It brings together a range of heterogeneous approaches, including design fiction, critical design, material speculation, and speculative enactments. What unites these approaches is not a shared methodology, but a common orientation. They all use design to explore possible futures in order to reflect on, question, and potentially change present assumptions, values, and trajectories.

While prior work has clarified what speculative design is and introduced a variety of methods for its application, far less attention has been paid to foundational methodological questions. In particular, it remains unclear what defines “good” or successful speculative research and how speculative design and its diverse practices and methods can be effectively applied in research contexts. As a result, researchers face ongoing challenges in applying speculative design to the study of emerging technologies and in evaluating its outcomes, for instance within academic peer-review processes.

This dissertation responds to this situation by examining how speculative design can be effectively applied to explore the design, roles, and implications of emerging technologies. It does so using the example of *otherware*, that is, autonomous and interactive technologies experienced as socially present others (e.g., voice assistants, social robots). Across five interrelated studies, it investigates speculative design’s methodological potentials, challenges, and “quality” both through practice and the systematic analysis of speculative design knowledge in HCI.

A first set of three case studies investigates speculative design (particularly design fiction and speculative enactments) within academic HCI contexts. These studies examine how speculative approaches and methods can be applied to explore potentially meaningful futures with voice assistants and social robots. Across the cases, speculations were grounded in empirical and theoretical insights and materialized through tangible artefacts such as fictional product websites, documentaries, and flyers. These materializations enabled participants to imagine, inhabit, and reflect on possible technological futures in situated and experiential ways. Through participant engagement, the studies surfaced values, tensions, and assumptions that informed the design of *otherware*. Together, these studies revealed recurring methodological strategies for effective speculative inquiry (e.g., grounding speculation, materializing imaginaries) and a transferable three-part research process: (1) informing the design, (2) (co-)creating fictional worlds, and (3) empirically engaging with these worlds through debate and reflection.

A fourth case study extends this investigation by situating speculative design within a real-world organizational context through an 18-month collaboration with an automotive company on the future of self-driving cars. By examining how speculative design practice changes when applied beyond academic and expert settings, it shows how business objectives and organizational structures can steer speculative design toward product-driven innovation rather than critical exploration. This shift affected speculation’s capacity to generate new knowledge about the potentials, challenges, and long-term implications of envisioned products and services. Speculations that closely resembled existing products and services proved less effective in stimulating discussion and uncovering assumptions about their future role and challenges than more provocative speculations. This finding highlights the importance of quality criteria for maintaining the exploratory, critical, and epistemically productive character of speculative design, particularly in organizational contexts.

Building on these findings, the fifth study addresses the question of quality directly. Through a systematic scoping review of 63 theoretical and methodological publications on speculative design, design fiction, and critical design, it

synthesizes the widely scattered characteristics scholars associate with “good” and successful speculations. This analysis results in a descriptive taxonomy that comprises nine quality criteria (e.g., critical, thought-provoking, participative), organized into three categories: speculative, discursive, and process. This taxonomy provides researchers, designers and practitioners with a shared vocabulary for planning, creating, and evaluating high-quality speculative designs.

Across its five studies, the thesis makes three connected methodological contributions: (1) it conceptualizes speculative design as a positive, participatory, and empirically informed approach to design research for studying emerging technologies; (2) it operationalizes this approach through a transferable three-part research process; and (3) it introduces a descriptive taxonomy for the quality of speculation that provides orientation within this process.

Together, these contributions offer recommendations and methodological guidance for researchers, designers, and practitioners in structuring and evaluating speculative design in HCI.

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PART I: INTRODUCTION AND OVERVIEW

Introduction

Imagine being invited to engage with a technology that does not yet exist. You might read a fictional manual or advertisement, interact with a staged prototype, or step into an imagined future situation in which the technology plays an active role. Rather than testing usability or measuring efficiency, such encounters invite reflection on how the technology might be experienced, what role it could take on, and whether it would be desirable to live with it.

This is the kind of situation speculative design creates. By working with fictional artefacts, scenarios, and enactments, speculative design enables engagement with possible futures in concrete and experiential ways. It shifts the focus from evaluating existing systems to exploring values, meanings, and consequences before technologies are fully realized (Dunne & Raby, 2013). As such, speculative design has gained increasing visibility in Human–Computer Interaction (HCI) and adjacent fields as an approach for exploring emerging technologies and their potential futures (Wong & Khovanskaya, 2018).

In my own work, I engaged with this approach through a series of academic and industry research projects conducted within the Experience & Interaction Design group at the University of Siegen. Across these projects, we examined the value of social conversations with voice assistants (Ringfort-Felner et al., 2022), the role of social robots in complex social situations (Dörrenbächer et al., 2022, 2023), and meaningful experiences in and with self-driving cars (Ringfort-Felner et al., 2023). What connects these projects is not a specific technology, but a shared shift in how these systems are experienced. Rather than being perceived merely as tools, they increasingly act, respond, and initiate interaction in ways that resemble social others. To describe this changing relationship, I refer to these technologies as *otherware* (Hassenzahl et al., 2021).

Although otherware often adopts human-like forms and behaviors, it is frequently designed according to traditional, tool-centered paradigms that prioritize efficiency and task performance (Dörrenbächer et al., 2022; Hassenzahl et al., 2021). This creates a disconnect between how these systems appear and how they are designed to function. Prior research has shown that this mismatch can reinforce gender stereotypes (Brahnam & De Angeli, 2012; Guzman, 2017), negatively influence children’s social behavior (Sciuto et al., 2018), and lead to interactions that felt unnatural or unfulfilling (Muresan & Pohl, 2019). Against this background, speculative design offered us a way to explore alternative future configurations of otherware and to reflect on what might constitute meaningful and desirable forms of interaction with such technologies.

While speculative design proved particularly valuable for investigating these questions, working with it also revealed recurring methodological challenges. In our projects, we encountered difficulties in publishing speculative research due to divergent understandings of what constitutes speculative design, in articulating the approach as a “method” within corporate collaborations in the absence of clear methodological guidance, and in consistently generating in-depth, design-relevant insights without shared assumptions about what makes speculation effective.

Over time, it became clear that these challenges were not unique to our projects but reflected broader methodological issues within the field. Emerging from art and design traditions, speculative design emphasizes exploration, openness, and critique over formalized procedures (Dunne & Raby, 2013). While this makes speculative design particularly valuable for envisioning alternatives and opening up new perspectives, it also complicates its systematic application, evaluation, and cumulative knowledge generation in HCI research.

In response to these challenges, researchers in HCI have already made substantial efforts to clarify and strengthen speculative design as a research approach in HCI, for example by proposing definitions (e.g., Coulton et al., 2017; Lindley & Coulton, 2015; Pierce et al., 2015) or specific methods (e.g., Blythe, 2014; Cheon & Su, 2018; Markussen & Knutz, 2013; Nägele et al., 2018). While these contributions have strengthened speculative design's position within research, core methodological questions remain insufficiently addressed. In particular, it remains unclear how speculative design can be effectively applied to the study of emerging technologies and what constitutes "good" or successful speculative research. As a result, speculative design remains challenging to apply, evaluate, and operationalize in a consistent and transparent manner (S. Bardzell et al., 2012; Lindley et al., 2016).

This dissertation emerges from the tension between speculative design's strength as an open, exploratory practice and the challenges this creates for its use and legitimacy as a research approach. Its central aim is to refine the methodological understanding of speculative design by examining its potentials, challenges, and "quality" for studying emerging technologies, using the example of otherware. It is an attempt to better understand how speculative design practices can be effectively applied in HCI to explore the design, role, and implications of emerging technologies. Based on that, it seeks to derive recommendations and methodological guidance that may support researchers, designers, and industry practitioners in the application and evaluation of speculative design. In doing so, it asks: How can we make speculative research more legible, not by constraining it, but by conceptualizing its processes, qualities, and working strategies more clearly across HCI communities?

Following the principle of research through *doing* design fiction (Coulton et al., 2017; Lindley, 2015), my research begins with multiple case studies conducted with colleagues in both academic and industrial contexts. The first three case studies examine how speculative design approaches and methods can be effectively applied to investigate the opportunities and challenges of emerging technologies, particularly voice assistants and social robots in academic HCI contexts. The fourth case study extends this investigation by situating speculative design within a real-world organizational context through an 18-month collaboration with an automotive company on the future of self-driving cars. It examines how industrial constraints and organizational objectives reshape speculative practices and their methodological requirements. Notably, this study highlights challenges that arise from the absence of shared methodological guidance and agreed-upon quality criteria. The fifth study responds to these challenges by directly addressing the question of quality. Through a systematic scoping review of theoretical and methodological contributions to speculative design, it investigates what defines "good" and successful speculation in HCI.

Together, these studies inform the reflections, contributions, and recommendations this thesis puts forward. The final chapter synthesizes the main findings, discusses how they refine our methodological understanding of speculative design in HCI, and outlines limitations and directions for future work.

The following chapter provides the conceptual foundation for this dissertation. It traces how speculative design entered and evolved within HCI, particularly through its third and fourth waves. It then turns to speculative design itself: its origins, variants, and position within research, before outlining the challenges that accompany its use as a research approach. Together, these conceptual foundations lead to the central research goals of this dissertation and prepare the ground for the studies that follow.

Speculative Design in HCI

The Turn Toward Speculation

Over the past decades, HCI has undergone significant epistemological and methodological shifts. These shifts are often described in terms of successive “waves,” each refining how the field understands and engages with technologies (Harrison et al., 2007). While early waves prioritized usability, efficiency, and cognitive models (Bødker, 2006), later ones increasingly foregrounded the social, cultural, political, and ethical dimensions of technology (Bødker, 2006; Frauenberger, 2019; Harrison et al., 2007). As technologies became embedded in everyday life, researchers came to understand them not as neutral tools but as sociotechnical artefacts. These artefacts are deeply entangled with cultural, political, and value-laden contexts that shape human experience, meaning-making, and social relations. This recognition contributed to the methodological expansion often associated with third-wave HCI. This wave embraces qualitative, participatory, critical, and reflective approaches. Within this evolving landscape, speculative design entered HCI as a way to critically and imaginatively engage with sociotechnical futures (Wong & Khovanskaya, 2018). It offers an approach for interrogating emerging technologies and the values embedded within them.

The importance of speculative design increased further with advancements in artificial intelligence and machine learning. As technologies became more autonomous, adaptive, and increasingly opaque, scholars began to argue for a more-than-human design or more-than-human-centered design (Coskun et al., 2022; Coulton & Lindley, 2019; Giaccardi & Redström, 2020), for decentering the human (Ciobanu, 2019), for designing for cohabitation (Smith et al., 2017), and for post-anthropocentric design (Devendorf et al., 2016). Within this trajectory, so-called “Entanglement HCI” was proposed as a fourth wave in HCI (Frauenberger, 2019). While historically HCI has its roots in engineering and psychology, these new approaches draw on non-anthropocentric theories from philosophy, anthropology, and science and technology studies (STS), e.g., actor-network theory, feminist new materialism, object-oriented ontology, or theories of new animism (Dörrenbächer, 2022; Forlano, 2017; Frauenberger, 2019). They argue that the increasingly blurred boundaries between humans and technologies and the hard-to-predict dynamics of complex systems make it necessary to look at the world as interrelations and dependencies rather than as a collection of separate entities. Sociality, in this view, is located neither in the human nor in the machine but in their relation.

In this context, speculation came to be seen as a methodological necessity for addressing uncertainty and the emergent dynamics of sociotechnical systems (Wong & Khovanskaya, 2018). It is grounded in the idea that understanding complexity requires imagination and methods that cultivate it (Pendleton-Jullian & Seely Brown, 2018).

This development forms part of a broader “critical turn” in HCI towards imaginative and anticipatory approaches for rethinking technological futures (Wong & Khovanskaya, 2018). Speculative design is one of the key approaches associated with this turn.

Speculative Design: An Evolving and Heterogeneous Landscape

In HCI, speculative design refers to “critically oriented research practices that create artefacts, representations, or depictions of possible and often alternate futures” (Wong & Khovanskaya, 2018, pp. 175–176). These practices deliberately distance themselves from immediate practical concerns such as product implementation or market feasibility (Dunne & Raby, 2013). Instead, they use design to prompt critical reflection and debate about possible technological futures (Auger, 2013; Dunne & Raby, 2013; Mitrović et al., 2021).

Historically, speculative design grew out of the critical design work of Anthony Dunne and Fiona Raby at the Royal College of Art (Dunne & Raby, 2013). Influenced by radical architecture and fine arts, they coined the term in the early

2000s to describe a design practice that uses design as *critique* and as a way of speculating about how things *could* be. They explain:

“This form of design thrives on imagination and aims to open up new perspectives on what are sometimes called wicked problems, to create spaces for discussion and debate about alternative ways of being, and to inspire and encourage people’s imaginations to flow freely.” (Dunne & Raby, 2013, p. 2)

In their so-called A/B Manifesto, Dunne and Raby differentiate speculative design from affirmative design (Dunne & Raby, 2013). Affirmative design focuses on solving problems, providing answers, and aligns with market logic and consumer needs. Speculative design, in contrast, adopts a critical stance: it identifies problems, poses questions, and provokes reflection. It does not aim to predict the future; rather, it expands the realm of possibilities to better understand the present and to consider what a preferable future might be.

Over time, speculative practices have proliferated across HCI, often under overlapping or adjacent labels. These include critical design (J. Bardzell & Bardzell, 2013; Dunne & Raby, 2013), adversarial design (DiSalvo, 2015), design fiction (Bleecker, 2009; Coulton et al., 2017; Sterling, 2012), discursive design (Tharp & Tharp, 2022), material speculation (Wakkary et al., 2015), and more performative formats such as speculative enactments (Elsden, Chatting, et al., 2017). Each of these approaches brings its own methods, intentions, and epistemological commitments, contributing to a rich but fragmented landscape.

To capture the diversity of practices that “leverage design to explore futures as a means to comment on—and potentially change—the present” (Kozubaev et al., 2020, p. 2), some scholars have proposed broader terms such as *alternative designs* (Pierce, 2021), or *design futuring* (Kozubaev et al., 2020). However, this thesis adopts *speculative design* as an umbrella term, as it is the most widely recognized label within HCI.

In the following, I outline several prominent speculative design approaches, their origins, and their methodological developments. This overview establishes a shared conceptual grounding for the thesis, clarifies key concepts and methods, and highlights the diversity of speculative practices within HCI.

Critical Design

Critical design is a design practice that uses provocative artefacts to challenge societal norms and expose tensions within existing sociotechnical structures (J. Bardzell & Bardzell, 2013; Dunne, 1997; Dunne & Raby, 2013). Rather than aiming to optimize products or solve predefined problems, critical design seeks to disrupt taken-for-granted assumptions and to prompt reflection on the social, cultural, and political dimensions of technology. A common strategy is the use of so-called *para-functional* objects, that is, artefacts that resemble familiar products but deliberately subvert their expected functionality in order to provoke critical reflection (Malpass, 2013). Dunne describes this technique as a form of *estrangement*, in which the familiar is made strange so that people question the sociotechnical norms they usually take for granted (Dunne, 1997). Critical design often draws on rhetorical strategies such as irony, parody, and black humor. This distinguishes it from certain speculative approaches that explicitly reject irony, such as serious silly design fiction (Blythe et al., 2016).

Originating as a critique of solutionist industrial design, critical design was first articulated by Dunne in *Hertzian Tales* (Dunne, 1997). In HCI, it has since been taken up and further theorized by scholars including Jeffrey and Shaowen Bardzell (e.g., J. Bardzell et al., 2014; J. Bardzell & Bardzell, 2013), Gabriele Ferri (e.g., Ferri et al., 2014), James Pierce (e.g., Pierce et al., 2015), and Matt Malpass (e.g., Malpass, 2013). Their contributions have strengthened its role as a reflective and discursive mode of inquiry within HCI.

Bardzell and Bardzell, for instance, conceptualize critical design as a mode of inquiry grounded in critical theory and metacriticism, which they describe as providing “cognitive handles for design research” (J. Bardzell & Bardzell, 2013, p. 3303). They further provide a list that helps to clarify what makes critical design “critical”:

“a design research project may be judged “critical” to the extents that it proposes a perspective-changing holistic account of a given phenomenon, and that this account is grounded in speculative theory, reflects a dialogical methodology, improves the public’s cultural competence, and is reflexively aware of itself as an actor—with both power and constraints—within the social world it is seeking to change.” (J. Bardzell & Bardzell, 2013, p. 3304)

At the same time, Ferri and colleagues caution that openness and disagreement are essential to critical design, yet it is also “possible to be too fragmented, where we lack even the most basic shared vocabulary with which to have our debates” (Ferri et al., 2014). To address this tension, they propose a *critical design canon*: a set of recurring themes and exemplary works intended to serve as shared reference points for researchers.

While such efforts have strengthened the theoretical discourse around critical design in HCI, the practice remains loosely specified in methodological terms. This distinguishes critical design from the following approaches, which offer more structured ways of engaging with possible futures.

Design Fiction

Design fiction is one of the most prominent speculative design practices in HCI and plays a central role in this thesis. It combines elements of design and science fiction, centering on the creation of *diegetic prototypes*, that is, designed artefacts that exist within fictional worlds and are treated as ordinary elements of everyday life (Bleecker, 2009; Coulton et al., 2017; Sterling, 2012). Rather than presenting technologies as concepts, diegetic prototypes depict how imagined technologies might be used, experienced, and socially embedded, thereby making future change appear plausible and tangible. In contrast to approaches such as critical design, design fiction is therefore often described as more “neutral,” emphasizing storytelling, scenario building, and the construction of coherent fictional worlds over mere provocation (Lindley et al., 2015).

The term design fiction was first introduced by science-fiction author Bruce Sterling in *Shaping Things* (Sterling, 2005). Here, he used it to describe a writing practice distinct from science fiction, one that, as he put it, “makes more sense on the page than science fiction does” (Sterling, 2005, p. 30). Julian Bleecker later transferred the term into design research, framing design fiction as a potential methodological approach rather than a literary genre (Bleecker, 2009). Following their collaboration at the Near Future Laboratory, Sterling articulated what has since become the most widely cited definition of design fiction: “the deliberate use of diegetic prototypes to suspend disbelief about change” (Sterling, 2012).

In HCI, design fiction has since been expanded and methodologically refined by scholars such as Eva Knutz and Thomas Markussen (e.g., Knutz et al., 2014; Markussen & Knutz, 2013), Mark Blythe (e.g., Blythe, 2014, 2017, 2023; Blythe & Encinas, 2016), and Joseph Lindley and Paul Coulton (Lindley, 2015; Lindley & Coulton, 2015, 2016), to name a few. Their work has been central to clarifying definitions, exploring epistemological contributions, and proposing frameworks for practice.

Knutz, Markussen, and Christensen, for instance, introduced a typology to address ambiguities in design fiction’s purpose, form, and role in research (Knutz et al., 2014). Their typology characterizes design fiction across five criteria: (1) the use of “what-if” scenarios, (2) the manifestation of critique, (3) specific design aims, (4) materialization and form, and (5) aesthetic dimensions. They later expanded this work with a four-step methodology for prototyping design

fictions: (1) writing speculative scenarios, (2) establishing fictional rules, (3) experimenting through world building (e.g., drawing, building, visualizing), and (4) prototyping the design fiction (Markussen & Knutz, 2013).

Lindley, Coulton, and their collaborators contributed further methodological and conceptual developments. Notably, they introduced *anticipatory ethnography* as a way of operationalizing design fiction (Lindley et al., 2015). This approach applies ethnographic techniques to design fiction artefacts to generate actionable insights. They propose three complementary modes of inquiry: (1) analyzing the process of creating the fiction, (2) examining how audiences interpret and interact with it, and (3) analyzing the fiction itself. They illustrate the third mode through an analysis of the film *Her*, in which they observed scenes, took notes, clustered insights via affinity mapping, and derived knowledge about human–AI relationships (Lindley et al., 2015).

The same authors later advanced the genre convention of *design fiction as world building* (Coulton et al., 2017, 2019), which is central to the case studies presented in this thesis. This convention defines design fiction as the construction of coherent fictional worlds in which future technologies plausibly exist and can be explored. These worlds are assembled through diverse media such as quick-start guides, newspaper articles, maps, and videos, which together build the world. This approach is exemplified in projects such as *Game of Drones* or *The Empathy Engine* (Coulton et al., 2017), each of which employs multiple media to create a plausible future world.

Over time, design fiction’s openness has further given rise to a range of participatory extensions, including co-design fiction (Ambe et al., 2019), futuristic autobiographies (Cheon & Su, 2018), and participatory design fiction (Nägele et al., 2018). These approaches involve participants directly in imagining future situations and articulating the values, concerns, and questions raised by emerging technologies.

In sum, design fiction encompasses a variety of definitions and methods and is best understood as a flexible research approach within HCI rather than a prescriptive methodology.

Performative and Experiential Approaches

Speculative design in HCI has further expanded toward performative and experiential approaches that emphasize lived and embodied engagements with future scenarios. Emerging partly in response to the limitations of artefact- and narrative-centered speculative practices, these approaches invite participants to imagine, enact, or inhabit possible futures by interacting with speculative artefacts or performing specific scenarios (Simeone et al., 2022). They adopt a more empirical stance, in which speculative design offers insights into the felt, situated experience of emerging technologies (Kozubaev et al., 2020).

Prominent approaches include Wakkary et al.’s material speculation (see Wakkary et al., 2015) and Elsdén et al.’s speculative enactments (see Elsdén, Chatting, et al., 2017). Material speculation introduces counterfactual artefacts as sites of critical inquiry. These objects are situated within people’s homes and everyday routines. Rather than conforming to established norms or uses, they challenge expectations and suggest alternative ways of living with technology. Encountering such artefacts in real-world settings encourages participants to reflect on the assumptions, practices, and sociotechnical conditions that shape everyday life.

Speculative enactments, by contrast, involve participants directly in acting out future scenarios, such as “meta-dating” or “quantified weddings” (Elsden, Chatting, et al., 2017). Through staged situations and improvisation, participants reflect on both the imagined experience and the speculative technologies involved. These enactments are documented and qualitatively analyzed to generate insights into the topic at hand.

In this thesis, such performative and experiential approaches are used alongside design fiction to explore how speculative futures can be imagined, enacted, and empirically investigated.

Speculative Design Beyond Academia

While the approaches discussed above situate speculative design within academic HCI, speculative practices have also traveled well beyond scholarly contexts. Companies, design agencies, and governmental organizations increasingly reference speculative design and design fiction as new ways of engaging with the future (e.g., Google Design, 2020; Quinn, 2021).

However, despite this growing uptake, it is often unclear which specific speculative design practices are actually used in these contexts, or how closely they align with their academic counterparts. In many cases, design fiction appears to function more as a broad label or trendy buzzword, similar to design thinking, but without its critical orientation (Seitz, 2017). This is a consequence of speculative design's openness and adaptability.

Speculative Design and Research

In HCI, speculative design primarily seeks to generate knowledge (Kozubaev et al., 2020). It can be situated within the tradition of Research through Design (RtD) (Gaver, 2012), where design activity serves as a central method for inquiry. Unlike other RtD approaches that often explore imminent phenomena through, for example, building and using prototypes, speculative design distinguishes itself by focusing on alternative realities and possible futures.

Within this tradition, the knowledge generated is particular (Stolterman, 2008) and context-dependent (Lindley & Green, 2021), often "provisional, contingent, and aspirational" (Gaver, 2012, p. 938). It is (co-)produced both through hands-on making (Ratto, 2011; Smith, 2024) and through interpretive engagement, negotiation, and reflection (J. Bardzell et al., 2015; Lindley & Green, 2021). When abstracted beyond individual cases, such knowledge can take the form of "intermediate-level knowledge" (Höök & Löwgren, 2012), that is, conceptual, design-oriented insights that are grounded in practice yet transferable across contexts to guide future design.

The epistemic value of speculative design thus lies not in valid prediction or immediate problem-solving, but in surfacing assumptions, enabling critical reflection, and expanding the conceptual space within which futures can be imagined, discussed, and consciously shaped (Dunne & Raby, 2013; Lindley & Green, 2021).

While speculative design generally produces domain-specific insights, for example regarding artificial intelligence and human-computer interaction (Lindley & Potts, 2014), it can also generate knowledge about speculative design *itself*. As Coulton and colleagues emphasize, "[t]he best way to understand the many difficulties of design fiction is to attempt to create one" (Coulton et al., 2017, p. 5). In addition, Lindley identifies two further relationships between design fiction and research (Lindley, 2015). Research *into* design fiction generates new knowledge about the practice through inquiry into pre-existing knowledge. Research *for* design fiction, by contrast, refers to contextual investigation carried out to support the design and production of fictional artefacts. This thesis draws on all three modes (research *through*, *into*, and *for* speculative design) to examine both emerging technologies and speculative design as a research practice.

Challenges of Doing Research with Speculative Design

Although speculative design has gained prominence in academia and in applied settings, it remains a contested and demanding research practice. Rather than constituting a single method, it comprises a diverse and evolving set of practices and tools used to explore potential sociotechnical futures. At the same time, however, it remains methodologically open, creating uncertainty about how speculative design should be applied, evaluated, or taught (Baumer et al., 2020; Ferri et al., 2014; Lindley et al., 2016). I argue that these challenges persist primarily because of two interrelated issues in the field.

First, there is a lack of methodological clarity regarding how speculative design can be applied effectively as a research approach for generating knowledge about emerging technologies. While numerous approaches and methods have been proposed, they are often tied to specific practices (e.g., design fiction) or phases (e.g., creation, evaluation). For instance, researchers have introduced methods for prototyping design fictions (e.g., Markussen & Knutz, 2013; Nägele et al., 2018), for constructing fictional worlds (e.g., Coulton et al., 2017), for engaging participants in speculations (e.g., Cheon & Su, 2018; Elsdén, Chatting, et al., 2017), or studying design fiction empirically (e.g., Lindley et al., 2015). Yet there exists no general process or agreed-upon set of methodological elements that guides speculative research across contexts¹. As a result, researchers and practitioners must navigate speculative design largely on their own, experimenting with what works and what does not. This experimentation has led to increasingly varied applications across projects, as well as uncertainty about what speculative design is and how it should be practiced.

Second, there is a lack of clarity regarding what constitutes “good” or “bad” speculations (S. Bardzell et al., 2012; Grand & Wiedmer, 2010; Lindley et al., 2016; Lindley & Coulton, 2015; Markussen & Knutz, 2013). To date, much of the work in HCI has focused on characterizing speculative design and its applications, rather than understanding and articulating the qualities that make speculative research successful. Although many contributions touch upon the quality of speculation (e.g., in methodological reflections), no consolidated view or shared understanding exists. This challenges both the creation of effective speculations and their assessment, for example when reviewing speculations in the context of academic publishing (Lindley et al., 2016). In the absence of shared criteria, reviewers often either align with a particular “school” of speculation or fall back on conventional HCI evaluation standards (e.g., sketches, prototypes, and user studies) to assess the quality of speculative designs (Baumer et al., 2020; Lindley et al., 2016). As Baumer et al. (2020) argue, it is inappropriate for reviewers to expect conventional outcomes from designs intended to provoke debate. Similarly, Bardzell et al. (2012) note that traditional skills in evaluating sketches or prototypes do not necessarily apply to critical design, whose goal is to provoke and stimulate discussion rather than to optimize use. In response, Baumer et al. (2020) proposed various “evaluative frames” for design fiction, drawing on HCI traditions such as critical design, narratology and literary theory, studio-based design “crits”, user studies, scenario and persona development, and thought experiments. They deliberately avoid prescribing fixed criteria, emphasizing instead that different contributions require distinct evaluation criteria.

These two challenges highlight a significant methodological gap in speculative design research, which this dissertation seeks to examine and respond to.

¹ Please note that this reflects the state of the field at the time this dissertation was written. A recent systematic review has since proposed a general process for speculative design in HCI; its relevance for this thesis is addressed in the discussion chapter.

Refining Speculative Design: Central Research Goals and Methodological Approach

The previous chapter traced how speculative design has evolved from a design practice into a recognized research strand within HCI. At the same time, it showed that its growing adoption has not been accompanied by comparable clarity about its methodological use in research. In particular, fundamental questions remain about how speculative design can be applied effectively in research and how the quality of speculative work can be conceptualized and assessed. The result is a paradoxical situation: speculative design is increasingly employed in HCI, yet it remains difficult to apply effectively, to evaluate within academic standards, or to teach as a research approach.

With this thesis, I seek to refine the methodological understanding of speculative design in HCI by addressing the following research questions:

- **RQ1 (Methodology):** How can speculative design be effectively applied to investigate the opportunities and challenges of emerging technologies in HCI? Which speculative design approaches, methods, or processes are particularly well-suited for this purpose?
- **RQ2 (Applicability & Scaling):** What are the potentials and challenges of speculative design in practice? How do methodological requirements such as applicability, acceptance, and impact shift when speculative design is applied beyond expert communities and academia?
- **RQ3 (Standards & Quality Criteria):** What defines “good” or successful speculative research? Which criteria or processes can guide its application and evaluation?

These questions are explored across three phases and five interrelated studies that together follow a dual methodological approach of research *through* and research *into* speculative design (Lindley, 2015) (see Figure 1 for an overview).

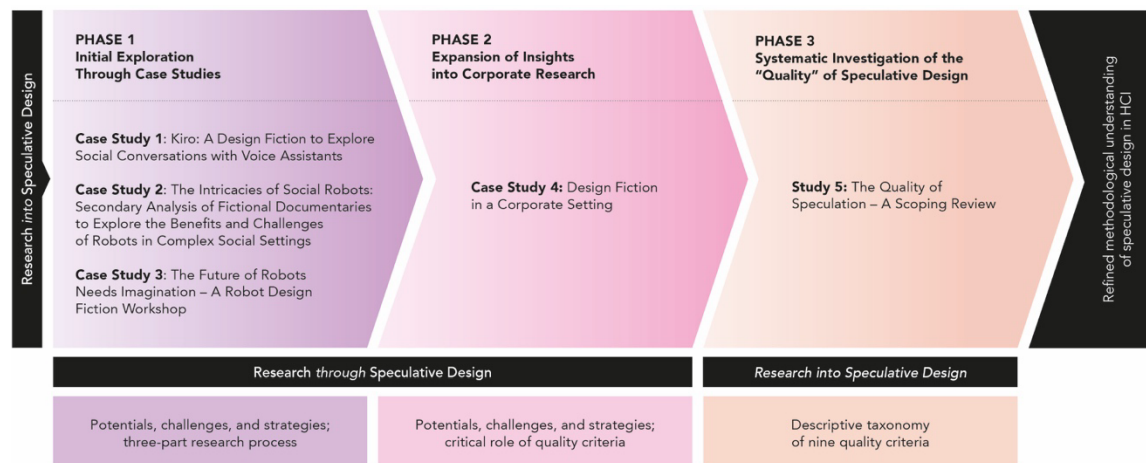


Figure 1: Overview of the research phases, case studies, methodological approach, and key outcomes.

The first phase comprises three case studies (Case Studies 1–3) that examine how speculative design approaches and methods can be applied to investigate emerging technologies, particularly voice assistants and social robots, in academic HCI contexts. Through systematic reflection on design processes, decisions, and outcomes, these studies reveal concrete strategies for researching the “not-yet,” while underscoring the potentials, challenges, and inherent limitations of speculative inquiry. They further position speculative design as a positive, participatory, and empirically informed

approach to design research that unfolds in a three-part process: (1) informing design, (2) (co-)creating fictional worlds, and (3) empirical investigation.

The second phase extends this investigation by situating speculative design within a real-world organizational context through a fourth case study (Case Study 4), conducted as part of an 18-month research collaboration with an automotive company on the future of self-driving cars. This study examines how speculative design unfolds within organizational structures and business objectives, showing how such contexts can steer speculation toward product-driven innovation rather than critical exploration. At the same time, it identifies strategies for applying speculative design in industry and highlights the importance of explicit quality criteria for supporting its acceptance and effective use in such settings.

The third phase addresses the importance of quality criteria directly through a fifth study (Study 5). Based on an analysis of 63 theoretical and methodological publications on speculative design, design fiction, and critical design, this study identifies nine key criteria associated with “good” and successful speculation and consolidates them into a descriptive taxonomy. The resulting taxonomy provides a shared vocabulary and a starting point for creating and evaluating high-quality speculative designs.

Taken together, the first four case studies investigate speculative design in practice, generating methodological insights through its application across diverse research projects and contexts on otherware (research through speculative design). Building directly on the challenges and methodological requirements revealed in these applications, the final study shifts the focus toward research *into* speculative design to examine how the quality of speculation can be conceptualized and assessed in HCI.

Together, these five studies refine the methodological understanding of speculative design in HCI. They demonstrate how speculative design can be used to explore the design, role, and implications of emerging technologies and provide concrete recommendations and tools to guide its application and evaluation in research and practice.

Phase 1: Initial Exploration Through Case Studies

The first phase of this thesis examines how speculative design can be effectively applied to investigate the opportunities and challenges of emerging technologies, and which approaches, methods, or processes are particularly well-suited for this purpose (RQ1). It adopts a research-through-design approach and comprises three case studies that systematically reflect on and compare different configurations of speculative design in practice.

Case Study 1: Kiro: A Design Fiction to Explore Social Conversations with Voice Assistants

This chapter is based on the following publication:

Ringfort-Felner, R., Laschke, M., Sadeghian, S., & Hassenzahl, M. (2022). Kiro: A Design Fiction to Explore Social Conversation with Voice Assistants. *Proceedings of the ACM on Human-Computer Interaction*, 6(GROUP), 1–21. <https://doi.org/10.1145/3492852>

Introduction

The first case study explores the potential and value of socially fulfilling conversations with voice assistants (VAs) in a concrete everyday context: the car. It uses design fiction to create a convincing near-future vision of an in-vehicle social VA (sVA), called *Kiro*, and empirically explore how such a system might be experienced and evaluated by laypeople.

Context

In recent years, VAs whether in the form of smart speakers (e.g., Amazon Alexa, Google Home) or smart-phone-based personal assistants (e.g., Apple Siri, Microsoft Cortana) have become increasingly integrated into everyday life, particularly in homes and cars. While often placed in social spaces and designed with human-like cues that suggest social interaction (Cowan et al., 2017), their core functionality remains pragmatic: executing simple commands, retrieving information, or controlling devices.

At the same time, advances in machine learning and other forms of “artificial intelligence” are expanding the scope for more complex, socially oriented conversations. Rather than merely executing tasks, VAs can serve quasi-social functions (Coeckelbergh, 2011) and provide fulfilling, that is enjoyable and meaningful, social experience, such as socializing or emotional disclosure.

While potentially valuable, empirically exploring the potential of fully-fledged “social” VAs in everyday life remains challenging. On the one hand, the commercial market solely focuses on predominantly practical applications, with only rare exceptions like Replika² (Luka, 2017). This makes it quite difficult to change the preconceived perception people have of voice assistants (Clark et al., 2019). On the other hand, the technological possibilities available at the time of the study did not allow for elaborate social conversations.

To address these constraints, speculative approaches (particularly design fiction) have been used to explore social dimensions of VAs, including gender, care, and emotional relationships with machines (Seymour & Van Kleek, 2020;

² This reflects the state of commercially available systems at the time of the study.

Søndergaard & Hansen, 2018). Yet this research leaves open how laypeople would respond to the offer of a realistic sVA presumably available on the market.

Accordingly, this case study creates a convincing near-future vision of a sVA and empirically explores its possibilities and challenges. In doing so, it focuses on the car as a meaningful application area. As a mobile and intimate space shared for a specific period (Laurier et al., 2008), the car offers a setting well-suited for both superficial (e.g., gossip) and in-depth conversations (e.g., processing difficult decisions). However, many people drive alone (Center for Sustainable Systems, 2019). Given the pervasiveness of in-vehicle VAs (Lo & Green, 2013) and the suitability of the car as a place for conversations, it seems likely that future in-vehicle VAs will offer more socially-oriented types of conversations.

Method

To empirically explore the potentials and pitfalls of a future sVA, we used design fiction. We followed a three-phase process informed by our research goals and by existing methods and approaches in speculative design (see Table 1 for an overview). First, we created a “preferable” near-future vision of an in-vehicle sVA, called *Kiro*. This vision was informed by models from psychology and psychotherapy, as well as a collection of potentially positive social experiences gathered through a survey. Second, we materialized this vision by creating several artefacts (e.g., technical 3D model, product descriptions). These artefacts were combined into a coherent narrative and embedded within a product website of a fictional start-up company. Finally, we initiated discussions by confronting laypeople with the vision through a focus group and different online channels. This allowed us to explore the thoughts, feelings, and concerns of people as a response to *Kiro*. In the following, I will present each step in detail.

Table 1: Design fiction process.

	Step 1: Vision Building		Step 2: World Building	Step 3: Confrontation	
Goal	Creation of a preferable vision of an in-vehicle sVA		Manifestation of the vision	Initiation of a critical discourse; examine potentials and pitfalls of the vision	
Inputs	Models from psychology and psychotherapy	Positive anticipated experiences of 6 individuals	Results of step 1	Result of step 2	
Method/ Approach	Research for design fiction (Lindley, 2015)	Anticipatory ethnography (Lindley et al., 2015)	Design fiction as world building (Coulton et al., 2017)	Focus group	Different online channels (1) Social media (Facebook, LinkedIn, XING) (2) Discussion space (Spectrum) (3) Online article (4) E-Mail reactions
Results	General functions	Positive anticipated experiences and opinions	Fictional product website	Thoughts, feelings, and reaction of people being confronted with the vision	

Step 1: Vision Building

To create a meaningful, grounded, and authentic vision of *Kiro*, we drew on theoretical models from psychology and psychotherapy that describe the “design” of positive conversations and relationships. Specifically, we based our conceptualization of *Kiro* on Sachse’s Complementary Relationship Design (Sachse, n.d.), which outlines six fundamental relationship motives, and Rogers’ Person-Centered Conversation Therapy (Rogers, 2000), which defines three relational attitudes. Although these models were originally intended for human–human interaction, they offered a useful

inspiration for conceptualizing *Kiro*'s general functions and the way it might interact with drivers. Table 2 provides an overview of the motives and attributes and shows how they informed the design of *Kiro*.

Table 2: Models from psychology and psychotherapy and how they informed the design of *Kiro*.

Model	Motives/ Attitudes	Description	Inspiration for <i>Kiro</i> 's design (Design implication)
Complementary relationship design (Rainer Sachse)	Recognition	Humans strive for positive absolute feedback about themselves as a person, e.g., about their own abilities or attractiveness.	<i>Kiro</i> provides positive and "honest" verbal feedback on the abilities and attractiveness of the human counterpart after an acquaintance period.
	Importance	Humans strive for feedback on their meaning and importance to their counterpart, e.g., by expressing interest or attention in interaction.	<i>Kiro</i> provides undivided attention, is interested, never forgets anything, "reflects" on past trips and topics discussed, and takes them up on the next trip.
	Reliability	Humans strive for stability, resilience and consistency in social relationships and a respective feedback on this, e.g., through actions such as joint activities or joint planning of future activities.	<i>Kiro</i> provides unrestricted availability, shared driving experiences, and visualizes "thinking" about upcoming joint trips to show that the relationship is stable and consistent over time.
	Solidarity	Humans strive for feedback on the fact that the counterpart supports whenever it is needed.	<i>Kiro</i> provides support during the ride by giving advice, tips, or emotional commitment.
	Autonomy	Humans strive for making their own decisions and their acceptance of the counterpart.	<i>Kiro</i> accepts the attitude of its counterpart and merely provides tips, advices, suggestions, or ideas.
	Boundaries/ territoriality	Humans strive for defining their own domains (e.g., my car) that are determined by a boundary and to determine who crosses it.	<i>Kiro</i> is not permanently installed in the car (portable device) and allows the user to decide whether and when the personal retreat space "the car" should be shared.
Person-centered Conversational therapy (Carl R. Rogers)	Empathy	Empathetic understanding. The "real" understanding of a person and his/her values, motives, wishes, and fears.	<i>Kiro</i> strives to understand its counterpart in her/his experience and the values, motives, wishes, and fears associated with it.
	Unconditional positive attention	Acceptance, sympathy, or appreciation of the feelings and expressions of the interaction partner.	<i>Kiro</i> accepts its counterpart without judgement or prejudice. No forcing of an own opinion.
	Congruence	Authenticity, genuineness, and/or transparency. Contributing one's own into the relationship.	<i>Kiro</i> has an own "life story" that it can bring into the relationship (consists of a record of its first journey (the delivery to the user) and the subsequent experiences.

We further refined our preliminary fiction through *anticipatory ethnography* (Lindley et al., 2014), collecting positive (i.e., meaningful, enjoyable) experiences and social use cases people could imagine having with *Kiro*. In doing so, we followed Lindley and colleagues' second potential application, that is, studying how an audience interacts with or perceives a design fiction. To do so, we used an online survey asking participants to imagine using *Kiro* in everyday life and to describe their (imaginary) positive everyday experiences with it. Participants were informed about *Kiro*'s basic features (e.g., perfect communication partner, shares feelings, not permanently installed in the car) through a product description and were encouraged to imagine that they had already spent several trips with *Kiro*. To stimulate imagination, we asked seven questions (e.g., "What do you like about *Kiro*?", "How did *Kiro* change your car ride?" or

“Which experience with *Kiro* do you remember most?”). In total, six frequent drivers (4 female, 2 male, age: 25 to 59 years, median=27) participated. In sum, we collected 50 positive statements. We used thematic analysis (Blandford et al., 2016) to structure the content and identify themes and recurring patterns across participants’ responses.

Across responses, participants consistently imagined *Kiro* as an idealized companion and friend: always attentive and understanding, non-judgmental, unconditionally supportive, and never angry or hurt. Importantly, they did not envision *Kiro* as a human equivalent, but as an idealized companion offering forms of social interaction that would require rather *superhuman* social powers from fellow humans.

We used these inputs to shape our design fiction.

Step 2: World Building

To materialize the vision of *Kiro*, we followed the approach of *design fiction as world building* (Coulton et al., 2019). Inspired by how technology companies announce new products online (e.g., Mayfield Robotics, n.d.; Senic, n.d.; Spire Health, n.d.), we created a product website (www.heykiro.com) that introduces *Kiro* as the latest offering from a fictional Dallas-based start-up, *Springfield Technology*.

Product websites typically combine various media forms, such as text, images, and animations, and include, for example, detailed information about product features, functionality, the technology, or the science behind the product. Following this convention, we developed product descriptions as well as a series of realistic images and animations of the product itself, placed in the car or at home (Figure 2).



Figure 2: Different realistic images of the product serving to promote Kiro on the website in a credible way.

We designed *Kiro* as a puck-like shaped device (ca. 48x17mm) with a disc at the top, which simulates eye contact through a moving light and a rotating key ring on the underside to allow carrying like a keychain. Additionally, we designed a suitable charging station as a keyholder at home, on which *Kiro* displays its “thinking” as simple outlines of the content of a past conversation and upcoming ones.

In total, we created seven pages that combined different artefacts (Figure 3 shows an excerpt³):

- A **cover page**, that teased the product with the tagline “*Never ride alone — Meet Kiro, the world’s first sociable AI.*”
- A **product page**, that described Kiro’s functionalities and features using realistic images and animations.
- A **user stories page**, that presented fictional user opinions and experiences derived from our anticipatory survey, organized under headings such as “*People love their Kiro*” or “*Why people recommend Kiro.*”
- A **science page**, that outlined the psychological models by Sachse and Rogers as the scientific basis for *Kiro*.
- An **about-us page**, that described the vision and fictional “origin” story of the fictional start-up *Springfield Technology*.
- A **pre-order page**, that offered the “*Kiro Social Car Companion Kit*” for €309, including fictional product details, box contents, and delivery information.
- A **FAQs page**, that answered typical questions such as “*Where does Kiro have to be placed in the car?*” or “*What if I lose my Kiro?*”

To address ethical and legal issues and to inform visitors about the fictional nature of the site, we included a disclaimer under “General Terms and Conditions”, stating:

“The website heykiro.com is a fictional product website created for research purposes. All displayed content is for demonstration and research purposes ONLY and does not exist in reality.”

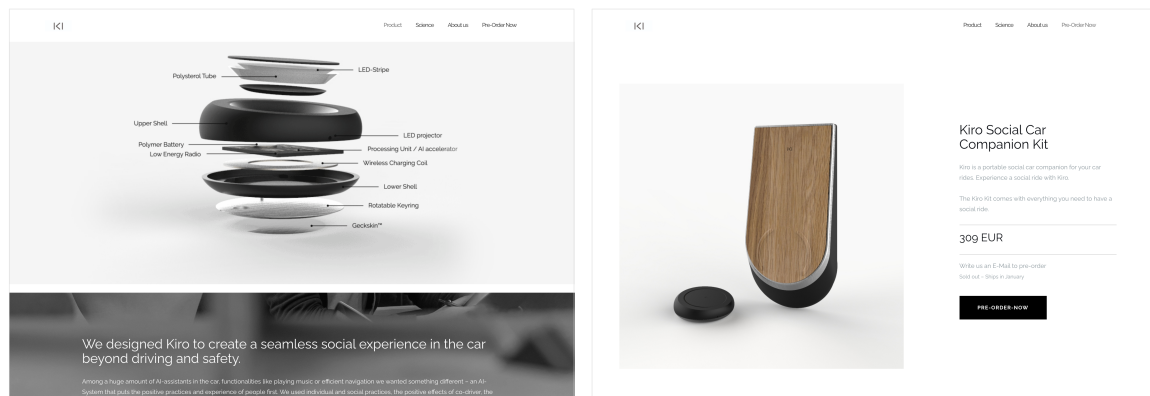


Figure 3: Parts of the fictional product website.

³ Please, visit the website www.heykiro.com for all details

Step 3: Confrontation

To empirically explore how people respond to the vision of *Kiro*, we run a market-research-style focus group and gathered further reactions via multiple online channels.

Focus Group. We conducted a two-hour, market-research-style focus group with five frequent drivers (2 female, 3 male; age: 37–51 years, median=41) on the topic of “social conversational agents for driving”. As an introduction, we informed participants that the discussion would concern an sVA for the car to gather insights for the further development of such systems. At this stage, we deliberately withheld the fictional nature of *Kiro* and the start-up company to elicit factual instead of speculative responses. We discussed the ethical implications of this temporary deception in advance and addressed them thoroughly during the final debriefing.

After the introduction, we invited participants to share their daily driving routines and experiences. We then presented *Kiro* via the fictional product website, keeping the story of an already functional product soon to be launched. In the subsequent group discussion, participants shared their initial thoughts and feelings. Next, we asked them to imagine using *Kiro* during the car rides they had previously described. Interesting topics were taken up by the moderator and discussed further.

At the end, we debriefed participants by disclosing the fictional nature of *Kiro* and explaining the study’s purpose and methods. Participants were given the opportunity to ask questions, raise concerns, and withdraw their data, none chose to do so. The focus group was audio- and video-recorded and later transcribed. We conducted thematic analyses (Blandford et al., 2016), sorting the content by similarity.

Online Responses. We used four distinct ways to collect further responses towards *Kiro*:

1. **Social Media:** We shared *Kiro*’s website on Facebook, LinkedIn, and Xing with captions such as “*Artificial Intelligence designed to be good company in cars! Check it out!*”. The posts gave no indication of *Kiro* being fictional.
2. **Discussion Space:** We created a public discussion space on the platform *Spectrum*, accessible via *Kiro*’s website. We invited users to discuss three topics: “A world with *Kiro*...”, “Would you like to have a car ride with *Kiro*?” and “What do you think and feel?”.
3. **Online Article:** We contacted the German online magazine for innovation *Technology Review*, which published an article about *Kiro* titled “How a portable digital assistant for the car could look like”. This introduced *Kiro* to a broader tech-interested audience.
4. **E-Mail:** Finally, we included an email address on the website to “pre-order” the product and as a contact for support inquiries.

Overall, our social media posts received 57 likes, 10 shares, and 9 comments; the discussion space generated nine comments; and the article three. We received three e-mails, one of which led to a one-hour video call with the innovation department of a German radio station about in-car audio and *Kiro*’s potential role in that context. As with the focus group, all responses were transcribed and thematically analyzed.

In the following, I first briefly outline the domain-specific findings to illustrate what this case study revealed about sVAs, before turning to the methodological insights.

Domain Specific Findings

The empirical responses revealed a complex and ambivalent picture of how people relate to the possibility of having social experiences with an in-vehicle sVA. Across both the focus group and the broader online engagement, reactions ranged from skepticism and concern to curiosity and interest.

Concerns and Challenges

The idea of engaging in an emotionally intimate conversation with a machine provoked critical responses, especially in the focus group. Participants characterized *Kiro* as “uncanny”, “queasy”, and “untrustworthy”, with specific fears related to privacy, data misuse, manipulation, and loss of control. They also questioned the necessity of *Kiro*, referring to the availability of “real” (i.e., human) social contacts. As a result, conversation topics revolved rather around “unimportant” mundane things (e.g., cooking topics) or practical ones (e.g., reading out news, finding a parking space). These topics were perceived by participants as being both, safe and useful. In this sense, *Kiro* was reduced to an assistant or hint-giver rather than a potential companion or friend.

Probably, participants doubted the trustworthiness of the technology, since the fictional developer “Springfield Technology” was unknown; accordingly, there was no basis of trust that might have offered a sense of security. They might also have negative associations with VAs in general due to existing experiences, such as with Amazon’s Alexa. Importantly, these concerns should not be interpreted as rejection or as a lack of open-mindedness. Rather, they reflect basic requirements for the design of sVAs: trust, transparency, and a clear understanding of data practices. Moreover, if sVAs are designed in “social competition” with human conversation partners, questions about their necessity seems quite reasonable. This raises a central design consideration: should sVAs imitate human–human conversation, or must they be approached from a fundamentally different perspective?

Ideas and Potentials

Alongside these concerns, *Kiro* also evoked positive responses and curiosity, particularly in the unprompted online comments. These reactions illuminate the potential of sVAs. Several commenters playfully explored what life with *Kiro* might be like, imagining everyday uses such as shared laughter, listening to podcasts together, or discussing radio content. Others projected the idea further, considering how *Kiro* might act as a mediator during shared rides or even how “groups of *Kiros*” could interact socially and connect users in novel ways.

Notably, positive respondents did not primarily perceive *Kiro* as a substitute for a human conversation partner. Instead, much like participants in the anticipatory ethnography, they imagined *Kiro* as a means to enhance their existing human–human relationships. Consequently, the envisioned scenarios went beyond superficial or pragmatic issues, evolving into rich situations, where *Kiro* motivates and encourages (before or after an event), helps to relieve stress, becomes an expert discussion partner (e.g., podcast or radio content), or supports reflection by remembering conversation topics people had with their friends.

Design Considerations

These findings suggest that the acceptance and value of sVAs may hinge on whether an sVA is perceived as a substitute and imitation of human–human conversation or as something different—a complement to already existing social experiences. Participants who perceived *Kiro* as an imitation and replacement of a human conversation partner questioned its competence and potential value. In contrast, people who were positive towards *Kiro* perceived it as an enrichment to their social experiences and imagined idealized conversations, at least to some extent distinct from conversations they would have with other people.

To support this through design, we consider it crucial to create new, distinct types of social human-machine conversations, rather than pursuing ever more realistic imitations of human interaction. Some approaches in HCI as well as in Human-Robot Interaction (HRI) already suggest not to imitate humans, but to focus on what is unique for each “species” (Kuijter, 2019; Kuijter & Giacardi, 2018; Welge & Hassenzahl, 2016). This implies understanding

technology such as VAs not as interfaces or tools, but as social counterparts with their own “interests”, “needs”, or “quirks” rooted in their technological nature.

Echoing findings from social robotics (Welge & Hassenzahl, 2016), we argue that by exploiting machine-immanent yet social “superpowers” through design, sVAs can make more sense—not as a substitute for other people, but as a novel, complementary form of social interaction.

Methodological Reflection

In this study, we used design fiction to explore the future of sVAs. To do so, we created *Kiro* and confronted people with a potential near-future vision. We followed a three-phase process (vision building, world building, and confrontation) which integrated established concepts such as anticipatory ethnography and design fiction as world building, while adapting them to our research goals.

To create a meaningful and authentic design fiction, we grounded *Kiro* in psychological and psychotherapeutic models of human conversation and relationships, as well as in anticipated user experiences. The theoretical grounding helped us conceptualize potentially meaningful forms of human–machine interaction. The fictional user stories translated this conceptual model into concrete; emotionally grounded everyday scenarios rooted in participants lived realities. Together, these sources proved valuable in creating a design fiction that was not only plausible and relatable, but also potentially meaningful.

To materialize the vision of *Kiro*, we adopted Lindley and Coulton’s convention of design fiction as world building. This approach enabled us to construct a tangible future scenario in which the “*world’s first sociable AI for cars*” exist—realized through a fictional product website and complementary artifacts.

The website conveyed the general idea of having social conversations with an in-vehicle VA, while remaining vague about how such conversations might unfold. This *vagueness* allowed participants to project their own expectations, concerns, and hopes onto the design. Some imagined *Kiro* as a substitute for interpersonal conversation; others interpreted it as enabling a novel kind of interaction, distinct from human–human conversation. In this way, the fiction became a reflective space: concrete enough to be imaginable, yet open enough to allow diverse imaginaries to emerge.

A key element of our approach was to empirically inform and interrogate the design fiction in various ways. This is not inherent to design fiction and criticized as lacking in the field (Dörrenbächer et al., 2020). By combining a focus group with open-ended online responses (e.g., social-media comments), we accessed a broad range of perspectives beyond our own reflections. Although these responses were neither unbiased nor representative, they nevertheless offered valuable insights into how people make sense of the idea of an sVA, including emotional reactions, and ethical concerns. They even pointed toward potential design directions, suggesting that machine-mediated social conversations could be meaningful—or even desirable—if designed differently from human-to-human conversations. Although this may not provide a full answer to the question of *whether* we really ought to design for such experiences, it points to design directions worth exploring.

To elicit these responses, we deliberately presented the design fiction as real. This strategic use of *plausibility* blurred the boundary between fiction and reality. It prompted participants to respond to what they perceived as a near-future reality rather than a speculative “what if.” However, this strategy raises ethical considerations, including the risk of participants feeling misled which need to be sensibly managed (Coulton et al., 2016). All participants in our study were carefully debriefed and informed about the propose and fictional nature of *Kiro* at the end. As far as we know, none of them experienced harm. On the contrary, many expressed curiosity and interest in the approach.

Reflections on the Reception of the Study

Finally, it is worth noting that this case study underwent four different rounds of peer review, each met with very different receptions. While some praised the work for its well-crafted and theoretically grounded fiction, as well for its empirical engagement, others criticized the lack of a functioning prototype. This reflects expectations rooted in traditional empirical or engineering paradigms. Others questioned whether the work sufficiently challenged dominant assumptions to qualify as “design fiction,” revealing a different set of expectations rooted in critical design traditions. While we consider our fiction to be critical by challenging settled notions of what VAs are, others may hold different conceptions of what constitutes “criticality.” Especially in traditions shaped by Dunne and Raby, speculative and critical design is often tied to dystopian or provocative imaginaries. In contrast, our approach followed the more positive traditions of design fiction.

These receptions illustrate how the evaluation of speculative work depends on the reviewers’ disciplinary backgrounds, prior exposure to speculative design, and implicit notions of “quality”.

Summary

This first case provides an example of how speculative design, particularly design fiction, can be methodologically applied to explore emerging technologies, specifically sVAs. It contributes to our methodological understanding of speculative design in several ways:

- It presents a three-phase process—vision building, world building, and confrontation—that integrates existing methods while offering a concrete and adaptable framework for its application.
- It illustrates how diverse sources such as psychological theory and participants’ imaginaries can meaningfully inform speculative designs.
- It points to design strategies such as *ambiguity* and *plausibility* as effective means to engage participants in meaningful discussions about future technology.
- It demonstrates that empirical engagement with speculative artifacts—though still uncommon in design fiction—can yield valuable insights that can inform future design.
- Finally, it exposes the inconsistent evaluation criteria of design fiction within academic research.

Case Study 2: The Intricacies of Social Robots: Secondary Analysis of Fictional Documentaries to Explore the Benefits and Challenges of Robots in Complex Social Settings

This chapter is based on the following publication:

Dörrenbächer, J., Ringfort-Felner, R., & Hassenzahl, M. (2023). The Intricacies of Social Robots: Secondary Analysis of Fictional Documentaries to Explore the Benefits and Challenges of Robots in Complex Social Settings. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, Article 371, 1–13. <https://doi.org/10.1145/3544548.3581526>

Introduction

The second case study investigates social robots in complex social situations, continuing the exploration of meaningful human–machine interaction. Like the first case, it employs design fiction, but differs in how the fictions were created, materialized, and analyzed. The study draws on fictional documentaries developed by students in a speculative design course, each depicting imagined future encounters with social robots. These documentaries served as data for a secondary analysis to identify potential scenarios, roles, and experiences with social robots.

Context

Cynthia Breazeal, a pioneer of social robotics, defines sociable robots as systems that “is able to communicate and interact with us, understand and even relate to us, in a personal way (Breazeal, 2002, p. 1)” —ultimately, interacting with them “is like interacting with another person” (Breazeal, 2002, p. 1). This vision positions social robots as highly sophisticated agents that emulate human-like intelligence and interaction. As a result, much of social robotics research has focused on equipping robots with capabilities such as speech recognition, emotion detection, learning, facial expressions, and gestures—all aimed at mimicking human or animal behaviors. This approach has led to a dominant focus on social cognition: how humans perceive and respond to social cues from robots. However, what these studies often lack, is a notion of the social setting the robot will be applied to, the emerging practices that surround them, as well as a reflection on how practices may and could differ, if the social partner is a machine, rather than a living being.

Accordingly, this study explores three interrelated questions:

- (1) What are the scenarios in which robots can be socially effective, and what roles might they assume in these scenarios?
- (2) How might their presence change these scenarios and associated practices over time and what are the social and ethical implications?
- (3) How can we design for positive experiences with social robots?

Method

To explore social robots in complex social situations, we asked 19 master’s students in HCI at the University of Siegen to develop concepts for fictional social robots and examine their potential societal implications. These concepts materialized in the form of fictional documentaries that portrayed the robots and their anticipated impact within plausible near-future scenarios. We used these documentaries as data for a secondary analysis, aiming to better understand commonalities and differences across potential scenarios, robot roles, and imagined experiences. The process

followed a similar three-part structure as in Case Study 1 (vision building, world building, confrontation) but differed in how each step was realized and interconnected.

Step 1: Laying the Groundwork

The process began with a critical analysis of existing social robots (e.g., Aibo, Hobbit, Hitchbot, Kuri). The students critically reflected on the robots' functions, interaction styles, and its usage in everyday life. This reflection included both positive aspects (e.g., "Playing music while following the user could be stimulating when cleaning the house") and negative ones (e.g., "The functions seem arbitrary: playing music has little to do with Kuri's main idea of being a family member"). The students concluded that most "social robots" primarily serve practical or entertainment purposes and, in this sense, function more as tools with a social interface than as real social counterparts.

Based on this critique, the students imagined not-yet-existing, but potentially meaningful concepts of future social robots.

Step 2: Materialization and Reflection

To materialize their concepts, the students created fictional documentaries about their robots. These documentaries were intended to depict a world in which the robots were already widely used, showing both their applications and consequences. For the latter, the students recorded interviews with fictional stakeholders of their robot. To do so, they asked fellow students, grandparents, or friends to slip into the roles of stakeholders important to the scenario of the fictional robot, such as the CEO of a robot company, a passenger in a train, or a slacker living in a shared flat. Speaking in role, interviewees described their imagined personal experiences with the robot, including their (imagined) feelings, thoughts, and opinions about the robot itself. This approach resembles the anticipatory ethnography used in Case Study 1 but differs in its more dialogical and explicitly critical form.

The students provided vivid descriptions of their robots and invited participants to imagine living in a world where such robots already existed. They prompted these imaginations by asking interview-like questions such as: "We heard you had a very exciting, positive experience with the robot last week, would you tell us about it?" These prompts encouraged participants to imagine concrete situations and to reflect on various positive and negative experiences. Most students chose a suitable setting to film the interviews, e.g., next to a bus stop to further stimulate participants' imaginations. All answers were spontaneous, immediate improvisations, and video-recorded.

The final documentaries also included contextual elements such as voice-over narration (e.g., "The robot was launched two years ago, and a lot has changed since then..."). This established a connection between today's world and a plausible near future.

In total, eight fictional documentaries were produced, each approximately six minutes long. Each depicted a distinct social robot embedded in a specific social context, ranging from public spaces to private households. Examples include SEYNO, a robot fostering respect between passengers in trains; PATO, a robot to watch movies with; and PARFAR, a robot to help couples who argue a lot. Notably, the robots themselves were never shown in the documentaries. Instead, the focus lay on how human actors imagined and described the robot, their experiences, and opinions (see Figure 4 for some video stills). A full overview of the documentaries is available in the original publication of this study (Dörrenbächer et al., 2023).

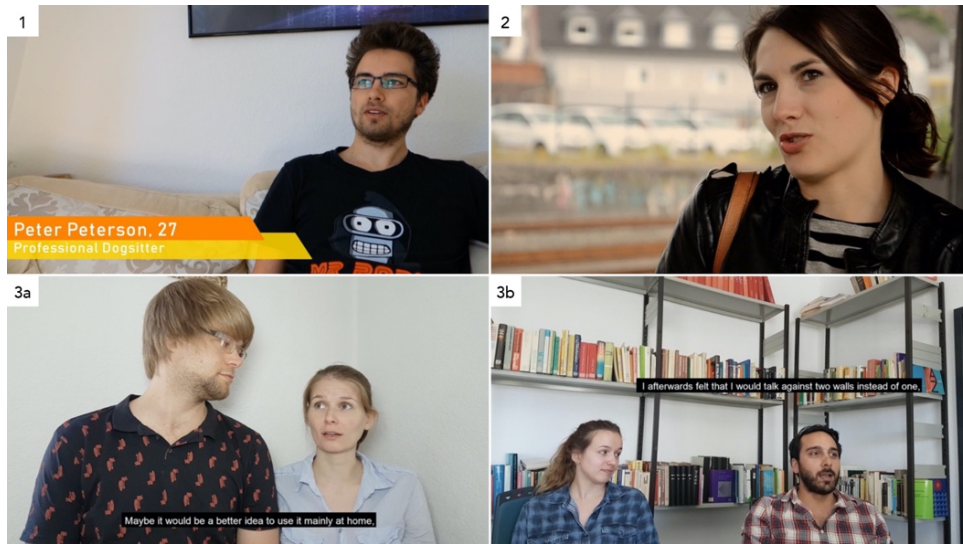


Figure 4: Video stills from three fictional documentaries. Interviewees comment on: (1) PATO, a robot for watching movies with; (2) SEYNO, a robot approaching disturbing behavior in public transportation and ensuring respect between passengers; (3) PARFAR: a robot solving conflicts between lovers.

Step 3: Secondary Analysis

We used these fictional documentaries as data in a secondary analysis. In contrast to Case Study 1, where empirical data were gathered through a dedicated confrontation, our analysis here builds on the fictional reflections already woven into the documentaries themselves. We examined the imagined application scenarios of the robots, as well as the imagined positive and negative experiences reported in the videos. From the positive experiences, we wanted to gain a deeper understanding of what might be meaningful in interactions with social robots and from the negative what to avoid in social robot design. In addition, we focused on the imagined relationship, how it shaped the experience, the perception of the robot, and the person herself- or himself in an intra-active process. As in Case Study 1, we conducted a thematic analysis of the video material to identify patterns across scenarios, roles, and experiences.

Domain Specific Findings

The secondary analysis of the fictional documentaries revealed four types of application scenarios, grouped into two overarching robot roles: substitutive and mediating. Substitutive robots engage in dyadic interactions, replacing a human partner in tasks such as companionship, or debate training. Examples include PATO, and TALKLIKE, a robot that helps users practice argumentation. Mediating robots, by contrast, act as third parties within social dynamics—supporting conflict resolution, or encouraging respectful behavior (e.g., PARFAR, and SEYNO).

Across these scenarios, participants imagined 19 distinct experiences, which we organized into seven recurring themes—two predominantly positive, four negative, and one neutral. Positive experiences centered around feelings of relatedness (e.g., reduced loneliness, improved social connection) and inspiration (e.g., access to new ideas, opportunities for self-reflection). Negative experiences included protest/reactance (e.g., discomfort with judgmental or intrusive robots), social disintegration (e.g., reduced interpersonal skills, reliance on robots), anti-social behavior (e.g., misuse or

provocation of robots), and embarrassment or shame (e.g., intimate information are revealed by the robot). These experiences differed depending on whether the robot were imagined as substitutes or mediators. In dyadic substitution, for example, negative experiences centered on social isolation, dependency, and the discomfort of interacting with a machine that imitates human qualities too closely. In mediation, concerns shifted towards the erosion of social skills and the lack of emotional depth expected in situations requiring empathy or sensitivity.

Importantly, many of these experiences—positive and negative—were tied to how “human-like” the robots were imagined to be. Many of the challenges depend on the idea that the robots are similar to humans and, thus, compete with them. Conversely, the perceived benefits stemmed from imagined characteristics and skills, which humans appreciate, but find challenging or impossible to realize in everyday social interaction. In dyadic substitution, participants highlighted aspects, such as “always being present”, “never forgetting anything”, “being able to change identities”, or “representing people that are not present or that are even already dead”. In group mediation, participants mentioned positive robotic abilities, such as “being objective/neutral”, “concentrating on facts instead of feelings”, “being calm and self-composed”, or “having no sense of shame”. Taken together, the robots’ perceived value arose not from mimicking humans, but from their distinctly machine-like capacities.

Implications for Social Robot Design

The findings point to a shift in how designers might conceptualize social robots. While roboticists frequently assume that mimicking human abilities and behaviors ensures sociality, we would rather suggest that strong anthropomorphism prevents satisfying social experiences with robots in the long run. The fictional documentaries indicate that robots may be socially effective when they offer new kinds of experiences grounded in attributes humans find difficult to embody—such as neutrality, or emotional detachment. These insights mirror the findings from Case Study 1, where participants valued *Kiro* not for its resemblance to humans but for the ways it complemented and extended human social capacities.

Methodological Reflection

This second case study follows a similar overarching structure as Case Study 1 (vision building, world building, and confrontation) yet its methodological character differs across these steps.

Whereas Case Study 1 grounded its fiction in psychological theory and anticipated positive experiences, this study began with a critical examination of existing social robots. By analyzing their roles, functions, and shortcomings, the students developed fictional counter-designs that challenged dominant assumptions and explored alternative forms of social interaction.

In this case study, world building took the form of a performative, co-creative process culminating in fictional documentaries as speculative design artefacts. Methodologically, this aligns with performative speculative methods such as speculative enactments (Elsden, Chatting, et al., 2017; Elsden, Durrant, et al., 2017), experiential scenarios (Candy & Dunagan, 2017), experiencing utopia (Dörrenbächer et al., 2020) or what has been described as multi-stakeholder theater (Ryöppy et al., 2016) or stakeholder drama (Buur & Friis, 2015). By adopting fictional roles, participants responded spontaneously *as if* they had lived experience with the imagined robots presented.

This speculative enactment encouraged participants to explore their own (imagined) feelings, thoughts, and, finally, fictional experiences. Since neither the robot nor the interviewees’ attitudes were pre-defined in detail, there was ample room for developing individual, quite reflective stories. The fact that the participants never got to see a picture of the possible robot—reminiscent of approaches, such as invisible design (Briggs et al., 2012)—gave them freedom to use their own imagination.

Notably, the imaginary worlds became more concrete and defined through interviewing. For example, participants spontaneously imagined functions or the appearance of the robot, e.g.: “*When the robot comes towards me like this – as you know, it staggers so strangely when it does this, ...*”. Participants talked about relationships and experiences, thereby shaping their own fictional characters and the specific robot at the same time. This revealed their own values, as well as feelings and thoughts about the particular robots and the envisioned scenario. Thus, the final documentary can be seen as the result of a critical co-creation through imagination and spontaneous reflection triggered by the initial concept.

In general, participants became emotionally involved while performing. Several times the setting, e.g., in front of a bus stop, made them think of real experiences they had in these places, e.g., being disturbed by a passenger playing loud music. This way, the imaginary accounts were linked to lived experiences and did not remain mere intellectual reflections. This blurred the boundaries between the actual (i.e., their present everyday life, their own identity) and the possible (i.e., a future world, possible identity). In addition, the approach encouraged a focus on changes over time. In their imaginary accounts, participants often explained how their attitudes towards the robots changed from the first contact to getting used to them.

As in Case Study 1, we analyzed participants’ reflections—here embedded *within* the fictional documentaries. This resonates with Lindley and colleagues’ anticipatory ethnography, which treats fictional artefacts as real to derive actionable insights about emerging technologies (Lindley et al., 2014, 2015). Similar to Lindley and Sharma’s analysis of *Her*, we examined the documentaries to surface patterns in imagined experiences, concerns, and expectations.

The analysis revealed how people *currently* feel about the future possibilities of social robotics, surfacing challenges and potential benefits of a not-yet-existing technology. Importantly, the findings echoed those from Case Study 1: the perceived value of social machines tends to emerge when they differ from humans, not when they mimic them. This suggests that both forms of analysis—whether based on *confrontation* (Case Study 1) or *enactment* (this Case)—can yield valuable insights for shaping future forms of otherware.

Strengths and Limitations of the Approach

A core strength of the present approach compared to, for example, mere interviews is the relational view implied by role-play and a focus on everyday experiences. This helps to understand robots as part of broader, evolving socio-technical ecosystem. Unlike most Human-Robot Interaction (HRI) methods, it does not put a focus on the robot itself as a technical product, but on the social dynamics and possible controversies that arise from using a robot in the world.

However, the approach also has limitations. It depends on the imagination, the interest and talent for roleplay, the prior knowledge of the participants, as well as the ideas already embedded in the robots. Since most participants did not have experiences with social robots at all, some of them just reproduced already existing well-known critiques of social robotics instead of actually putting themselves into the suggested scenario. This might also be due to using the word “robot”, which certainly prompts well-known science fiction clichés. In this respect, it might be better to not speak of robots at all, but to use other more open terms, such as, “objects with intent” (Rozendaal et al., 2019). The dependency of the method on the conceptual input and the imagination of the participants themselves reminds us of the fact that speculative methods focus on finding problems rather than solving them. The method hypothesizes rather than confirms challenges and opportunities for social robots.

Summary

The second case study refines the methodological understanding of speculative design in several ways:

- It shows how speculative design can extend beyond diegetic prototypes to examine relational dynamics, social tensions, and broader socio-cultural entanglements within imagined futures.
- It demonstrates that fictional documentaries can function as a credible speculative artefact that support both co-creative worldbuilding and critical reflection. While used here for internal analysis, such artefacts could also serve as catalysts for public debate.
- It shows that reflection can occur *within* the act of speculation itself, rather than being confined to post-hoc discussion or evaluation.
- It highlights the value of strategic invisible design and ambiguity, which foster imaginative engagement and enable diverse interpretations.
- Finally, it shows that speculative design—even when based on imagined experiences—can yield actionable insights that inform the design of future technologies.

Case Study 3: The Future of Robots Needs Imagination – A Robot Design Fiction Workshop

This chapter is based on the following publication:

Ringfort-Felner, R., Neuhaus, R., Dörrenbächer, J., & Hassenzahl, M. (2022). Design Fiction: The Future of Robots Needs Imagination. In J. Dörrenbächer, R. Ringfort-Felner, R. Neuhaus, & M. Hassenzahl (Eds.), *Meaningful Futures with Robots: Designing a New Coexistence* (pp. 114–129). Chapman & Hall/CRC. <https://doi.org/10.1201/9781003287445>

Introduction

The third case study continues the exploration of social robots and their integration into everyday life. It investigates how speculative design can support collective reflection on the long-term societal implications of social robots that are close to market deployment. In contrast to Case Study 2 where students imagined meaningful encounters with entirely fictional robots, this study invited roboticists to speculate on “desirable” and positive futures for their *own* robots. These visions were then explored and critically examined through “future dialogues” involving a range of fictional stakeholders.

Context

The idea of living with robots has long captured the public imagination. In films and series such as *Blade Runner* (Scott, 1982), *I, Robot* (Proyas, 2004), or *Westworld* (Nolan & Joy, 2016), robots are typically portrayed as emotionally complex, hyper-intelligent entities—often destined to rebel against their human creators. Although fictional, such narratives profoundly shape public expectations and anxieties: they influence how we imagine robots, what we hope for, and what we fear.

In contrast to these cinematic portrayals, roboticists are currently developing robots intended to live with us in domestic spaces (e.g., VIVA⁴), assist with shopping (e.g., I-RobEka⁵), support elderly care (e.g., KoBo34⁶), or function as therapeutic tools, for instance in autism therapy (e.g., ERIK⁷). These robots are not speculations—they already exist in laboratories, and trade fairs.

But what will happen when these robots enter the real world? Will people embrace them? Will they ease daily burdens—or create new ones? Will they foster connection, or accelerate social isolation? While roboticists often focus on design specifications, functional affordances, and technical implementation, the far-reaching social, emotional, and ethical implications of their creations remain less systematically addressed.

This case study employs speculative design to support developers in critically reflecting on the futures their robots may shape *before* these technologies enter the real world. The study was conducted within the three-year interdisciplinary research project GINA (High-Quality Interaction Strategies for Service and Assistive Robotics), which investigates the conditions of “good” human–robot interaction. As an accompanying initiative, GINA facilitates dialogue and collaboration among eight research projects funded within the German program *Robots for Assistance Functions*. The present study was conducted in collaboration with four of these projects.

4 <https://www.interaktive-technologien.de/projekte/viva>

5 <https://www.interaktive-technologien.de/projekte/i-robeka>

6 <https://www.interaktive-technologien.de/projekte/kobo34>

7 <https://www.interaktive-technologien.de/projekte/erik>

Method

This case study followed a similar three-step process as the previous cases but again differed in how the individual steps were realized. First, we constructed plausible futures based on the developers' visions of how their robots might be designed and used in the year 2045. Second, we materialized these futures through a set of design fiction artefacts, including scenarios and fictional product flyers. Finally, we conducted a Robot Design Fiction Workshop in which developers, researchers, and laypeople collectively speculated on and discussed these envisioned futures. The following subsections describe each step of this process in detail.

Step 1: Informing the Design

We began by collaborating with the developers of four social robots (VIVA, I-RobEka, ERIK, and KoBo34) to construct speculative scenarios set in the year 2045. For each robot, we conducted a 30-minute interview with one or two members of the development team, typically engineers and, in some cases, designers. The aim was to gain insight into their long-term visions for the robot. We asked questions such as: "What functions might the robot have in 2045?", "What role might it play in people's lives?", and "How might the world around the robot have changed because of it?" All interviews were audio-recorded and subsequently summarized to extract envisioned functions, roles, and anticipated societal developments.

Step 2: Materializing the Future

To materialize the developers' envisioned futures, we created a set of design artefacts for each robot: a short story describing everyday life with the robot (see Figure 5 for an excerpt) and a fictional product flyer outlining its features, capabilities, and societal roles (see Figure 6 for an excerpt). These artefacts served as entry points into four distinct speculative worlds.

We developed the artefacts in collaboration with designers, writers, and the respective robot teams to ensure they were both compelling and faithful to the original visions. At the same time, we intentionally amplified selected aspects of the developers' descriptions to introduce productive friction to prompt reflection. Following the invisible-design approach used in Case Study 2, the robots themselves were never shown. Instead, their functions, roles, and everyday use were conveyed through narrative and contextual description.

Early on a Wednesday morning in 2045. The mall fills with the first customers and robots. Businesspeople pick up their pre-ordered breakfast from robots. Families settle down in the café, enjoying fresh coffee and croissants, while robots run their errands or play with their kids. A jogger is doing his laps in the rooftop garden, while robots do his weekly grocery shopping. Teenagers hang out in the arcade and giggle at the clothing suggestions sent to them by a robot. The mall offers stores to buy everything imaginable, as well as a variety of opportunities for leisure and recreation. Robots are ubiquitous— high-tech assistants, whose sole purpose is to make the shopping experience as pleasant as possible. Do you notice how the robots get to know the visitors, their clothing size, their likes and dislikes better with each visit? How they flawlessly adapt their behavior to their acquired knowledge? Recently, many of the premium shopping malls have started to cooperate and exchange the data collected by their robots...

Figure 5: Excerpt from the short story describing everyday life with the shopping robot I-RobEka. Reproduced from *Meaningful Futures with Robots: Designing a New Coexistence*, 1st ed., J. Dörrenbächer, R. Ringfort-Felner, R. Neuhaus & M. Hassenzahl (eds.), p. 114, © 2023 Chapman & Hall/CRC, by permission of Taylor & Francis Group.

Discover our new version of VIVA, the social robot that offers more harmony and well-being in your everyday life!

Now available in a number of new designs!

Here in the VIVA store on the second floor.



From singles to big families – VIVA makes life more beautiful

As a new member of the family, we immediately take VIVA into our hearts. The social robot takes note of our needs and understands them, thereby getting to know us a little better with each new day. Whether we want to share our thoughts and what we experienced during the day, seek support or motivation, or whether we need an additional member for a game or just need some space – **we simply feel good with VIVA.**

There's the right VIVA for everyone

Everyone is different and tastes differ. That's why **VIVA now comes in a variety of designs** – including a futuristic sci-fi look as well as a fluffy soft cat.

Do you want your VIVA to have a good humor and be quick-witted or more calming and empathetic? Creative and sensitive or feisty and dynamic? **Discover your very own personal companion for a harmonious life right now.**

Our well-being is always the number one priority

Unlike human beings, VIVA doesn't express its own opinions. Judgments phrased as advice or even reproaches are also foreign to it. Instead, the social robot helps us to help ourselves. Thanks to its keen sense of our moods and needs, it reflects these in conversation, asks questions, and thus enables us to create a **greater sense of well-being in our lives on our own.**

VIVA is full of surprises

Like any living creature, VIVA has a mind of its own and requires rest, entertainment, and social contact. VIVA can satisfy these needs on its own if you're not at home or in the mood for interaction, by exploring its home, dancing to its favorite music or chatting with other VIVAs, amongst many other things.



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Figure 6: Fictional product flyer showing future vision for the social robot VIVA (top); Fictional product flyer showing future vision for the shopping robot I-RobEka (bottom).
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Step 3: Exploring the Futures through Critical Dialogue

To explore how life within these speculative worlds might unfold, we conducted a four-hour online robot design fiction workshop. We invited academic researchers, members of the robot development teams, and professional role-players to participate. In total, 20 people took part: twelve researchers from three universities involved in the overarching GINA research project, six developers from the four social robotics projects (including engineers and designers), and two professional role-players.

During the workshop, participants used the design fiction artefacts on a shared Miro board to immerse themselves in the envisioned futures and their respective robots. This involved listening to the scenarios and reading the fictional product flyers. This initial engagement was followed by an open discussion of first impressions.

Subsequently, we asked participants to imagine a variety of fictional characters whose lives might be affected by these robots in 2045. These included, among others, a child, a parent, a janitor, a health-insurance representative, a tech visionary, a politician, a candy maker, a pet, and even the robot itself. In small groups, participants embodied these fictional stakeholders to explore their emotions, opinions, and imagined everyday experiences. Staying in character, they engaged in what we call *future dialogues*: improvised, in-role conversations in which they collectively explored and negotiated life with the robots. For instance, one researcher became a seven-year-old girl who sadly recounted how her brother had stopped playing with her because of the family's social robot. Another took on the role of a therapist reflecting on how robotic companions might either reinforce isolation or enhance social support.

Through this collective imagination and role-play, the workshop surfaced a wide range of critical perspectives and design-relevant questions, such as: How can robots be designed to foster, rather than inhibit, social interaction? Might traits such as conflict avoidance—typically seen as desirable—have unintended consequences for social life? Do we need robots that not only assist but also challenge, provoke, or initiate difficult conversations? Alongside these questions, concrete suggestions also emerged, including training programmers to help people develop competences for interacting with social robots.

Importantly, such themes are rarely addressed in conventional development processes, which often center on the robot itself rather than on the broader social dynamics, frictions, and transformations it might generate. In this sense, the speculative engagement became a valuable opportunity for developers to consider broader questions and possible implications of their robots.

Methodological Reflection

This case study follows a similar three-step process of vision building, world building, and confrontation but again differs in the input who informed the design fiction, the artifacts created and the kind of confrontation.

Unlike the previous studies, which were grounded in psychological theory (Case Study 1) or critique of existing technology (Case Study 2), this case began with developers' own long-term visions of their robots. These visions sit between imagination and reality: they are aspirational and optimistic yet still tied to ongoing technical trajectories and institutional agendas. This provided a starting point that was both plausible and meaningful. At the same time, it positioned developers as co-authors of the speculative worlds. This increased the relevance of the scenarios for them and fostered deeper engagement with the futures under discussion.

As in the previous studies, world building served to materialize these visions. Through short fictional narratives and product flyers, the speculative futures became tangible and easy for participants to imagine and discuss. In this case, we deliberately elaborated on and amplified selected aspects of the developers' visions. This made implicit assumptions and consequences more visible (e.g., what large-scale deployment of these robots might mean for everyday routines or

institutional practices). The amplification remained subtle enough to keep the futures plausible and positive, yet introduced sufficient friction to stimulate discussion. As in Case Study 2, the use of invisible design shifted attention away from the robot's form and toward the broader implications and social dynamics that would accompany its widespread use.

In contrast to Case Study 2, where fictional experiences emerged through performative interviews, this case used future dialogues in which participants deliberately adopted fictional stakeholder roles. Participants argued not as researchers or engineers, but as children, parents, insurers, therapists, or even the robot itself. This enabled participants to decenter their own expertise and explore instead alternative perspectives. Each role introduced a distinct perspective and set of values, enabling conflicting expectations and concerns to surface within a shared speculative discourse. Developers, in particular, engaged with their own technologies from the standpoint of those who might live with them. This allowed them to recognize implications often overlooked in conventional development practices. Obviously, this approach also has limitations. As in Case Study 2, its effectiveness relies on participants' imagination, their role-play abilities, and their willingness to adopt and explore unfamiliar perspectives.

Summary

This case study further expands the methodological understanding of speculative design.

- It demonstrates how design fiction artefacts—such as product flyers and scenario texts—can serve as catalysts for discussion and speculative dialogue.
- It highlights the value of multi-stakeholder perspectives by inviting participants to step into the shoes of imagined users, professionals, or even the technology itself.
- It shows that speculative design can move upstream in the innovation process, enabling reflection before technical decisions become real.

Synthesis of Central Findings

The preceding case studies examined speculative design, particularly design fiction and performative approaches, as a methodological approach for studying otherware in academic HCI contexts. Taken together, these case studies surface shared methodological patterns that provide orientation for structuring and conducting speculative research in HCI.

1. **Grounding Speculation in Theory, Critique, and Practice:** Across all three case studies, speculation was grounded in different forms of input: psychological models and anticipated user experiences (Case Study 1), critical analyses of existing social robots (Case Study 2), and aspirational future visions articulated by robot developers (Case Study 3). Despite their differences, each grounding strategy provided a productive foundation for developing speculative scenarios that were imaginative yet plausible and potentially meaningful.
2. **Materializing Futures through World Building:** Across all three case studies, abstract imaginaries were materialized through different artefacts: a fictional product website (Case Study 1), fictional documentaries with in-role interviews (Case Study 2), and scenario texts and fictional product flyers (Case Study 3). These artefacts constructed plausible and coherent fictional worlds that participants could imagine, inhabit, and reflect upon. Ambiguity and invisible design functioned as productive strategies, inviting interpretation and allowing participants to project their own meanings, expectations, and concerns onto the speculative worlds.
3. **Engaging Participants as Co-Speculators:** Across all three case studies, speculative futures were shaped not only by the researchers but through the active involvement of different participant groups. Rather than positioning participants as passive recipients of designer-authored visions, the studies engaged them as active co-creators of speculation: participants contributed anticipated everyday experiences through an online survey (Case Study 1), co-produced fictional documentaries through role-play-based interviews (Case Study 2), and articulated and extended visions of future lives with social robots through interviews (Case Study 3). This participatory engagement expanded speculation beyond the designers' perspectives and allowed the speculative worlds to be shaped by participants' own assumptions, imaginaries, and lived experiences.
4. **Empirical Engagement with Speculation:** Rather than treating speculative artefacts as the endpoint of design or mere thought experiments, all three studies used them as starting points for empirical engagement. Case Study 1 collected reactions through focus groups and online channels, Case Study 2 analyzed fictional documentaries as qualitative data, and Case Study 3 generated empirical material through a robot design fiction workshop. While not all approaches amounted to empirical investigation in a narrow sense, each demonstrates how speculative artefacts can be systematically engaged with to surface aspirations, tensions, and design-relevant considerations related to emerging technologies.
5. **Speculation as Critical and Constructive:** Collectively, the case studies exemplify a constructive approach toward speculative design. Instead of foregrounding dystopian or cautionary futures, they developed positive and meaningful imaginaries. These imaginaries did not prescribe ideal solutions; rather, they created discursive spaces in which participants could negotiate what might be considered desirable, for whom, and why.
6. **A Three-Part Process for Speculative Design in Research:** Across the case studies, speculative inquiry followed a recurring three-part process comprising three interrelated phases: (1) informing the design, (2) (co-)creating fictional worlds, and (3) empirical investigation. This process was shaped both by our research objective of exploring meaningful futures with otherware and by established speculative design methods and conventions.

The next phase of this dissertation examines how speculative design, structured through the preceding methodological insights, unfolds under real-world organizational constraints shaped by business objectives and institutional structures.

PHASE 2: EXPANSION OF INSIGHTS INTO CORPORATE RESEARCH

The first phase of this thesis examined speculative design in academic contexts. The second phase shifts focus to a different context: corporate research. This phase specifically addresses RQ2 (Applicability and Scaling) by examining how speculative design unfolds under real-world organizational conditions.

Case Study 4: Design Fiction in a Corporate Setting

This chapter is based on the following publication:

Ringfort-Felner, R., Neuhaus, R., Dörrenbächer, J., Großkopp, S., Theofanou-Fülbier, D., & Hassenzahl, M. (2023). Design Fiction in a Corporate Setting – a Case Study. *Proceedings of the 2023 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 2093–2108. <https://doi.org/10.1145/3563657.3596126>

Introduction

The fourth case study is based on an 18-month collaboration between the University of Siegen and a major German automotive company. While the collaboration aimed to explore future perspectives on self-driving cars and in-car activities through design fiction, we used the collaboration as an opportunity to examine how business objectives and institutional structures reshape speculative design as a research practice. Over the course of the collaboration, we informed speculations through a kickoff workshop and stakeholder interviews. We developed stories about a future with self-driving cars through story writing and enactments, materialized them through 24 artifacts (e.g., city map, quick start guides), and engaged laypeople in reflecting on them. We analyzed what worked well, which challenges emerged, and how organizational structures and business objectives shaped our speculative practice. In doing so, the study refines the methodological understanding of speculative design by clarifying its potentials, constraints, and requirements in a corporate context.

Context

Although (or because) speculative design usually de-emphasizes the development of market-ready products, speculative approaches hold new potential for businesses. They allow companies to explore alternatives to their current approaches and to reflect on the societal and individual implications of future products and services (Aguesse & Decreton, 2022; Bleecker et al., 2022; Božanić & Bertalaníč, 2019; Girardin, 2020; Mitrović et al., 2021). As Le Guin claimed: “If we don’t think about alternatives, we’re stuck with what we’re doing now” (Mitrović et al., 2021, p. 17).

To date, however, corporate decision-makers largely treat the future as a matter of business opportunities and product innovation (Near Future Laboratory, 2026). They often neglect the far-reaching societal consequences of their products or services (Lam & Lim, 2016). In contrast, advocates of speculative design call for “a revolution, a shift away from market-driven imperatives, and the constraints that these impose, towards more responsible approaches” (Božanić & Bertalaníč, 2019). Speculative approaches are thus one way for companies to take responsibility for the societal and individual consequences of their future products and services (Božanić & Bertalaníč, 2019; Girardin, 2020; Mitrović et al., 2009; Near Future Laboratory, 2026).

While it appears that a wide range of companies and organizations are already using speculative approaches to examine future products or services (e.g., Google, Greenpeace, IKEA, Apple; Mitrović et al., 2009), little is known about what companies define as design fiction or how they practice it. Only a few studies (Brown et al., 2016; Google Design, 2020; Wu et al., 2019) document concrete industrial applications, describing not only the value of speculative design

approaches to the industry but also the processes used and the challenges encountered. These accounts suggest that speculative practices can be difficult to integrate into business contexts and risk being perceived as irrelevant or indulgent if they clash with organizational expectations and norms.

Building on this work, the present case study investigates: (1) how the corporate context reshapes academic speculative design practice, and (2) how speculative design can function as a tool for speculation and futuring in a technology- and product-centered corporate context.

Method and Procedure

This case study followed the three-part research process introduced in Phase 1. While the overall structure remained consistent, each phase unfolded in context-specific ways shaped by the organizational objectives and conditions of the collaboration (see Figure 7 for an overview). First, we informed the creation of the speculations through a kick-off workshop with industry participants and interviews with 16 laypeople on positive in-car practices. Second, we created a fictional world through enactments and story writing, complemented by interviews with laypeople about imagined possible experiences within that world. We then materialized the world through 24 diegetic prototypes. Third, we asked ten laypeople to engage with the fictional world through probes and focus groups to surface positive as well as negative issues around the imagined future. We concluded by presenting the results to all project participants. In total, six design researchers, six employees from the automotive company, and 29 laypeople were involved in the process (see Appendix, Tables A1 and A2).

Throughout the project, we collected a comprehensive set of data (e.g., files and documents from the process, recordings and notes from meetings and workshops, and results of the different steps). In addition, we conducted three follow-up interviews (with two industry and one academic participant) upon project completion to reflect on the process and outcomes. These interviews were semi-structured (approx. 60 minutes each), audio recorded with consent, transcribed, and analyzed using thematic analysis (Blandford et al., 2016).

In the following, I present each step of the process in detail.

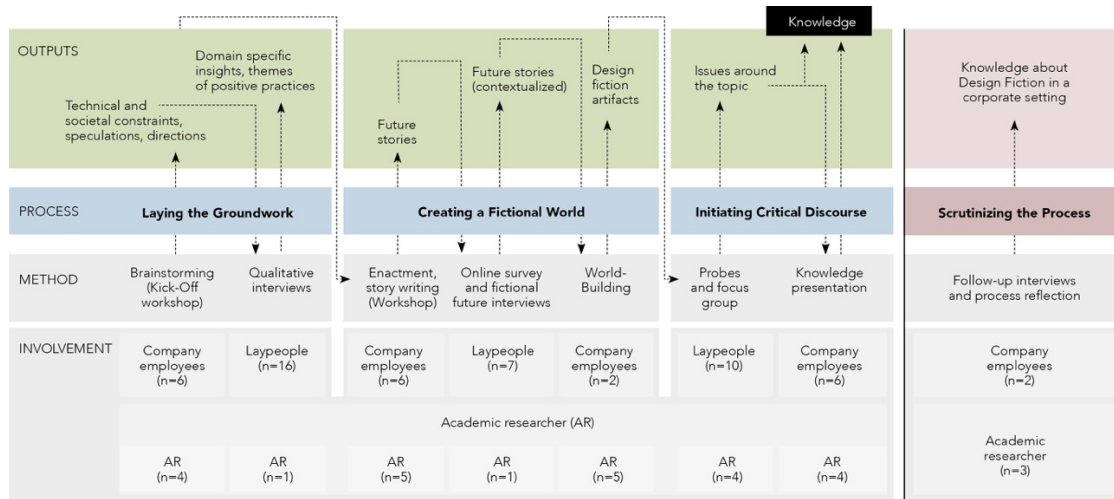


Figure 7: Overview of the 18-month research process.

Step 1: Laying the Groundwork

We began with a one-day kick-off workshop involving academic researchers and industry participants to establish a shared understanding of speculative design and align expectations. We introduced design fiction as world building, presented examples from prior work, and outlined the planned three-part process. As we aimed to create a valuable design fiction for the company, we discussed which goals, processes, and results would be valuable for them. Subsequently, we speculated on technical aspects (e.g., how intelligent is the vehicle in the future?) and on environments and contexts (e.g., which values people hold in the future?) based on megatrends. This followed an ecological approach to speculative design (Auger, 2013) and resulted in a set of guiding directions for the fictional world.

In addition, we conducted 16 interviews with laypeople to collect positive practices while driving as further inspiration (i.e., practices that have the potential to enhance human well-being; Klapperich et al., 2018a).

Step 2: (Co-)Creating a Fictional World

Based on the kick-off workshop, the goal of the next step was to create a positive future in which self-driving cars and related products address broader societal challenges (e.g., lack of space, psychological illnesses in society). Thereby, concrete ideas should emerge on how people spend their newly gained time in cars (i.e., products or services).

Creating concepts and future stories through enactments and story writing. We started with a two-day workshop with academic researchers and industry participants to generate speculative concepts and narratives. Initially, we presented the results of the previous step (e.g., positive practices, environments and contexts). Afterwards, all participants “traveled” to an imaginary world of 2035 through enactments. Working in parallel groups, participants explored future driving and what people could do while being driven (see Figure 8). On the second day, participants wrote short fictional stories about the near future of self-driving cars. Each story was required to depict a possible world and society in 2035, elucidating the role of self-driving cars in it, and how people might spend their time in cars. The story writing resulted in fifteen different stories, summarizing aspects of interest from all participants.

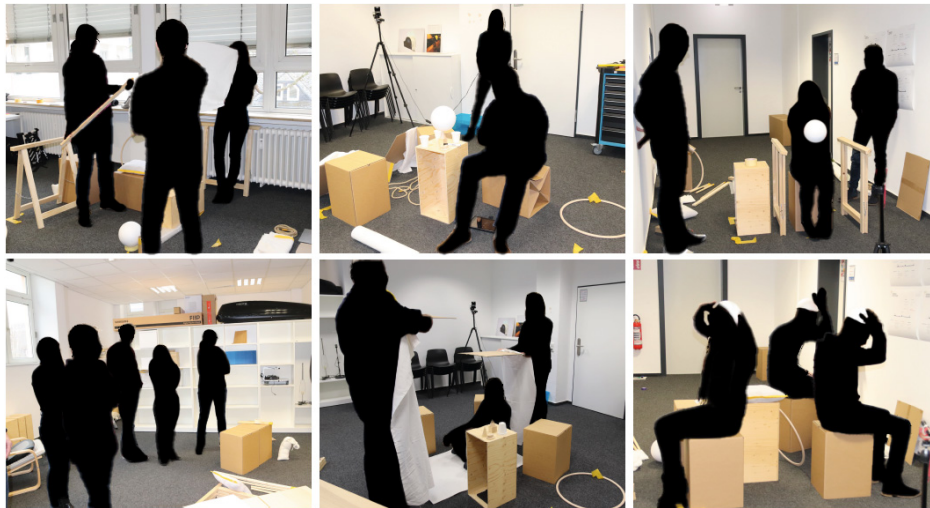


Figure 8: Excerpts of the enactments and discussions.

Selecting stories. After the workshop, we consolidated all written stories and discussions into 21 design fiction stories. Academic and industry participants first reviewed the stories individually before we discussed and selected them collectively. This was a strategic choice to find industry-relevant yet challenging and speculative stories that would provide new insights into the future of self-driving cars. In the joint discussion, we selected nine design fiction stories (some of which were more speculative than others). We consolidated these into one story about the near future of self-driving cars, incorporating different products/services that resonate with the society's values and norms.

Laypeople imagine the everyday mundane in the fictional world. To further develop the fictional world, we invited seven laypeople to imagine and reflect on their fictional everyday life within it. We first used an online survey to immerse participants in the fiction by describing the world and its products, following the approach used in Case Study 1. Imagination-enhancing prompts (e.g., "Which experiences do you remember most?") supported participants in developing situated and experiential accounts of everyday life in the fictional world. Subsequently, we asked the participants to rate the products (i.e., which product had the strongest impact, which is most desirable, and which is least desirable). Such questions were used in previous work to figure out which scenario visitors of an exhibition consider possible and desirable (Jenkins et al., 2020). In our case, however, we undertook a stronger product focus to assess whether the participants considered their perceptions of the products desirable. To deepen these insights, we conducted follow-up interviews with each participant, focusing on their fictional life, product use, experiences, thoughts, and feelings. The interviewer adopted the role of a journalist and framed the interviews within the fictional context, asking questions such as "How has your everyday life changed since you started using these products?". While methodologically similar to the in-role interviews used in Case Study 2, this step was more explicitly oriented toward product-related insights, reflecting the needs and expectations of the corporate context.

Building the fictional world through a range of diegetic prototypes. To materialize the fictional world, we created 24 diegetic prototypes, including quick-start guides, brochures, maps, posters, legal texts, street signs, and blog posts (see Figure 9). These artefacts illustrated how everyday life in 2035 differs from the present and were inspired by prior design fictions, such as the quick start guide for a self-driving car (Near Future Laboratory, 2015) or the Geneva city map (Near Future Laboratory, 2019). To provide coherent access to the fictional world, we assembled all artefacts into a fictional website⁸. Throughout this process, we collaborated closely with the industry partners, discussing narrative perspective, intended audiences (e.g., laypeople, experts, policymakers), and suitable modes of engagement.

⁸ The website is confidential and not publicly accessible.



Figure 9: A section of the diegetic prototypes created⁹.

Step 3. Initiating Critical Discourse and Final Presentation

In the final step, we confronted ten laypeople with the fictional world to spark discussions about the potential and challenges the created future might hold. In this case, we used a combination of probes and focus groups to capture both individual reactions and group-based dynamics. We promoted the study as a good opportunity for laypeople to talk about and discuss the topic of self-driving cars. As in Case Study 1, we left open whether the story about self-driving cars is real or fictional and debriefed participants in the end¹⁰.

In the first part of the confrontation, each participant received selected artifacts (quick start guides, brochure, map, access to the website) in a box sent to their home address. Participants documented their initial reactions using short videos and reflection sheets, which included general assessments of the mobility and world presented (14 semantic differential pairs, e.g., enjoyable–unpleasant, conventional–novel) as well as evaluations of individual products (e.g., most impactful, most desirable, least desirable). Thus, we again combined speculative design with evaluation methods known from affirmative design.

Second, we held two online focus groups, similar to Case Study 1, each with five participants¹¹. After introducing the fictional world via the website, participants discussed their impressions and potential implications for their everyday lives. We complemented these discussions with six questions about the desirability of the world and products presented (e.g., “On a scale of 0-10, how much would you like to have the mobility concept in your everyday life?”, “If you could freely choose one product when buying a car, which would it be?”). Thus, we initiated a critical discourse while obtaining concrete feedback on the products from potential customers.

⁹ Some texts in the image are covered or removed to maintain confidentiality.

¹⁰ The study was ethically reviewed and approved by the university's and company's ethics board.

¹¹ Due to the covid-19 pandemic, the focus groups had to take place fully remote.

Finally, we presented the entire process, the design fiction, and the insights gained to all project participants and some other company employees.

Findings and Reflection

While this case followed the three-part process and speculative practice from Phase 1, the corporate context shaped how methods were used, which futures were explored, and what kinds of insights emerged. The following section analyzes how this context reshaped each phase and clarifies the methodological potentials and challenges of speculative design in corporate research contexts.

Step 1: Laying the Groundwork

We found the kick-off workshop to be essential for aligning the perspectives and expectations of academic researchers and industry participants. During the workshop, industry participants emphasized their interest in generating new ideas for how people might spend their time in future self-driving cars and in confronting potential customers with design fictions to evaluate desirability and market potential. This resembles affirmative rather than speculative design. In contrast, we as academic researchers emphasized the value of design fiction to explore alternative ideas beyond marketability and to examine the broader societal implications of imagined products and services. To reconcile these perspectives, we highlighted the possibility of combining the company's product-centered objectives with the broader potentials of speculative design. This did not mean abandoning the product focus, but rather situating products and related interactions within a wider socio-technical context. Through this alignment, we established a shared goal: to create a positive future in which mobility and related products have a positive impact on pollution, lack of space, efficiency pressures, and psychological illnesses in society. In this way, combining our partner's objectives with the possibilities of design fiction made the approach valuable for them.

Step 2: Creating a Fictional World

With shared ground established, the collaboration shifted from negotiating goals to co-creating speculations.

Through *enactments and story writing*, participants explored a wide range of scenarios, ranging from probable and serious to improbable and even humorous (e.g., a machine that empties the human brain of work overload). While the overarching focus remained on future in-car activities, participants were encouraged to situate their ideas within broader societal contexts and to anticipate possible consequences.

One group, for example, enacted a shared ride scenario in which passengers sat face-to-face—a configuration frequently portrayed in future mobility concepts. The resulting experience of “forced” communication quickly felt uncomfortable and sparked critical discussions about the role of shared mobility in shaping social interaction among strangers. Although industry participants initially expressed interest in novel in-car activities, it turned out that it was less the ideas that emerged, but above all, the discussions, the tensions revealed, and the anticipated consequences that the industry participants appreciated. This continued in the story-writing phase, where participants, for instance, developed fictional narratives about rising societal stress levels and their repercussions for mobility. Compared to stories centered on concrete user-car interactions, such narratives prompted deeper discussion and reflection on the possible roles' mobility technologies might assume within future everyday life.

As the process moved toward *story selection*, differences in preferences became apparent. Industry participants preferred stories to drive business growth based on criteria such as degree of innovation, alignment with corporate goals, and brand focus. We, in contrast, preferred more critical and provocative stories that challenged common assumptions

about future mobility. This exemplifies the differing objectives of business and speculative design. Whereas profit-oriented companies seek offerings that are positively received by customers and competitive in the marketplace, speculative design aims to explore more unconventional and challenging ideas in order to generate insight. The discussion resulted in a balanced story set: some with clear market relevance, others retained for their capacity to challenge common assumptions about self-driving cars.

To further develop the fictional world, we conducted follow-up “*future interviews*” with laypeople. They imagined how they might use the fictional products, reflected on possible consequences, and evaluated the products based on their imagined experiences (e.g., “for me, it was extra work, which I didn’t enjoy”; “It was very satisfying to be able to support other people in such a simple way”). We found that industry participants valued these interviews, particularly for gaining inspiration, opening the field, and creating new insights and perspectives. At the same time, however, we observed that industry participants interpreted participants’ reflections as forms of customer feedback, suggesting concrete product preferences. From a speculative research perspective, however, these accounts primarily indicate whether participants considered their *imaginings* of the products and use desirable. Usually, in a corporate context, interviews are conducted about real product use, yielding valid and generalized results. Creating fictional data in a corporate setting can thus be misleading. This highlights how important it is to clearly communicate the origin and purpose of gathered data.

Finally, *world building* through diegetic prototypes proved valuable for both academic and industry participants. It encouraged us to thoughtfully consider a possible future in detail and to tell a future in a believable way. However, the corporate context shaped how the world was created and presented. For instance, we introduced a fictional company to avoid brand bias, where audience perceptions might be influenced by existing attitudes toward the real company. Additionally, we used controlled focus groups rather than broader public engagement (as in Case Study 1 with social media) to address confidentiality concerns around potential innovations. These adaptations illustrate how speculative design might be reshaped when applied in corporate settings to inform innovation.

Step 3. Initiating Critical Discourse and Final Presentation

The industry participants were very interested in how the imaginary products were perceived by laypeople and whether potential customers accepted and desired them. The discussions of the participants and their assessment provided corresponding insights. However, we again found that these assessments can be misleading. The products rated as most desirable were not necessarily those that revealed the greatest potential for well-being or social change. Additionally, we found that earlier decisions shaped the insights generated. Product ideas we selected earlier in the process based on their potential for market success were rated most desirable by laypeople (e.g., “This is exactly what I need”). However, these ideas rarely provoked discussions about potential problems, opportunities, or consequences for society related to this product. In contrast, more provocative concepts sparked broader controversial discussions, thereby allowing more nuanced insights into possible opportunities, challenges, and consequences the idea embodies.

The final presentation further revealed a core challenge: translating the complex, multidimensional insights generated through the process into actionable knowledge for product development. Rather than offering clear answers, the process revealed diverse perspectives, controversial opinions, and critical reflections on practices and potential products. While the presentation provided a nuanced understanding of the near future of self-driving cars envisioned and related reactions of laypeople, further internal work was required to derive concrete implications for product development. Nonetheless, industry participants valued the approach for broadening their perspective on societal context, challenging assumptions, and incorporating social and ethical considerations into early-stage innovation. These

reflect core values of speculative design. Yet concerns remained regarding data representativeness, the time and effort required, and the ambiguity of the results.

Discussion

In the present case study, we methodologically bridge the potential tensions between corporate needs and the academic understanding of what speculative design could or should be. As a result, we created and investigated a positive near future of self-driving cars through potential “product ideas” and “innovations,” but placed in a broader societal context. We created both “likely” as well as more provocative innovations, and confronted laypeople with them to learn more about the potentials, challenges, and desirability of embedding particular technologies into daily life. Our findings show that our corporate partners were interested in the speculative methods we applied, the emerging discussions, areas of tension revealed, and related future questions. However, we also found that it is challenging to balance certain objectives of speculative design and business, such as creating marketable innovations that are widely accepted by an audience but at the same time reveal insights into possible long-term consequences through (controversial) discussions.

In the following, I reflect on the process we applied and discuss potential, challenges, and methodological strategies for applying speculative design in corporate contexts based on our findings.

Design Fiction in-between the Speculative and Affirmative in a Product-Centered Corporate Context

With its roots in art and design, speculative design and design fiction operate outside the corporate context and business-related goals. Indeed, these approaches take pride in removing “the constraints from the commercial sector that define normative design processes” (Auger, 2013, p. 11). They see value in free exploration beyond the limits of reality (Dunne & Raby, 2013). So instead of making a self-driving car the subject, academic speculative design would certainly be more open, framing the boundaries rather vaguely in terms of “mobility” or “autonomous system.” For the corporate setting, we adopted a stronger product-centricity (i.e., cars) to justify both the process and its outcomes through concrete innovations for cars.

Consequently, our approach is not easily placed in Dunne and Raby’s suggested juxtaposition of speculative design versus affirmative design. It operated in between both approaches, combining elements of affirmation and speculation. In terms of speculative design, we employed design to ask questions, spark discussions, and explore broader social and ethical implications of self-driving cars. In terms of affirmative design, we created quite particular innovations, used design to inform potential acceptance and hence production. This confirms previous findings about the use of speculative design in a corporate context (Wong & Khovanskaya, 2018). Specifically, Wong and Khovanskaya wrote that: “the distinction between ‘speculative’ and ‘practical’ design is riddled with situational complexities that make it hard to say that speculative is the opposite of practical” (Wong & Khovanskaya, 2018, p. 184).

While speculation was considered valuable by our partners, we believe this only worked well especially *because* we couched it in an overall more focused product-centered approach. This resembles the strategy of Wu et al. (2019) used in the marine industry. They designed their process around the two goals of sparking discussion around ethical issues and solution-oriented ideation. To them, this was “a strategic choice that reflects the dynamic relation between [their] positional stance and the primary goal of the industrial context” (Wu et al., 2019, p. 11). We also “toned down” criticality (Wu et al., 2019) by speculating on a positive future with self-driving cars. This helped to overcome difficulties large organizations have in dealing with criticism.

The Specific Value of Speculative Design for Product-Centered Companies

While we believe that it is important to incorporate business objectives into speculative work in a corporate setting, we also found that related elements (e.g., potential future product innovations) were not the most valuable outcomes, not even for the company itself. While in our case, the key objective was to generate ideas for potential innovations, we found that industry participants (i.e., our collaborators) ultimately valued the resulting discussions and emerging topics rather than the product ideas themselves. In this sense, speculative design proved to be a powerful tool for shifting attention from individual products to the broader sociotechnical context, offering the company a means to anticipate critical or beneficial interdependencies at an early stage of development, without the need for fully functional prototypes. Conscious use of this knowledge can inform future product ideation and, if appropriately integrated into design, accentuate aspirations that yield positive effects on both individuals and the environment.

Finding the Balance Between Affirmation and Critical Speculation: Challenges and Strategies

While aligning business goals with speculative design proved important in this project, it also brought a number of methodological challenges to the fore:

(1) Affirmation and Provocation. Consistent with prior work (e.g., Auger, 2013; Bleecker et al., 2022), this case underlines the importance of provocation. It is a key factor in eliciting audience engagement and deeper contemplation on a subject (Auger, 2013). For this, designers sometimes even depict repulsive futures (e.g., Burton, 2006). This contradicts the goal of creating innovations accepted and desired by potential customers. In terms of an affirmative process, prototypes are meant to be confirmed or not; in terms of speculation, they need to create resonance. Of course, ideas don't have to be extremely provocative or "repulsive" to resonate (see also Case Study 1). However, as James Auger puts it: "If a design proposal is too familiar it is easily assimilated into the normative progression of products and would pass unnoticed" (Auger, 2013, p. 14). Thus, if "innovations" are meant to reveal broader issues, they must create resonance, a kind of friction to counteract easy assimilation. Our case suggests that internal discussions among the core team can already be a good predictor for resonance, since the ideas that generated internal discussion were those that also sparked discussion with laypeople.

(2) Confidentiality and Public Discourse. Speculative design increasingly emphasizes the involvement of diverse stakeholders to surface multiple perspectives (Bleecker et al., 2022). Public discussions (e.g., through social media, exhibitions, or open forums) can elicit such a wide range of perspectives (Jenkins et al., 2020; Ringfort-Felner et al., 2022); see also Case Study 1. Yet, in corporate contexts, confidentiality around potential innovations limits these opportunities. Public engagement risks exposing intellectual property and is often restricted by internal regulations. Critical futures studies often criticize that companies rarely consider the values and interests of other stakeholders besides customers (Barbrook, 2007; Son, 2015). To counter this, appropriate strategies are needed to enable broader discussions despite confidentiality. Controlled confrontational settings—such as focus groups or internal workshops—can provide critical exchange while maintaining confidentiality. Moreover, public discussions might be more accessible when companies use speculative design to "discover" rather than to develop marketable products.

(3) Answers and Questions. Speculative design rarely produces clear answers. Instead, it generates questions, tensions, and multiple—sometimes contradictory—perspectives. This is quite different from the idea of affirmative processes. They are structured, solution-oriented, and often use evaluations to get "representative data" to help inform decisions. In our case, we touched upon affirmation by, for instance, asking laypeople to rate the desirability and acceptance of the fictional products. Of course, ratings indicate whether an audience finds a future product plausible, acceptable, or desirable. However, to make well-informed decisions, it is important to consider this information in the

context of all emerging discussions and from different perspectives (e.g., the potential to create well-being). Once we focused on the ratings themselves, we tended to neglect ideas with a potential to generate well-being or affect change. Echoing prior work (Bleecker et al., 2022), we think that speculative design requires time and iterative reflection to consider implications or strategies based on the different perspectives and opinions that have emerged. For companies, this means shifting expectations: speculative design does not yield ready-made answers but can guide long-term strategy, surface blind spots, and open up alternative trajectories for innovation.

Recommendations

Based on these findings, this study exposes two implications for applying speculative design within corporate research contexts.

First, the intended objectives with which speculative design is applied are crucial. They shape the form of speculative design, as well as which and how an audience can be involved. An objective can be to discover broader issues, assuming that what is created will never appear on the market, or to investigate possible and concrete future products and innovations. The former requires more provocation to create resonance; the latter relies on the incremental to maximize acceptance. In corporate settings, a deliberate combination of both may be methodologically productive: conservative concepts can function as entry points for organizational acceptance, while more provocative ideas can reveal tensions, long-term consequences, and overlooked societal implications. The objective of speculation should therefore be articulated explicitly, as it structures both the process and the interpretation of results.

Second, the corporate context exposes the need for clearer quality criteria. Speculative design remains an open and loosely defined approach, with no formalized procedures and no consolidated agreement on what constitutes “good” speculation (Baumer et al., 2020). In our case, this openness made the approach easy to adapt, but also harder to explain, justify, and gain acceptance for. Key qualities essential for knowledge generation such as provocation could easily be dismissed. At the same time, speculative design often uses the same techniques and tools as affirmative design (e.g., product catalogs). While this makes it particularly appealing for the corporate context, it also increases the risk of being misinterpreted or co-opted. To ensure that speculation does not become just another product design and evaluation method and thereby lose its specific value to business, we consider quality criteria for speculative design inevitable. Clearer criteria can safeguard the balance between affirmation and critical exploration while supporting the effective use of speculative design across both academic and corporate research contexts.

Limitations and Further Research

While this case offers important methodological insights into the application of speculative design in a corporate context, several limitations must be acknowledged.

First, our findings are shaped by the company’s location (Germany), its industry (automotive), and its specific organizational culture. Differences across industries, companies, or even individual departments can substantially influence how easily speculative design can be integrated. Moreover, mobility and transportation are an integral part of everyday life, and the according infrastructure is often taken for granted and appears unchangeable. Imagining more radical changes may be easier in domains with fewer infrastructural constraints. Future work is needed to understand how our experiences with the application of speculation in industry relate to other cultural contexts or domains.

Second, although we collaborated closely with company employees, not all relevant stakeholders within the company were involved. Engaging more stakeholders within the company can improve the understanding and acceptance of the particular type of knowledge speculation creates. In addition, no direct interaction took place between laypeople and

company stakeholders due to ethical concerns. An increased exchange between industrial participants and laypeople could have been valuable for the industrial participants to gain a deeper understanding of the process and our findings. In the present case, the academic researchers alone “translated” the outcomes of the work with laypeople into insights for the company and their business.

Third, laypeople were limited to the primary target group of the company (i.e., potential customers). In the future, it would be worthwhile to involve other stakeholders (e.g., politicians, urban planners) in such processes to incorporate broader perspectives and values.

Finally, the case does not fully reflect typical business operations, which often unfold under significantly shorter timeframes and stronger commercial pressures. Nonetheless, it provides a detailed investigation of speculative design—its application, potentials, and challenges—under real-world organizational constraints. Most importantly, it highlights a central methodological issue: the epistemic value of speculation depends on its quality, yet criteria for assessing such quality remain insufficiently articulated.

PHASE 3: SYSTEMATIC INVESTIGATION OF THE “QUALITY” OF SPECULATIVE DESIGN

The previous case studies (Phases 1 and 2) demonstrated the potential of speculative design to critically interrogate the not-yet. At the same time, they underscored that the methodological openness that enables speculative design to remain exploratory and generative can create challenges for its application, acceptance, and evaluation. Case Study 4, in particular, revealed that the epistemic value of a speculation depends on its quality, yet what constitutes such quality remains insufficiently defined.

Phase 3 addresses this gap by systematically examining the qualities that characterize successful speculations in HCI. It marks a shift from research *through* to research *into* speculative design and forms a central contribution to the dissertation’s third research question on standards and quality criteria for speculative design.

Study 5: The Quality of Speculation – A Scoping Review

This chapter is based on the following publication:

Ringfort-Felner, R., Dörrenbächer, J., & Hassenzahl, M. (2025). The Quality of Speculation – A Scoping Review. *Proceedings of the 2025 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 2373–2394. <https://doi.org/10.1145/3715336.3735794>

Introduction

Study 5 examines what defines a “good” speculation in HCI by synthesizing the widely scattered qualities, dimensions, and attributes that scholars associate with successful speculations. It does so through a systematic scoping review of 63 theoretical and methodological publications on speculative design, design fiction, and critical design. Based on this review, the study identifies nine recurring qualities, which are organized into three overarching categories: speculative, discursive, and process. Together, these qualities form a descriptive taxonomy that provides a starting point for creating and evaluating high-quality speculative designs.

Method

For the scoping review, we applied the dedicated extension of PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses, Scoping Review) (Tricco et al., 2018) to ensure its quality. The review was guided by two research questions: (1) What characterizes “good” speculations in HCI? and (2) What contributes to a speculation’s success? To address these questions, we focused on theoretical and methodological contributions to speculative design, that explicitly reflect on its underlying principles, concepts, and processes (Lindley, 2015). Such works generate knowledge about the practice by analyzing relevant cases (e.g., S. Bardzell et al., 2012; DiSalvo, 2012) or exemplary “good” speculations (e.g., Ferri et al., 2014). By synthesizing insights across these contributions, we aim to identify well-grounded, valid and transferable quality criteria for speculative design.

Source Database and Search Strategy

We used the ACM Digital Library (DL) as the main database for its extensive collection of HCI-relevant publications, including key venues such as CHI, DIS, NordiCHI, and GROUP, which are recognized for publishing speculative design work. We conducted an initial search of the most prominent strands and commonly referenced terms in HCI, “Speculative Design”, “Design Fiction”, and “Critical Design” (Kozubaev et al., 2020; Pierce, 2021). We searched for these terms in the title, abstract, or keywords. The concrete search query was as follows:

Title:("Speculative Design" OR "Design Fiction" OR "Critical Design") OR Keyword:("Speculative Design" OR "Design Fiction" OR "Critical Design") OR Abstract:("Speculative Design" OR "Design Fiction" OR "Critical Design")

The search yielded 869 records, from 1956 to November 18, 2024.

Screening and Selection

Initial screening. We screened the title and abstract of all 869 records to determine whether a paper contributes to theory or method of speculative design and is relevant to our research questions. To decide between inclusion and exclusion, we used the criteria listed in Table 3.

Table 3: Inclusion and exclusion criteria.

Code	Inclusion criteria
IC1	The work is about speculative design, design fiction, critical design or related approaches, such as speculative enactments or material speculation.
IC2	The work contributes methodologically or theoretically to speculative design, design fiction, critical design, or related approaches.
IC3	The work is academic.
Code	Exclusion criteria
EC1	The work is not about speculative design, design fiction, critical design, or related approaches.
EC2	The work is about methods, approaches, or concepts that intersect with speculative design, design fiction, or critical design (e.g., design sketches, design stories, absurd design) but does not explicitly address these approaches as its primary focus.
EC3	The work itself is a speculative concept, a design fiction, a critical design, or it presents one.
EC4	The work uses speculative design, design fiction, critical design or any another form of speculation to investigate a particular topic (e.g., nature-robot interaction, smart cities, bullying) and related research questions.
EC5	The work is a book, studio or workshop proposal, demo, poster, video showcase, forum, or similar.
EC6	The work is a duplicate of another entry.

Based on these criteria, we included 79 papers and excluded 790. Among the excluded papers, 251 used speculative design to explore specific topics (e.g., the future post-COVID; Troiano et al., 2021) but did not offer theoretical or methodological recommendations on speculative design (EC4). Another 87 focused on or provided insights into methods or concepts related to speculative design (e.g., design sketches, forecasting) but were not explicitly about speculative design (EC2). Additionally, 82 represented speculations themselves without a theoretical or methodological contribution (EC3), 239 were unrelated in content (EC1), 125 were workshop proposals or similar (EC5), and six were duplicates (EC6).

Expanded corpus. To broaden the corpus, we conducted a citation-based search. We used Python and the Semantic Scholar Academic Graph (S2AG) for retrieval and sorting the references by number of citations. Subsequently, we screened all records with three or more citations (n=241) based on title, abstract, and keywords. We set a threshold of three to limit our search to the most relevant publications in this domain. From the 241 papers reviewed, we added 15 to our corpus. We excluded 226 records for the following reasons: 85 were duplicates of already included or excluded papers (EC6); 77 focused on other approaches or concepts (EC2); 44 were not about speculative design (EC1); 16 were non-research articles (EC5); and four used speculative design to investigate specific topics (EC4). Please note that some reports added via citation search are not in the ACM Digital Library.

Full-text screening. We proceeded with full-text screening of the 94 included publications from our initial and citation search, applying the same inclusion and exclusion criteria. During this phase, we excluded 31 papers with no

substantial methodological contribution to speculative design (EC2). Figure 10 shows the PRISMA flow chart of our screening and selection process.

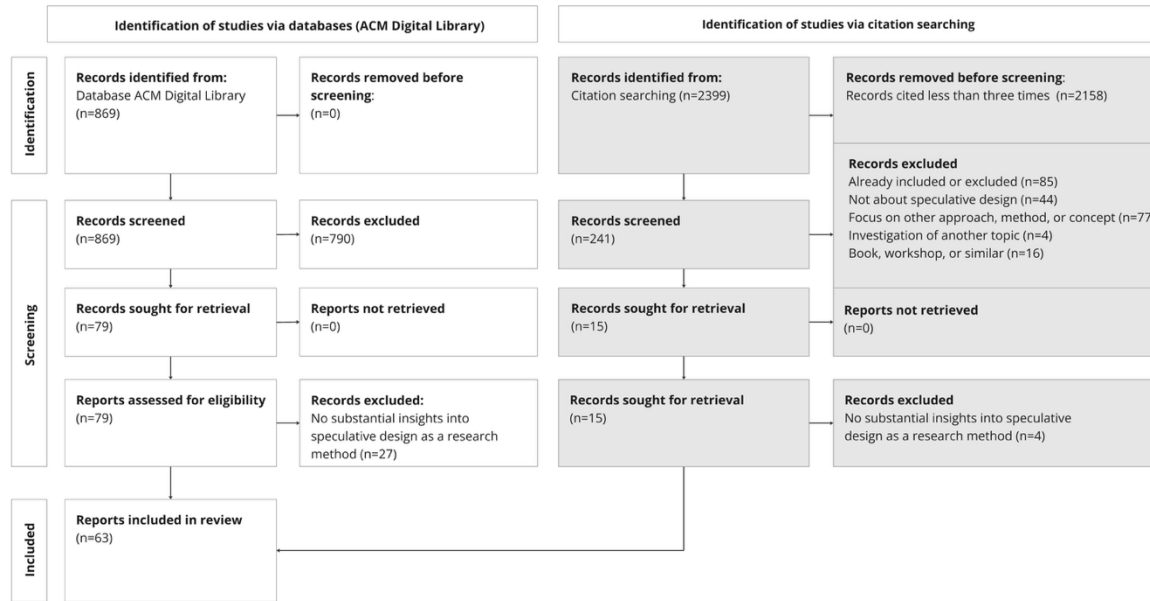


Figure 10: PRISMA flow diagram of our screening and selection process.

The Corpus

Our final corpus consisted of 63 publications from 2005 to 2023, primarily from CHI, DIS, and NordiCHI. Most papers focused on design fiction (37 of 63, or 58.73%), followed by critical design (9 of 63, or 14.29%), speculative design (8 of 63, or 12.70%), and speculative enactments (2 of 63, or 3.17%). The others were about material speculation, reflective design, research fiction, alternative designs, design futuring, futuristic autobiographies, and infrastructural speculations.

In terms of contribution types, 23 papers (36.51%) described methods or approaches for practicing speculative design; 17 (26.98%) proposed definitions, classifications, or frameworks; and 13 (20.63%) dealt with analyzing, evaluating, or reflecting on speculative designs. Additionally, nine papers (14.29%) discussed speculative design as a strategy for applications, such as engaging with dystopian futures, or exploring utopias. One paper (1.59%) provided a survey of speculative design literature within the context of sustainable HCI. A full list of all included papers is provided in the original publication on which this chapter builds (Ringfort-Felner et al., 2025).

Analysis

To identify the qualities, dimensions, or attributes that characterize “good” or successful speculations in HCI, we followed Braun and Clarke’s six phases of reflexive thematic analysis (Braun et al., 2022). This approach treats analysis as a creative and interpretative act, emphasizing the researcher’s active role in constructing meaning.

1. Familiarization: We began by reading all 63 papers and extracting sentences that explicitly or implicitly described when a speculation is or becomes “powerful,” “effective,” “successful,” “good,” “better,” or “richer” (e.g., “*To work effectively in a design fiction context, the diegesis must simultaneously be relatable to the reality of the audience, but also*”).

must build a fictional-substrate upon which the design provocation or new technology being prototyped can reside believably” (Lindley & Potts, 2014, p. 1082)). We also extracted definitions that highlighted key characteristics of speculative design (e.g., “a design fiction constructs imaginative fictional realities” (Tanenbaum et al., 2012, p. 1588)), descriptions of analyzed speculations (e.g., “the description is vague enough to give an impression of a design rather than a precise account. [...] such vagueness might result in creative misunderstandings and further ideas” (Blythe, 2014, p. 6)), and criteria researchers used to evaluate or select “good” speculations (e.g., provocativeness or concreteness (Wu et al., 2022)).

2. Coding: We then condensed each extracted statement into a short phrase starting with “A good speculation...” (e.g., “...is relatable,” “...fosters debate”), capturing key characteristics and attributes of a “good” speculation.

3. Initial theme generation: We grouped these phrases based on similarities to identify recurring characteristics.

4. Reviewing and developing themes: We revisited all extracted statement to clarify how each quality contributes to a speculations’ success (e.g., relatability fosters identification, which supports reflection). Using an online collaborative whiteboard, we mapped interrelations between qualities, refining and organizing them further.

5. Refining, defining and naming themes: We defined each identified quality and category, resolving overlaps and sharpening distinctions where needed.

6. Producing the Report: Finally, we completed the analysis during the writing of the publication on which this chapter is based.

Result: A Descriptive Taxonomy for the Quality of Speculation

From the 63 papers, we identified nine distinct qualities of a “good” speculation in HCI that contribute to its success. We grouped these qualities into three categories (speculative, discursive and process) and propose them as a *descriptive taxonomy* for the quality of speculation (see Figure 11). In the following, I briefly outline the three groups of qualities.

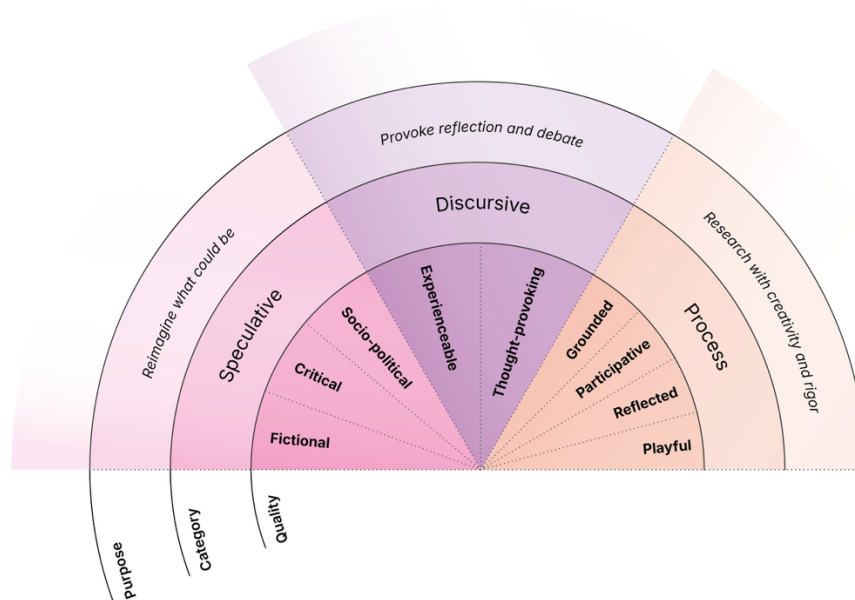


Figure 11: A descriptive taxonomy for the quality of speculation. Graphic design by Anna Hoch.

Speculative Quality

The speculative quality encompasses the core characteristics of speculative design, that is, what distinguishes it from affirmative, solution-oriented approaches. It comprises three different qualities: *fictional*, *critical*, and *socio-political*.

- **Fictional** refers to the creation of imaginative worlds, systems, or products. Fiction creates a safe space for exploration and critique free from real-world constraints and consequences. It opens up new ways of thinking about technology and society.
- **Critical** refers to the deliberate questioning of dominant societal, cultural, and technological assumptions through design. Here, critique is about destabilizing and challenging entrenched thinking and provoking reflection on existing values and systems. It draws attention to alternative pathways and helps illuminate where preferable futures might lie within the broader landscape of possible futures.
- **Socio-political** refers to the engagement with broader societal and political issues such as human rights, environmental policies, or social justice. This quality shifts attention from individual artifacts to the broader societal systems they inhabit, emphasizing how imagined technologies, once widely adopted, can influence and transform these systems.

Together, these qualities operate in a dynamic interplay: *fictional* provides the narrative foundation of a speculation, while *critical* and *socio-political* shape its focus and form. In combination, they turn a design into a speculative design and help to reimagine and critically examine what could—and *should*—be.

Discursive Quality

The discursive quality encompasses key characteristics that make a speculation conducive to reflection, debate, and insight generation. It consists of two core qualities: *experienceable* and *thought-provoking*, each with several sub-qualities.

- **Experienceable** refers to the comprehensibility and tangibility of a speculation. It ensures that an abstract speculation becomes real and tractable to a level that audiences can seriously engage with it. This quality is composed of six sub-qualities: materialized, plausible, coherent, relatable, specific, and simple.
 - *Materialized* refers to the manifestation of a speculation in a tangible form (e.g., immersive written narratives, artifacts, performative experiences). It enables audiences to better imagine and engage more deeply with alternative futures.
 - *Plausible* refers to the believability and credibility of a speculation as perceived by an audience. It encourages suspension of disbelief and forces audiences to engage with the claims and provocations inscribed in the speculation as if they were real.
 - *Coherent* refers to the internal consistency of a speculation, where all elements align with the established rules and logic of the created world. It helps bring fictional futures to life and encourages deeper reflection on the values, biases, and ethics embedded in designs.
 - *Relatable* refers to the capacity of a speculation to connect its fictional elements with the audience's reality. It fosters emotional engagement and critical reflection on the technologies or scenarios being presented.
 - *Specific* refers to the detail and concreteness of a speculation. It helps to make a particular future or reality vivid and imaginable.
 - *Simple* refers to the clarity, comprehensibility, and digestibility in which a speculation communicates its ideas to its audience. It ensures accessibility and enables audiences to easily grasp speculative concepts.

- **Thought-provoking** refers to the capacity of a speculation to captivate and challenge. It ensures that a speculation stimulates critical reflection and debate. This quality is composed of three sub-qualities: captivating, provocative, and ambiguous.
 - *Captivating* refers to the intrinsic appeal of a speculation and its ability to spark curiosity. It invites further exploration, often driven by its *novelty* or *uniqueness*.
 - *Provocative* refers to a speculative design's ability to challenge and disrupt its audience. It evokes emotional, intellectual, or social responses that offer insights into the audience's concerns or hopes towards a specific technology.
 - *Ambiguous* refers to the deliberate vagueness and interpretability of a speculation. It invites multiple interpretations, encouraging the audience to derive their own meanings and perspectives.

The discursive qualities *experienceable* and *thought-provoking* play complementary roles in speculative design. The former transforms abstract ideas into tangible and accessible forms that enable understanding and engagement, while the latter introduces the necessary charm, tension, and ambiguity to stimulate reflection and debate. They interplay is essential for fostering meaningful discussions about future possibilities and the societal, cultural, and ethical implications of emerging technologies.

Process Quality

The process quality encompasses key methodological aspects that researchers consider valuable within speculative design research. It consists of four qualities: *grounded*, *participative*, *reflected* and *playful*.

- **Grounded** refers to the empirical and theoretical foundations that underpin a speculation. It enhances the credibility, relevance, and reliability of speculations.
- **Participative** refers to the active involvement of diverse stakeholders in the creation or discussion of speculative designs, including non-designers, non-experts, and marginalized or vulnerable groups. It fosters diverse perspectives and new insights, ensuring that a wide range of community voices are represented and considered.
- **Reflected** refers to designers' and researchers' critical self-examination of how their intentions, interpretations, and positionalities influence the creation and outcomes of speculative designs. It fosters informed and responsible design decisions when envisioning futures.
- **Playful** refers to the exploratory and creative nature of speculative design. It emphasizes flexibility, experimentation, and a willingness to take risks, creating fertile ground for new ideas and unexpected outcomes.

The process qualities are especially important in academic settings. They foster creative yet significant and responsible research speculations that prioritize contextual relevance, and collaborative engagement. In doing so, they help steer speculative design away from individualistic or self-serving tendencies.

Taken together, this descriptive taxonomy articulates what constitutes high-quality speculative design in HCI. Table 4 provides an overview of all qualities, their descriptions, outcomes, and positive impacts.

Notably, many of these qualities echo insights from the preceding case studies, including the value of grounding speculation, the importance of provocation, and the value of involving participants in the speculative process (see Phases 1 and 2). As such, the taxonomy synthesizes and further refines methodological understandings emerging from both existing literature and our empirical work.

Table 4: Overview of all qualities, their descriptions, outcomes, and positive impacts.

Category	Qualities	Short Description (A “good” speculation...)	Outcome	Positive Impact
Speculative	Fictional	... explores alternative realities or futures.	Critical rather than affirmative speculation	• Promotes critical exploration of alternative possibilities
	Critical	... questions societal, cultural, and technological assumptions.		• Encourages rethinking existing technologies and societies • Encourages critical understanding of the present
	Socio-political	... addresses societal and political dimensions of technology.		• Broadens perspectives on technology and society • Raises awareness of the social, cultural, and ethical implications of emerging technologies
Discursive	Experienceable	... is comprehensible and graspable.	Credible, tangible, and experiential rather than abstract speculation	• Fosters understanding and envisioning of alternatives • Enhances engagement and reflection
	Materialized	... is manifested in a tangible form.		
	Plausible	... is believable and credible.		
	Coherent	... is internally consistent.		
	Relatable	... connects fictional elements to the audience’s reality.		
	Specific	... is detailed and concrete.		
	Simple	... is comprehensible and digestible.	Intriguing and thought-provoking rather than comforting speculation	• Encourages audience engagement and deep contemplation on a subject • Stimulates critical reflection and debate
	Thought-provoking	... captivates and challenges.		
	Captivating	... sparks curiosity.		
Process	Provocative	... challenges and disrupts.	Significant, inclusive, responsible, and creative rather than idiosyncratic, unsubstantiated and conventional speculation	• Enhances the relevance and intellectual rigor of speculative designs • Fosters diversity of perspectives • Promotes inclusivity • Encourages mutual learning • Helps uncover biases • Promotes informed decision-making and responsible design • Fosters ideation and enables unexpected outcomes
	Ambiguous	... is deliberately vague and open to interpretation.		
	Grounded	... is informed by empirical data and theoretical concepts.		
	Participative	... is informed by diverse stakeholders.		
	Reflected	... is informed by critical self-examination.		
	Playful	... is informed by exploratory and creative methods.		

Discussion

In the literature reviewed, the above outlined qualities are all associated with “good” speculative design. However, while these qualities certainly are relevant for speculative design in HCI, we neither regard them as a definitive checklist nor as universally applicable guarantee of the success of speculations. Instead, we suggest the *descriptive taxonomy* as an accessible, flexible, and practical resource for researchers, designers, and practitioners, that can be used to understand and communicate key qualities of speculative design, while supporting the creation and assessment of speculations that are: (1) critical rather than affirmative, (2) credible, tangible, and experiential rather than abstract, (3) intriguing and

thought-provoking rather than comforting, and (4) significant, responsible, and creative rather than idiosyncratic, unsubstantiated and conventional (see Table 4).

Notably, the qualities themselves stem from diverse speculative design practices (e.g., critical design, design fiction, speculative enactments), each with slightly different objectives and emphases. For instance, thought-provoking qualities are most prominent in critical design, while experienceable ones are particularly salient in design fiction and speculative enactments. It is the responsibility of researchers and designers to select, prioritize, and shape the qualities to best suit the function and objectives of a speculation. For instance, a critical design may emphasize thought-provoking qualities to disrupt established perspectives, whereas a design fiction may prioritize experienceable qualities to foster sense-making through storytelling. This aligns with Baumer et al.'s (2020) emphasis on the diverse contributions forms of speculative design can make and the need to adapt quality criteria based on the knowledge a speculation aims to create.

In line with ongoing debates in HCI regarding the use of standards, frameworks, or models for speculative design (Auger, 2013; J. Bardzell et al., 2014; Baumer et al., 2020; Lindley & Coulton, 2015, 2016; Ringfort-Felner et al., 2023), the taxonomy is intended to provide guidance but without imposing constraints. By emphasizing the outcomes and positive impacts of the qualities (see Table 4), we seek to support a flexible and context-sensitive application.

Application Areas

Intended as a flexible resource for researchers, designers, and practitioners, the taxonomy can be potentially useful in many contexts:

Research Projects: The taxonomy can offer researchers a framework to discuss, plan, create, and evaluate speculative designs. At the outset, it provides a shared vocabulary for researchers to discuss a speculation's purpose, and the qualities needed to achieve its objectives. Speculative and process qualities can also guide critical inquiries, such as: "Which assumptions should the speculation challenge?" or "Should participants be involved, and if so, which groups and at what stages?" The taxonomy can aid researchers in evaluating speculations by guiding the formulation of questions about outcomes and processes. For instance, researchers can assess the discursive quality before initiating a discourse by asking, e.g.: "Does the speculation feel plausible to me?" or "Does it make me curious to explore further?"

Academic Peer-Review: The taxonomy can function as a shared reference point for reviewers to identify both strengths and weaknesses of a given speculative design. For instance, it can help reviewers understand and explain why a speculation lacks thought-provocation by highlighting an absence of tension between the present and a speculative future or insufficient ambiguity. By referencing the taxonomy, reviewers can clarify their reasoning and provide constructive feedback for authors to better understand and respond to critique.

Education and Teaching: The taxonomy can serve as a teaching tool within HCI and interdisciplinary curricula. It can provide students with guidance for crafting critical, discursive, and scientifically relevant speculations, while equipping educators with a framework for teaching and delivering precise, constructive feedback on speculative design projects. For example, if students present absurd visions of a future (e.g., dogs teaching schoolchildren), educators can refer to the taxonomy to critique a lack of plausibility.

Collaborative Research Projects: In collaborations with companies or non-profit organizations unfamiliar with speculative design, the taxonomy can serve as a tool to elucidate the significance of speculative, discursive, and process qualities in research. By highlighting their relevance for constructive debate and knowledge generation, the taxonomy fosters a shared understanding among collaborators. This enables teams to thoughtfully integrate and critically evaluate key criteria, such as provocation, throughout the project. Researchers can also strengthen their arguments, for example, for ambiguous elements in design, which are unusual in corporate future visions.

AI-Training: Finally, the taxonomy can offer guidance for creating and evaluating AI-generated speculations, a growing application area in HCI (Blythe, 2023; Dunnell et al., 2024; LC & Tang, 2024; Wu et al., 2022). It can guide prompt formulation, such as: “Integrate more details while leaving out the concrete form of the technology.” Additionally, the taxonomy can expand on criteria for evaluating AI-generated speculations (Wu et al., 2022).

Challenges, Limitations, and Future Work

While we believe the taxonomy can provide a valuable resource for researchers, designers, and practitioners in HCI, it also presents certain challenges and limitations that need to be considered.

First, identifying and understanding the quality of research speculations does not inherently guarantee their success. As previously emphasized, their positive impact depends on their thoughtful and context-sensitive implementation. Further research is therefore needed to investigate strategies for effectively shaping speculative, discursive, and process qualities in practice. This includes drawing on literature that examines specific criteria such as ambiguity (e.g., Gaver et al., 2003; Sengers & Gaver, 2006). Future research should also explore how individual qualities manifest across different speculative design traditions such as critical design, design fiction, or speculative enactments. For example, what “provocation” means in design fiction may differ from how it is used in critical design both in tone and in the discourses it invites.

Second, although the taxonomy outlines potential criteria for evaluation, it currently lacks concrete questions to facilitate their assessment. Future work should build on existing evaluation approaches, such as those by Wu et al. (2022) and Bardzell et al. (2014), while addressing gaps to expand and refine the taxonomy as a practical evaluation tool.

Third, the taxonomy offers a range of qualities that can be flexibly combined depending on the context and function of a speculation. However, this flexibility may feel overwhelming in practice and carries the risk of overly rigid or formalized application. We argue that the articulation of each quality’s outcome and intended impact (see Table 4) can help navigate this complexity and support informed decision-making.

Fourth, the taxonomy is grounded in an analysis of 63 theoretical and methodological publications in HCI and thus reflects a specific corpus of literature. As a result, it may overlook perspectives emphasized in other sources, such as practical applications of speculative design. Although the qualities resonate with insights from the four case studies presented in this thesis, further work is needed to evaluate and, if necessary, refine, and extend the taxonomy. Such work should include applying and discussing the taxonomy with experienced speculative design practitioners who are already adept at judging the quality of speculative work. A workshop at CHI 2026 in Barcelona is already organized, using this taxonomy as an *initial* common ground for shared reflection and critique (Ringfort-Felner et al., 2026).

Finally, we acknowledge that both the review and resulting taxonomy are shaped by the cultural and geopolitical contexts of the included literature, which predominantly reflects the Western academic discourse. Future research should explicitly seek to identify and include work that reflects a broader range of cultural and geopolitical perspectives, to examine how qualities of speculation might be understood, applied, or reinterpreted across diverse sociotechnical contexts.

PART III – RESEARCH OUTCOME

General Discussion

This thesis set out to refine the methodological understanding of speculative design in HCI by examining its potentials, challenges, and “quality” in the study of *otherware*. Rather than asking *what* speculative design is, it investigated *how* it can be *effectively applied* and what characterizes “good” and successful speculative research.

This final section synthesizes the main findings of the thesis, outlines its key methodological contributions to speculative design in HCI, and discusses its limitations alongside directions for future work.

Summary of Findings

The five studies presented in this thesis refines the methodological understanding of speculative design in HCI by drawing on both research *through* and research *into* speculative design.

The first three case studies (Phase 1) examined speculative design in academic contexts, applying its approaches and methods to the study of otherware. They demonstrated how speculative design can make imagined possibilities concrete enough for participants to engage with. By situating participants within carefully constructed future scenarios, it enabled them to articulate expectations, concerns, and values that often remain implicit in discussions about emerging technologies. In doing so, the studies revealed ethical and social implications of the imagined technologies that informed their future design. Crucially, the case studies uncovered recurring methodological strategies that supported effective speculative inquiry. These included grounding speculation in theory, critique, or practice; materializing imaginaries through world building; deliberately working with both plausibility and ambiguity; and meaningfully engaging participants in the process. Across the studies, speculative design proved to be a positive, participatory, and empirically informed approach to design research that unfolded in three parts: (1) grounding the speculation, (2) (co-)creating fictional worlds, and (3) confronting those worlds with participants to generate empirical insight. This process integrated established speculative design methods and approaches, including anticipatory ethnography, speculative enactments, and design fiction as world building.

The fourth case study (Phase 2) extends this investigation by situating speculative design within a real-world organizational context through an 18-month collaboration with an automotive company. It showed how corporate objectives and organizational constraints shaped the academic practice of speculative design, redirecting its orientation toward product-driven innovation and evaluation rather than critical exploration. Crucially, this shift affected the kinds of insights generated. More provocative speculations elicited deeper discussions with laypeople and surfaced new questions, potentials, and concerns about future products and services. In contrast, speculations that resembled existing products were readily accepted, triggered little critical debate, and produced limited new insight. These dynamics underscored the need for quality criteria that preserve the critical and exploratory character of speculative design.

The final study (Phase 3) responded to this need directly by systematically examining what HCI scholars associate with “good” and successful speculation. Through a scoping review of 63 theoretical and methodological publications on speculative design, design fiction, and critical design, it identified nine quality criteria organized into three groups: speculative, discursive, and process. We suggested these qualities as a descriptive taxonomy that can help researchers, designers, and practitioners to better understand and communicate key qualities of speculative design, to create effective speculations in terms of knowledge generation, and to critically examine speculative design processes and outcomes. Importantly, this taxonomy resonates with and integrates the methodological strategies identified in the earlier case studies.

Taken together, the five studies offer a refined methodological understanding of speculative design in HCI. They show how speculation can generate rich, situated knowledge about the not-yet, while outlining methodological strategies, processual considerations, and quality criteria that can support such inquiry.

The next sections present the key methodological contributions of this thesis and situate them within the broader discourse on speculative design in HCI.

Towards a Positive, Participatory, and Empirically Informed Approach to Speculative Design in Research

This thesis positions speculative design as a positive, participatory, and empirically informed approach to design research, particularly for studying emerging technologies. This orientation responds to persistent critiques of speculative design, including its dystopian tendencies, its elitist authorship, and its lack of empirical follow-up. The following sections elaborate on each aspect of this approach, explaining what it entails and why it is relevant and valuable for HCI research.

Designing for Utopia: The Value of Positive Speculations

Speculative design has often been criticized for emphasizing dystopian or undesirable futures without articulating what might be valuable or preferable about them for wider audiences (Blythe et al., 2016; Tonkinwise, 2014). While dystopian speculation can be productive, for example by revealing risks, tensions, and unintended consequences of emerging technologies (Tanenbaum et al., 2016; Ullrich et al., 2025), it also risks producing cynicism and rejection rather than constructive reflection or change (Auger, 2013). In response, Blythe and colleagues have argued for a constructive critique (Blythe et al., 2018), positive fictions (Blythe et al., 2015), and “seriously silly” forms of speculative design (Blythe et al., 2016).

This thesis aligns with these efforts by advancing a positive approach to speculative design. This approach focuses less on what should be avoided and more on what could be *desirable*. It draws on theory from Positive Psychology (Seligman et al., 2005) and Design for Wellbeing (Hassenzahl et al., 2013) to investigate how future technologies might support human values and needs, thereby contributing to more meaningful and desirable futures.

Importantly, designing for *utopia* here does not imply naïve optimism or escapism. Instead, it is a critical and reflective act: a way of making desirable futures tangible while keeping them open to negotiation and critique (see also Dörrenbächer et al., 2020). It invites reflection on how such futures might feel, what might be valuable about them, who benefits, what trade-offs they entail, who might be excluded, and what structures may need to be dismantled for such futures to materialize. This resonates with Atwood’s concept of “Utopia,” which highlights how utopian and dystopian imaginaries are deeply intertwined (Noortman et al., 2021).

The value of this approach lies in the kind of knowledge it generates. It contributes to what Schneidewind describes as *goal* knowledge (Schneidewind, 2017). In contrast to *system* knowledge (what is) and *transformation* knowledge (how to get from the actual to a target state), goal knowledge addresses the question of *what should exist*. While HCI has excelled in generating system and transformation knowledge, it has rarely focused systematically on articulating and negotiating *which technological futures we actually want*. Speculative design, as demonstrated in this thesis, offers a means to more explicitly generate and contest such goal knowledge by envisioning and debating *preferable* futures.

At the same time, this positive orientation extends current debates about the role of speculative design in corporate and innovation contexts. It demonstrates how speculative design can be adapted to settings where overt critique or dystopian narratives may be rejected because they are perceived as irrelevant or direct criticism of existing technologies,

strategies, or development practices (Ullrich et al., 2025; Wu et al., 2019). In such contexts, a constructive and positively framed speculation can create space for reflection and discussion without triggering defensive reactions.

A Participatory Approach to Speculation: The Value of Co-Design, Enactments, and Collective Imagination

Another critique of speculative design concerns its elitist authorship: artefacts and narratives are often created solely by designers for designers, with little or no involvement of those they concern (Lyckvi et al., 2018). In response, the field has undergone a “participatory turn” (Farias et al., 2022), giving rise to approaches such as “participatory speculative design” (Farias et al., 2022), “participatory design fiction” (Nägele et al., 2018), “co-design fiction” (Ambe et al., 2019), or “critical participatory design” (Iivari & Kuutti, 2017). These approaches seek to democratize speculation and ensure that imagined futures reflect plural values and lived realities.

This thesis builds on and extends these developments by advancing and demonstrating a participatory and performative approach to speculative design in the study of otherware. This approach draws on co-creation and performative methods of speculative design, including futuristic autobiographies (Cheon & Su, 2018) and speculative enactments (Elsden, Chatting, et al., 2017). Participation here is not limited to generating ideas or responding to designer-produced artefacts (Farias et al., 2022); rather, it involves embodied engagement. Participants are invited to *inhabit* speculative worlds, assume roles, and reflect from *within* those worlds. In earlier work, we described this as *experiencing utopia* (Dörrenbächer et al., 2020), an approach in which utopian futures are imagined, enacted, and evaluated together with participants.

Despite its methodological complexity (particularly its reliance on participants’ imaginative and performative abilities), this embodied participation yielded insights that would not have emerged through making or discourse alone. It revealed how people emotionally and socially relate to imagined technologies: how they envision integrating them into everyday life and what they hope for, fear, or reject. These insights help anticipate how emerging technologies may shape everyday life and point to considerations that should inform their design.

In innovation and corporate research contexts, this approach also adds distinct value. It enables researchers and developers to “live with” their potential innovations and anticipate their social and ethical implications before they enter the real world.

Speculation as Inquiry: Bridging Imagination and Empirical Research

Another controversy in speculative design concerns the role of speculative artefacts in research. These artefacts are often exhibited or presented, yet the discussions and reflections they elicit are rarely examined as empirical material (Koskinen et al., 2008). This points to a deeper and still persistent issue: Speculative artefacts are often treated as the endpoint of speculative research rather than as the starting point for systematic inquiry (Cardenas Cordova et al., 2025).

This thesis treats speculative artefacts not as endpoints but as starting points for empirical investigation. In doing so, it returns to speculative design’s original intent: “not to show how things will be but to open up a space for discussion” (Dunne & Raby, 2013, p. 51). It builds on prior work that has used speculative artefacts as stimuli for debate (Jenkins et al., 2020) and aligns with Lindley and Potts’ argument that “[i]t is from that discursive space that design insights emerge” (Lindley & Potts, 2014, p. 1082). This thesis demonstrates that speculations can generate empirical material both from within speculative worlds (through enactments and recorded performances) and from outside them (through discussions of artefacts in, for example, social media or focus groups). Moreover, it shows that established qualitative methods in HCI, such as thematic analysis, can be applied to this material to produce design-relevant insights for technology design.

The insights generated through such speculative engagements are *indicative* rather than representative, yet they provide valuable material for developing hypotheses about how emerging technologies could or should be designed. In our own studies, for example, analyzing participants' performances and reactions revealed a markedly different design direction for otherware: not to imitate humans, but to draw on machine-inherent capacities as resources for design. This constitutes what Höök and Löwgren describe as intermediate-level knowledge: insights grounded in situated practice yet abstract enough to be transferable across cases (Höök & Löwgren, 2012).

Crucially, the value of such indicative insights depends on how well the underlying speculation is grounded (Ringfort-Felner et al., 2025). For example, Lindley et al.'s anticipatory ethnography of *Her* shows how insights derived solely from a fictional world can feel "strange and unsettling" and are difficult to translate into actionable design outcomes (Lindley et al., 2015). The authors describe these results as "plausible outsights" and explicitly question how useful and relevant such findings are for real-world design.

This underscores a reciprocal relationship between speculation and inquiry: speculation is informed by empirical observations and conceptual foundations, and speculative engagement, in turn, generates empirical insights whose relevance depends on that grounding. Through this interplay, speculative design becomes a meaningful form of inquiry, capable of transforming imagination into situated, design-relevant knowledge.

I argue that this positive, participatory, and empirically informed approach to speculative design defines important conditions under which speculative design can generate meaningful knowledge about otherware and the not-yet. Building on this approach, the next section introduces the three-part process of speculative inquiry developed and applied throughout this thesis. This process translates the approach into a structured yet flexible framework for conducting speculative research in HCI.

A Three-Part Process for Structuring Speculative Research

Speculative design encompasses a wide range of methods, yet these are often tied to specific practices, phases, or individual case studies. At the same time, the absence of a coherent methodological framework complicates its application and communication while hindering the development of shared standards for high-quality speculative inquiry.

This thesis contributes to a more systematic understanding of how speculative research can be structured. Across four case studies, it identified a recurring three-part process consisting of: (1) informing design, (2) (co-)creating fictional worlds, and (3) empirical investigation. This process proved transferable across technological domains (voice assistants, social robots, self-driving cars) and across research contexts (academic and corporate). In the following, I elaborate on each phase and describe how it corresponds to or advances existing work in speculative design.

1. **Informing Design.** The first phase corresponds to what Lindley describes as research *for* design fiction: the contextual and empirical inquiry that precedes and informs the creation of speculative artefacts (Lindley, 2015). Prior studies have drawn on ethnographic fieldwork, interviews, and trend analyses to inform speculation (Cardenas Cordova et al., 2025). This thesis builds on these approaches but extends them by showing how psychological and psychotherapeutic models (Case Study 1), anticipated positive experiences (Case Study 1), analyses of existing technologies (Case Study 2), and interviews with robot developers and laypeople (Case Studies 3–4) can inform the creation of *positive* futures. Rather than treating this phase as mere inspiration, this thesis shows its methodological relevance. Grounding speculation in contextual, empirical, or theoretical understanding ensures that it resonates with real-world concerns and contexts. It can further enhance their plausibility, specificity, and relatability. These are key qualities of speculative design (see Study 5).

2. **(Co-)Creating Fictional Worlds.** The second phase centers on creating and materializing these speculations, a core element of speculative design. This thesis does so through design fiction as world building, one of the few established conventions in the field (Coulton et al., 2017). This approach proved valuable across the case studies for constructing coherent, believable, and compelling fictional worlds through diverse diegetic prototypes. At the same time, the case studies revealed opportunities to expand how world building can be practiced in speculative research. First, they combined world building with speculative enactments (Elsden, Chatting, et al., 2017), enabling participants to inhabit and experience fictional worlds. Second, Case Study 2 introduced fictional documentaries as a novel and effective form of diegetic prototype. These documentaries brought fictional worlds to life through improvised in-role enactments by participants. Finally, this thesis identifies several sub-qualities (Study 5) that can guide researchers and designers in crafting experienceable and thought-provoking speculations that foster reflection and debate (i.e., discursive quality).
3. **Empirical Investigation.** The third phase centers on using speculative artefacts as tools for reflection, debate, and empirical inquiry (i.e., “provoke” (Cardenas Cordova et al., 2025)). Previous work has engaged audiences in responding to speculative artefacts, for example through exhibitions or workshops (Jenkins et al., 2020). This thesis builds on these efforts and extends them in two ways. First, it shows how social media, public discussion spaces, and online magazines can serve as venues for initiating public debate around possible futures (Case Study 1). Second, it demonstrates how reactions gathered through these engagements and enactments can yield valuable insights into the potentials and pitfalls of not-yet-existing technologies. Case Study 4 also highlights the particular challenges of this phase in corporate settings. These include confidentiality constraints that restrict opportunities for public engagement and the risk that speculative work is redirected towards product validation.

Taken together, this three-part process provides a methodological structure for speculative inquiry while giving structural form to the positive, participatory, and empirically informed approach outlined above. It organizes speculative research along shared phases while remaining flexible in how each phase unfolds. In doing so, it offers orientation without prescribing rigid procedural rules, thereby balancing flexibility with methodological clarity.

Most notably, this process has already informed further methodological developments in the field. A recent literature review by Cardenas Cordova et al. (2025) synthesized speculative design methods to identify common phases across speculative design processes. Their analysis of 52 studies identified four core phases: *select*, *explore*, *transform*, and *provoke*. These phases appeared in 67.3% of the studies examined, including our own (Case Study 4). Building on this synthesis, Cardenas Cordova et al. proposed the *Inverted Double Diamond framework*, a visual model of the speculative design process.

While their framework retains four phases, the process outlined in this thesis combines *explore* and *transform* into a unified, iterative co-creation phase (Cardenas Cordova et al., 2025). This reflects the entangled nature of world building in practice. Despite these structural differences, both process models converge in emphasizing *provoke* as a central phase of speculative design. This alignment reinforces a core argument of the thesis: speculative design’s methodological value lies not only in imagining and materializing alternatives but also in provoking reflection and discourse that generate research-relevant insights.

A Descriptive Taxonomy for the Quality of Speculation

Finally, this thesis contributes quality criteria as an orientation within the process in the form of a descriptive taxonomy. This taxonomy comprises nine criteria grouped into three categories: speculative, discursive, and process. The four case studies in this thesis provide empirical grounding for this taxonomy by illustrating how several criteria (e.g.,

experienceable, grounded, participative) manifest in practice and shape both the inquiry and the relevance of the insights generated.

While prior frameworks have focused primarily on defining or categorizing speculative practices, this taxonomy shifts attention to the quality of speculation itself: how and why certain speculations succeed in research. It addresses a longstanding methodological gap in the field, namely the absence of a shared understanding of what constitutes a “good” speculation (S. Bardzell et al., 2012; Grand & Wiedmer, 2010; Lindley et al., 2016; Lindley & Coulton, 2015; Markussen & Knutz, 2013). It also responds to ongoing calls for methodological and conceptual development in speculative design within HCI (J. Bardzell et al., 2014; S. Bardzell et al., 2012; Blythe, 2014; Kozubaev et al., 2020; Pierce et al., 2015).

By synthesizing criteria that have, until now, remained scattered across the literature, the taxonomy offers a structured yet flexible framework to support researchers, designers, and practitioners in understanding and evaluating high-quality speculative designs. In doing so, it contributes to several ongoing discussions within and beyond HCI. First, it informs debates on the evaluation of speculative design by providing criteria that can support the assessment of speculative work, particularly in academic peer review. Second, it contributes to discussions of speculative design as a pedagogical practice by offering vocabulary and structure for teaching speculative quality. Third, it informs emerging debates around AI-generated speculation by providing criteria that can guide both the creation and evaluation of machine-produced speculations. Finally, it supports corporate applications of speculative design by offering a framework for aligning expectations and articulating quality in collaboration with industry partners.

Taken together, the positive, participatory, and empirically informed approach to speculative design, the three-part process model, and the descriptive taxonomy constitute complementary methodological contributions. The approach defines the conditions under which speculative inquiry can generate meaningful knowledge; the process model gives structural form to this approach; and the taxonomy provides criteria for navigating and assessing quality within that structure. Combined, these contributions advance the methodological understanding of speculative design in HCI and clarify how it can be applied to investigate emerging technologies and the not-yet.

Limitations and Future Work

While this dissertation advances the methodological understanding of speculative design in HCI, several limitations remain that offer directions for future work.

First, the methodological approach and process model developed in this thesis are shaped by the aims and contexts of the case studies. These studies explored which futures with otherware might be desirable or problematic, and how such technologies could be shaped to support meaningful futures. In pursuing this orientation, the case studies draw primarily on two specific forms of speculative design: design fiction and speculative enactments. While these approaches reflect established conventions in HCI and lend themselves well to empirical investigation, they represent only a subset of the broader speculative design landscape. Accordingly, the contributions articulated in this thesis should be understood as one possible way of conducting speculative inquiry, not the only one. Future research should explore how other speculative traditions intersect with, diverge from, or extend the insights revealed through the case studies.

Second, all case studies presented in this thesis were conducted within Western European, academically oriented HCI research contexts and focused on emerging technologies such as voice assistants, social robots, and self-driving cars. This leaves open how far the findings can be transferred to other settings or technologies. Speculative design practices and the conditions under which they unfold may differ across cultural, political, and institutional contexts. For instance, approaches used in this thesis, such as initiating public debate via social media, may not translate to settings where

participation is restricted or shaped by different cultural norms. Future work should examine how the approaches and insights from the case studies translate to cultural and institutional contexts beyond Western Europe and how they may challenge or refine the thesis's methodological contributions.

Third, the approach, process model, and descriptive taxonomy developed in this thesis are provisional and orienting. They articulate recurring structures and qualities observed across cases and literature. As such, they do not constitute a universal model, a standardization of practice, or a means of measuring speculative quality. Rather, they offer orientation within a diverse, open, and evolving field shaped by differing practices and epistemic commitments. While initial applications in our own teaching and research are promising, these contributions have not yet been widely tested across diverse research, educational, and industrial settings. Further research across varied contexts is therefore required to examine their transferability, limitations, and unintended consequences.

Finally, this thesis engages with but does not resolve a fundamental methodological tension in speculative design: to what extent can frameworks such as those developed in this thesis provide orientation without constraining the openness and unpredictability that make speculation valuable in the first place? Although the proposed process model and taxonomy aim to provide orientation rather than impose constraints, any framework carries the risk of becoming rigid and prescriptive. Structure can gradually solidify into standardization, potentially narrowing the scope of speculation and limiting its capacity to generate genuinely unexpected insights. Future research should therefore examine how speculative design can remain methodologically open while still offering sufficient orientation to support rigorous inquiry, particularly in interdisciplinary collaborations and among researchers less experienced with speculative design.

Conclusion

I would like to close this thesis by returning to the tension from which it emerged: the tension between speculative design's strength as an open, exploratory practice and the challenges this openness creates for its use and legitimacy as a research approach. This thesis responds to that tension by offering methodological orientation to a practice that is intentionally open. Across five studies, it shows how speculative design can be shaped and guided as a research approach for studying otherware and the not-yet.

Drawing on these studies, the thesis puts forward three connected methodological contributions: a positive, participatory, and empirically informed approach to speculative design that defines the conditions under which speculative inquiry can generate meaningful knowledge; a transferable three-part process that operationalizes this approach; and a descriptive taxonomy for the quality of speculation that articulates criteria to orient reflection on quality within this process. Collectively, these contributions address longstanding critiques of speculative design in HCI, including its dystopian tendencies, its elitist authorship, its lack of empirical follow-up, and the absence of shared methodological processes and quality criteria. They offer recommendations and guidance that can support researchers, designers, and practitioners in conducting and reflecting on speculative research.

Speculative design will never be fully formalized, nor should it be. Its value lies in its openness and its ability to generate insight through the unconventional and the unexpected. Yet openness does not preclude methodological clarity. Clarifying the logics, phases, and qualities that can render speculative inquiry productive strengthens rather than constrains speculation. This thesis contributes to that effort by demonstrating how speculation can be oriented, structured, and reflected upon within HCI research.

While questions remain, such as how these contributions translate across cultural and organizational contexts, I am confident that they provide a valuable foundation for ongoing methodological dialogue in HCI about what effective and meaningful speculative research can entail.

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Appendix

Table A1: Participants from industry and academia and their involvement in the process.

ID	Assignment	Position/Role	Involvement in the process
IP1	Industry	Researcher, project lead	Entire process
IP2	Industry	Researcher	Kick-off workshop, enactments, story writing, selection of the final stories, final presentation
IP3	Industry	Researcher	Entire process
IP4	Industry	Developer	Kick-off workshop, enactments, story writing, selection of the final stories, final presentation
IP5	Industry	Developer	Kick-off workshop, enactments, story writing, selection of the final stories, final presentation
IP6	Industry	Researcher	Kick-off workshop, enactments, story writing, selection of the final stories, final presentation
RP1	Academia	Researcher, project lead	Entire process
RP2	Academia	Researcher/designer, HCI, project lead	Entire process
RP3	Academia	Researcher/designer, HCI	Entire process
RP4	Academia	Researcher/designer, HCI	Kick-off workshop, creation of artifacts, final presentation
RP5	Academia	Researcher, HCI	Enactments, story writing
RP6	Academia	Research assistant, HCI	Enactments, story writing, creation of artifacts

Table A2: Overview of laypeople and their involvement in the process.

ID	Age	Gender	Profession	Involvement in the process
P1	40	F	Fashion boutiques owner	Interview about positive practices while driving (Step 1)
P2	38	F	Human resources manager	Interview about positive practices while driving (Step 1)
P3	48	M	Technical manager industry	Interview about positive practices while driving (Step 1)
P4	49	F	Foreign language correspondent	Interview about positive practices while driving (Step 1)
P5	43	M	Insurance specialist	Interview about positive practices while driving (Step 1)
P6	53	F	Public service	Interview about positive practices while driving (Step 1)
P7	49	F	Team leader trade fair	Interview about positive practices while driving (Step 1)
P8	45	F	Graduate social worker	Interview about positive practices while driving (Step 1)
P9	37	M	Banker	Interview about positive practices while driving (Step 1)
P10	48	M	District manager	Interview about positive practices while driving (Step 1)
P11	35	F	Hairdresser	Interview about positive practices while driving (Step 1)
P12	50	F	Public service	Interview about positive practices while driving (Step 1)
P13	39	M	Electrical designer	Interview about positive practices while driving (Step 1), online survey and future interviews (Step 2)
P14	57	M	Consulting	Interview about positive practices while driving (Step 1), online survey and future interviews (Step 2)
P15	38	M	Senior solution architect	Interview about positive practices while driving (Step 1), online survey and future interviews (Step 2)
P16	33	M	Computer scientist	Interview about positive practices while driving (Step 1), online survey and future interviews (Step 2)
P17	54	F	Management marketing/design	Online survey and future interviews (Step 2)
P18	42	F	Management of administration and accounting	Online survey and future interviews (Step 2)

ID	Age	Gender	Profession	Involvement in the process
P19	59	F	Freelancer	Online survey and future interviews (Step 2)
P20	49	M	Yoga teacher	Probes and focus groups (Step 3)
P21	50	M	Event service	Probes and focus groups (Step 3)
P22	36	F	Accounting	Probes and focus groups (Step 3)
P23	45	F	Public service	Probes and focus groups (Step 3)
P24	46	F	Travel agent	Probes and focus groups (Step 3)
P25	42	F	IT employee	Probes and focus groups (Step 3)
P26	50	F	Public service	Probes and focus groups (Step 3)
P27	48	F	Tourism, Sales	Probes and focus groups (Step 3)
P28	37	M	Pilot and doctor	Probes and focus groups (Step 3)
P29	41	M	Dispatcher	Probes and focus groups (Step 3)