Design Science

A systematic literature review of the speculative design process and a proposed framework for speculative design

David Cardenas Cordova, Nick Kelly and Leo Rezayan

Queensland University of Technology, School of Design, Brisbane, QLD, Australia

Abstract

Speculative design is widely used in research contexts across multiple disciplines, emphasising problem-finding over problem-solving, and involves methods for exploring possibilities that challenge ingrained assumptions. This systematic literature review analyses speculative design methods used in 52 studies within disciplines such as human–computer interaction, fashion, urban planning, and healthcare, among other fields. It presents results about the common phases and methods of speculative design that are utilised in these studies. It identifies and characterises four core phases that appear to be common within speculative design processes, namely *select*, *explore*, *transform,* and *provoke*. It shares examples of how these phases are used to achieve the goals of speculative design. The discussion section considers the process of speculative design, leading to the synthesis of a framework that visually and conceptually organises these findings to facilitate their comprehension and application. This paper contributes to the understanding of speculative design by providing a clear process that addresses gaps in its theoretical and methodological foundations.

Keywords: Speculative design, problem-finding, design process, framework

Received 01 April 2025
Revised 19 September 2025
Accepted 19 September 2025

Corresponding author
David Cardenas Cordova
david.cardenascordova@qut.edu.au

Des. Sci., vol. 11, e38
journals.cambridge.org/dsj
DOI: 10.1017/dsj.2025.10030

1. Introduction

Speculative design is an approach to designing that involves envisioning future scenarios to question current ingrained assumptions, beliefs and values. It involves challenging the status quo and provoking critical reflection on societal issues (Dunne & Raby 2013). Rather than focusing on solving problems or providing answers, speculative design methods involve being critical, finding problems and asking questions to better understand the complexities and interdependencies of contemporary challenges (Dunne & Raby 2009). In this way, speculative design uses design practices as a primary tool to refine our understanding of the world, not only to uncover why things are the way they are but also to inform us about the potential social and ethical implications of design solutions and the consequences of inaction (Lindley & Green 2021). Speculative design has been widely applied in academic transdisciplinary contexts, such as human computer interaction (Park, Healey, & Kaniadakis 2021; Eghtebas *et al.* 2023; Phutane *et al.* 2023), fashion (Arora *et al.* 2023; Garcia 2023), social well-being (Andalibi *et al.* 2018;

Almohamed, Zhang, & Vyas 2020), urban planning (Stals, Smyth, & Mival 2019; Kwon *et al.* 2023; Marji, Thibault, & Shawash 2023; Bendor & Lupetti 2024), healthcare (Darby, Tsekleves, & Sawyer 2018; De Haas, Jun, & Hignett 2019; Hsueh *et al.* 2023; Maestre *et al.* 2023; Zolyomi & Snyder 2024), personal data and privacy (Søndergaard & Hansen 2016; Fox *et al.* 2019; Di Lodovico 2023; Kolovson, So, & Munson 2024), intimacy and relationships (Kaur *et al.* 2022; Aljuneidi, Gerstenberg, & Hassenzahl 2024), education (Pinto *et al.* 2021; Kender & Purgathofer 2022), artificial intelligence (Alfrink *et al.* 2023; Ashby *et al.* 2023; Hohendanner *et al.* 2023; Hollanek & Nowaczyk-Basińska 2024), governance (Gorkovenko & Taylor 2019; Tsekleves *et al.* 2022; Kafer 2023), business (Grafström *et al.* 2022; Ringfort-Felner *et al.* 2023) and environmental sustainability (Biggs & Desjardins 2020; Lindström & Ståhl 2023). By broadening the scope of design beyond problem-solving, speculative design critically examines the potential implications of both solutions and their absence, offering fresh perspectives on contemporary issues.

As with many design approaches, speculative design is dynamic, messy and heterogeneous, where adaptability of methods is an integral part of the process. Yet in the case of speculative design, this adaptability is amplified by its limited theoretical underpinnings (Pierce 2021). Speculative design is fluid, ambiguous, and diverse to the point that anyone might label a design process as 'speculative' without the reader knowing much about what was done. This ambiguity partly stems from the fact that speculative design is not a single unified methodology but rather an umbrella term encompassing a wide range of related, loosely defined approaches, such as design fiction and critical design (Auger 2013). This diversity can make it difficult to refer to and categorise work consistently, as authors may use terms like speculative design, design fiction or critical design in overlapping ways, as they are open to several interpretations (Auger 2013). For instance, a study might be labeled with one term in the title, while referencing other terms in the main text. In some cases, these terms are used as convenient labels for future-oriented work (Dunne & Raby 2013), despite lacking a genuinely critical stance or methodological rigour. This can lead to misapplication or the mistaken belief that speculative design has been applied, even when its reflective or provocative core is absent (Malpass 2017). While this diversity is a strength that encourages creative applications of speculative methods, it also leads to competing conceptions of speculative design and its practice. This lack of a shared foundation can become problematic when speculative design is selected and adopted as a research method, since there is no common core that supports and guides its implementation in the same way that conventional design methods do (De Haas *et al.* 2019; Tsekleves *et al.* 2022; Ringfort-Felner *et al.* 2023; Bendor & Lupetti 2024; Zhu, Wang, & Li 2024). Rather than seeking to standardise or narrow the field, this paper is motivated by an overarching aim of working towards a core understanding of speculative design while maintaining its diverse nature. Presently, insufficient theoretical work has been done to identify and articulate this speculative design core, leaving a gap in its conceptual and methodological foundations. Given the growing use of speculative design, articulating common methodological elements offers value in supporting clearer understanding and more informed application.

In keeping with this motivation, the paper addresses the research question: *What design phases and/or methods are utilised by researchers when conducting studies or conceptual work involving speculative design?* It takes the form of a systematic literature review (Grant & Booth 2009), which is appropriate for

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

addressing this question through a structured exploration of existing academic publications. While speculative design is also practised in industry and other non-academic contexts, this review focuses specifically on academic literature to clearly define the boundaries of the study. The review was conducted using Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Liberati *et al.* 2009) to ensure academic rigour and quality in the review process, in which 1684 publications were screened, leading to 52 selected publications being reviewed. Analysis was conducted using thematic analysis (Braun & Clarke 2006) to identify categories of design phases and the methods within them. The review reveals inconsistencies and conflicting perspectives in speculative design practice.

As a result of this systematic review, the paper concludes by discussing the speculative design process. It looks towards the possibility of a framework for speculative design that articulates its core phases, allowing diversity within design practice while addressing some of the aforementioned limitations. This discussion is motivated by a perceived need to enhance the understanding, accessibility, coherency and applicability of speculative design. For instance, what resources are available to a government department wishing to adopt speculative design? And do these resources contradict the perspectives found in the literature?

2. Background

2.1. Speculative design

Speculative design is a critical design practice that engages with imagined future scenarios to provoke reflection, critique and dialogue about present conditions and underlying assumptions (Auger 2013; Dunne & Raby 2013; Malpass 2017; Tsekleves *et al.* 2019; Lindley & Green 2021). Unlike traditional, *affirmative* design (Side A), which focuses on solving specific problems, optimising current systems and designing for production in the service of industry, speculative design is situated in the *critical dimension* (Side B), prioritising problem-finding, questioning assumptions, encouraging critical thinking and designing for debate in the service of society (Dunne & Raby 2013), as illustrated in Table 1. While the affirmative design seeks incremental improvement within commercial frameworks, speculative design disengages from these limitations by exploring alternative possibilities that challenge existing norms and provoke critical thought (Mazé & Redström 2009; Malpass 2017; Johannessen, Keitsch, & Pettersen 2019; Bray & Harrington 2021).

It is essential to note that speculative design does not aim to predict the future but instead to expand the realm of possibilities that can inform ethical, societal and technological considerations (Mazé & Redström 2009; Sterling 2009; Jakobsone 2017; Mitrović *et al.* 2021). This is often conceptualised through four categories of futures: probable, possible, plausible and preferable (Figure 1). *Probable futures* refer to events that are most likely to happen if current trends continue without major disruptions. *Possible futures* describe events that might occur, including scenarios that may seem unlikely but are not impossible. *Plausible futures* envision events that could happen, grounded in today's current understanding of science, technology and societal structures. It is more constrained than the 'possible futures' but still allows for creativity and innovation. *Preferable future*s, in contrast, do not relate to likelihood but to desirability; they describe what individuals, or society, aspire to happen, based on their values, needs and expectations. Speculative design

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 1. A/B Manifesto. Adaptation from Speculative Everything by Dunne & Raby (2013)

Side A	Side B
Affirmative	Critical
Problem solving	Problem finding
Design as process	Design as medium
Provides answers	Asks questions
In the service of industry	In the service of society
For how the world is	For how the world could be
Narratives of production	Narratives of consumption
Anti-art	Applied art
Research for design	Research through design
Applications	Implications
Design for production	Design for debate
Fun	Satire
Concept design	Conceptual design
Consumer	Citizen
User	Person
Training	Education
Makes us buy	Makes us think
Innovation	Provocation

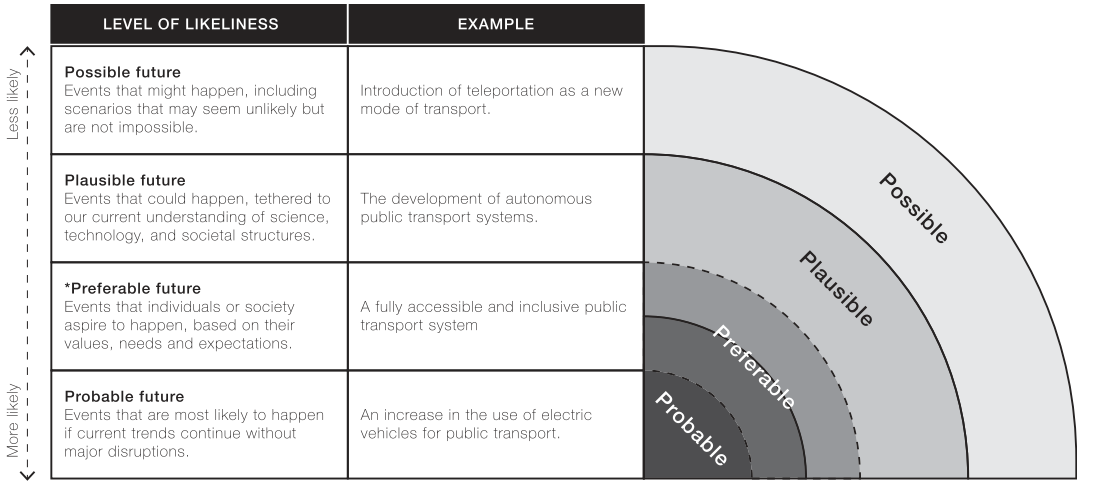

Figure 1. Adaptation from Dunne & Raby's Cones of possibilities, 2013.
*Preferable futures are based on desirability, not likelihood. They overlap with probable and plausible futures.

primarily engages with plausible futures to produce outcomes that are impactful and relatable, often including elements of controversy and ethical ambiguity (Dunne & Raby 2013; Malpass 2017).

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Historically, speculative design emerged in the mid-nineties, influenced by radical architecture and fine arts, and was further developed in the early 2000s by Anthony Dunne and Fiona Raby at the Royal College of Art. This design approach was forged in response to the uncritical focus on technological progress and commercially driven design practices. Instead, it advocates for design as a means of critique, which is not necessarily negative, but rather a form of wishful thinking, scepticism and constant questioning of what is given (Dunne & Raby 2013). Rooted in critical design traditions and influenced by conceptual art and the philosophy of technology, it challenged conventional views and assumptions about the role of products in daily life (Dunne & Raby 2013). Rather than offering a methodology, speculative design was conceived more as an attitude or mindset. Over time, speculative design has expanded into diverse fields such as human–computer interaction, urban planning, fashion, healthcare, public policy, and research, adapting methods to new contexts and challenges. While this expansion demonstrates its growing relevance and adaptability, it has also led to conceptual ambiguity, transforming speculative design into more of a label than a clearly defined practice, used by many who may interpret or apply it differently (Dunne & Raby 2013).

This issue of conceptual ambiguity is further reflected in the wide range of definitions found in the literature, which reveal different priorities and perspectives. Although most share a focus on imagination, provocation and critical engagement, the definitions converge on core ideas while diverging in focus. Dunne and Raby (2013) describe speculative design as a way to stimulate discussion about the diverse impacts of traditional design practice by presenting other modes of existence. Malpass (2013) frames it as a means of projecting socio-technical trends and envisioning products in new use contexts. For Auger (2014), it provides a philosophical and democratic space to interrogate emerging technologies outside market-driven priorities. Tonkinwise (2014) highlights that speculative design democratises the technology discourse, using the language and structure of design to engage broader audiences beyond the one-sided expert's opinion. Jakobsone (2017) underlines its critical stance towards the ethical and societal implications of technological advancements. Mitrović *et al.* (2021) further define it as an 'attitude' that combines multiple methods and practices to imagine and produce critical futures. These varied definitions not only reflect different emphases but also underscore the challenge of establishing a shared conceptual foundation for speculative design.

This conceptual openness becomes even more complex when considering the overlap between speculative design and related approaches such as critical design and design fiction. These practices are often discussed interchangeably due to their shared emphasis on critique, future imaginaries, and fictional narratives. Critical design, as discussed by Malpass (2013), engages with the ethical and cultural dimensions of design practice, while Dunne and Raby (2013) emphasise its role to challenge assumptions about the role of technology in everyday life by using speculative design prototypes. Design fiction, as defined by Bruce Sterling (in Bosch 2012), uses narratives and prototyping to suspend disbelief and immerse audiences in fictional futures. Hollanek and Nowaczyk-Basińska (2024) place design fiction under the speculative design umbrella, while Auger (2013) suggests that these terms serve more to semantically signal different intentions or perspectives than to rigidly define distinct approaches. However, this semantic distinction

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

matters, as the choice of term (design fiction, critical design, and speculative design) substantially influences how audiences unfamiliar with the field interpret and value the work. For example, 'fiction' suggests unreality, 'critical' reveals intentions for deep reflection and discussion, while 'speculative' implies a link between present conditions and imagined futures. Despite these nuances, all three approaches share a core intention: to critique current socio-technical trajectories by using prototypes and narratives to represent alternative realities (Dunne & Raby 2013; Tonkinwise 2014; Mitrović 2015). Nevertheless, their conceptual overlaps continue to blur boundaries, contributing to ongoing unclearness about what speculative design is and what it is not.

This conceptual openness, while beneficial in artistic and critical domains, becomes particularly problematic when speculative design is adopted explicitly as a research method, a context that requires clearer methodological foundations and reproducibility. Scholars argue that the absence of a common foundation makes speculative design difficult to teach, apply and evaluate in academic settings (De Haas *et al.* 2019; Tsekleves *et al.* 2022; Ringfort-Felner *et al.* 2023; Bendor & Lupetti 2024; Zhu *et al.* 2024). Others critique speculative design's practical value, particularly in commercial contexts. Since it often lacks a clear return on investment and rarely generates direct profit, businesses may see it as impractical and have little incentive to adopt it (Coulton, Burnett, & Gradinar 2016). Prado de O. Martins (2017) further argues that speculative design is often showcased in exclusive and highly intellectual venues, such as the Museum of Modern Art in New York or the Victoria and Albert Museum in London, raising concerns that it engages mostly privileged audiences and addresses 'first-world problems'. However, Auger (2013) counters this view, suggesting that speculative design engages broader audiences and democratises debates about emerging technology by making complex technological issues more accessible through tangible and imaginative means. A persisting tension is whether speculative design should be seen as a standalone method with its own process and value or as a tool that serves conventional design approaches (Mitrović 2015). Dunne and Raby (2013) argue that this perception limits its adoption, legitimacy and funding, particularly within industry. To overcome these challenges, some scholars advocate for structured yet flexible frameworks that help practitioners apply speculative design effectively while maintaining its critical and imaginative qualities (De Haas *et al.* 2019; Tsekleves *et al.* 2022; Ringfort-Felner *et al.* 2023; Bendor & Lupetti 2024; Zhu *et al.* 2024).

2.2. The problem space

In design, the problem space refers to a phase where designers explore, understand and define issues before developing solutions (Maher & Poon 1996; Dorst & Cross 2001). It involves investigating user needs, contextual factors and constraints to ensure that the 'right' problem is being addressed (Getzels & Csikszentmihalyi 1975; Kochanowska, Gagliardi, & Ball 2022). According to Dunne and Raby's (2013) A/B manifesto (Table 1), speculative design is considered a *critical* approach to design that emphasises expanding the problem space. In contrast, traditional design approaches in the affirmative dimension give equal weighting to problem-finding and problem-solving, as seen in the British Design Council's (2005) Double Diamond model (Figure 2). The first two out of four phases, 'discover' and 'define',

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

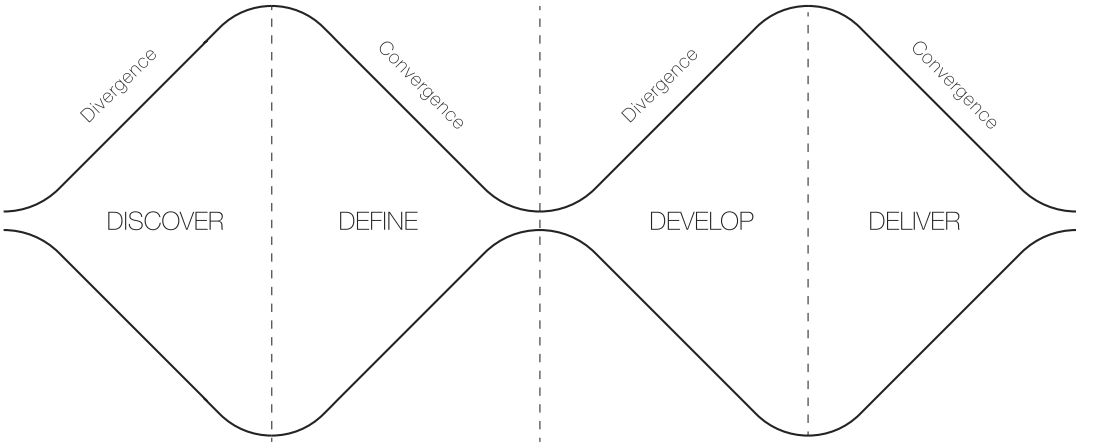

Figure 2. Adaptation from the British Design Council's Double Diamond design process, 2005.

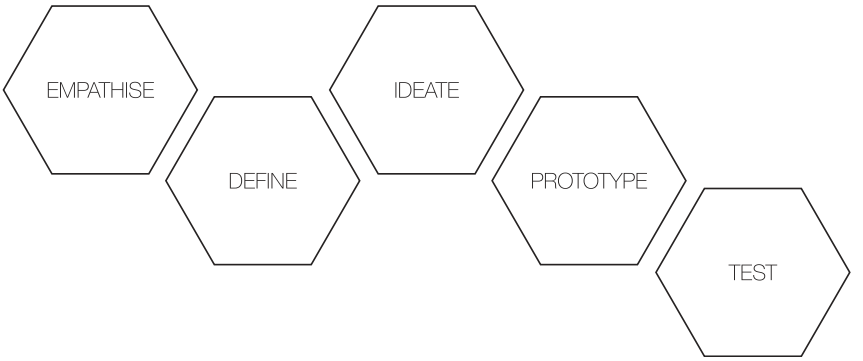

Figure 3. Adaptation from Stanford Design School's Design Thinking Process, 2018.

concentrate on understanding the problem through empathising with the user and gathering valuable insights, leading to reframing the issue to address specific user needs (Kochanowska *et al.* 2022). Similarly, the design thinking process framework (Stanford d.school 2018) dedicates two of its five phases to understanding the problem (Figure 3). The 'empathise' phase involves activities to deeply understand the user's needs, experiences and aspirations (Brown & Katz 2011). The subsequent 'define' phase synthesises the gathered information to clearly define the problem that needs to be solved (Iskander 2018).

Although these traditional design models incorporate the exploration of the problem space as part of their processes, speculative design offers a distinct emphasis by exclusively focusing on deepening the understanding of the problem space without aiming to create a solution. By shifting attention away from solution generation, speculative design enables a more critical and reflective approach (Dunne & Raby 2013). This perspective supports the development of future-oriented alternatives that invite new ways of thinking. By embracing uncertainty and exploring multiple possibilities, speculative design is particularly valuable in addressing complex, ambiguous or future-oriented problems, complementing and

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

extending traditional design approaches. For example, speculative design has been used in fields such as healthcare and urban planning to envision scenarios that help policymakers and stakeholders anticipate emerging needs and ethical considerations (Darby *et al.* 2018; De Haas *et al.* 2019; Stals *et al.* 2019; Kwon *et al.* 2023; Marji *et al.* 2023).

The theoretical value of speculative design has been well-established since the work of Dunne and Raby (2013). However, there is a lack of coherence in how design researchers and practitioners integrate these ideas into their practice. While there is a core of well-recognised approaches and methods, such as the cone of possibilities (Figure 1), the way these methods are chained together and applied remains highly diverse. This diversity is a strength, as it allows for flexibility and adaptation, but it is also problematic in clearly defining the 'core' of speculative design in practice. As a result, discussions about speculative design often remain nebulous. Moreover, establishing such a core is crucial for its application in research, where clarity and rigour are essential, and can also support its integration into education and industry.

3. Method

A systematic literature review was conducted to build an understanding of how researchers are using speculative design within their practice. It addresses the research question: *What design phases and/or methods are utilised by researchers when conducting studies or conceptual work involving speculative design?* This review adopts the guidelines of the PRISMA framework (Liberati *et al.* 2009) to provide a structured, transparent, rigorous and reproducible review process. Critical review methods were used to identify strong points, limitations, inconsistencies, conflicting perspectives, previous contributions and unaddressed gaps in the existing body of speculative design literature (Grant & Booth 2009). This review is thus a systematic review, structurally examining the literature, with a critical synthesis of that literature, to make a contribution by responding to the research question.

The systematic literature review proceeded through four phases: (1) Data identification and collection, (2) Screening, (3) Full-text review and eligibility and (4) Data inclusion, analysis and synthesis (Figure 4). In the final phase, inductive thematic analysis (Braun & Clarke 2006) was used to identify recurring patterns across the selected publications. This approach offered a structured process for synthesising findings and highlighting key insights within the literature.

3.1. Data identification and collection

To identify academic publications related to speculative design, a comprehensive search was conducted across five major databases, including Scopus, Web of Science, JSTOR, ProQuest and ACM Digital Library, up to and including June 2024. The retrieval criterion used across all platforms was the precise search term 'speculative design', selected to identify academic work that explicitly self-identified with this term. We acknowledge that speculative design is often used as an umbrella term encompassing related approaches such as critical design, design fiction, speculative enactments, and material speculation, among others, which share overlapping practices and aims. Speculative design, as originally

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

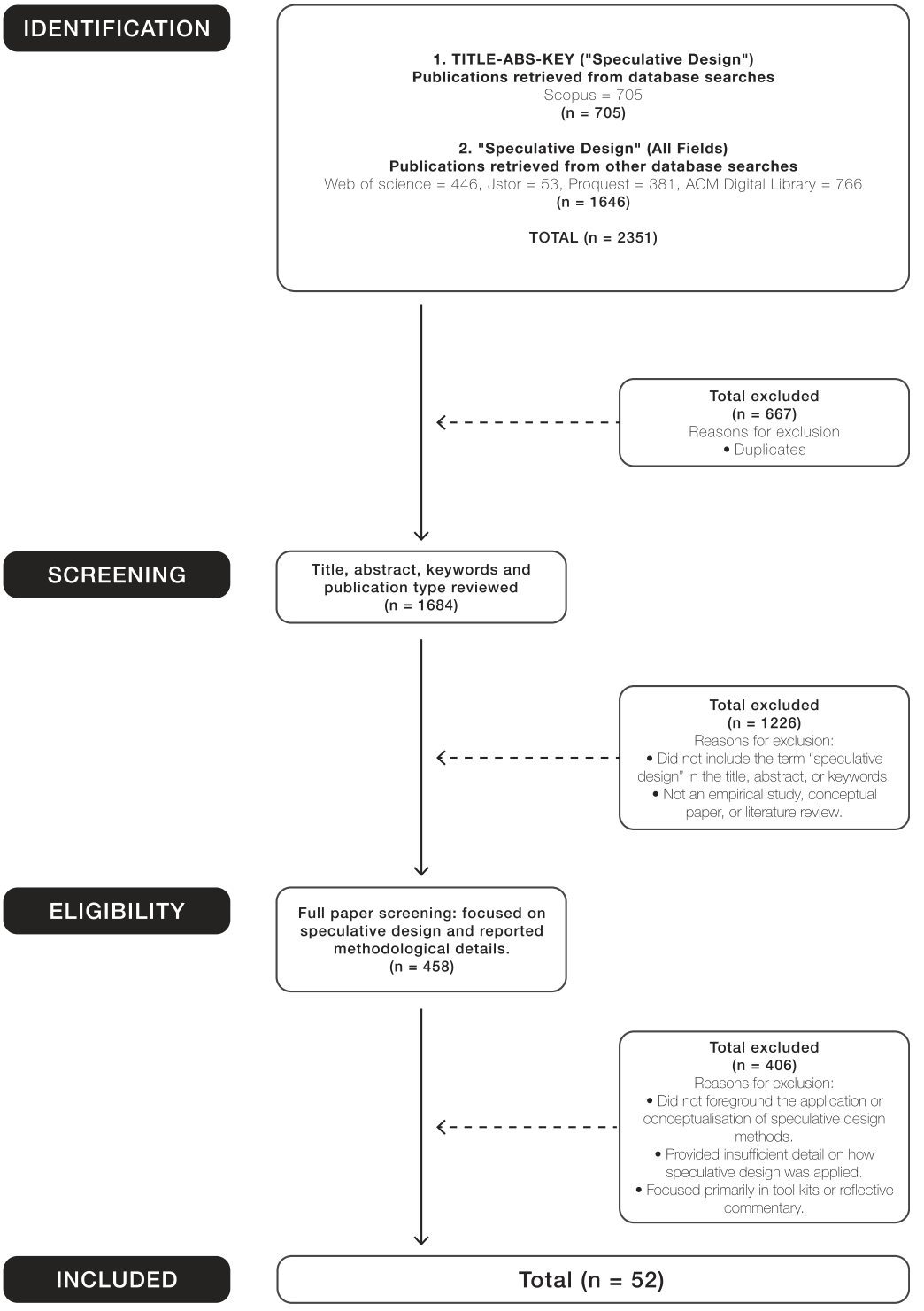

Figure 4. PRISMA flow diagram.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

proposed by Dunne and Raby (2013), was intended to broaden and encompass a range of future-oriented critical practices. However, for the purpose of this review, we included only studies where the authors explicitly used the term 'speculative design' to describe their work. This decision was methodological rather than conceptual, aiming to reduce ambiguity during the screening process and maintain a consistent dataset. While there is ongoing debate and diverse perspectives around how speculative design should be defined and how it relates to similar practices, this review does not aim to resolve those conceptual boundaries. Instead, our scope focuses on exploring the processes and methods used by researchers who explicitly framed their work as speculative design.

Given the varying capabilities of each database, the search strategy was adapted accordingly. While Scopus supports simultaneous field-specific queries across title, abstract and keywords, other databases, such as Web of Science, JSTOR, ProQuest and ACM Digital Library, offer different search filtering options. To maximise the retrieval breadth of publications using the term *'speculative design'* and help reduce the likelihood of retrieving duplicates from separate field-specific searches, the search in these databases was conducted across all available fields (Table 2).

Additionally, several parameters were applied to refine the dataset, including date, type of publication, quality of publication and language (Table 3). Given that the field of speculative design is still emerging, no date range was included in the search to capture all available sources at the time of the search (June 2024). The earliest included publication was from 2013, which reflects when academic interest in speculative design began to grow in a more systematic and methodologically explicit way. Primary sources such as articles, case studies and conference papers

Table 2. Term search query for databases

Database	Search query	Fields queried
Scopus	TITLE-ABS-KEY ('speculative design')	Title, Abstract, Keywords
Web of Science	'Speculative design'	All fields
JSTOR	'Speculative design'	All fields
ProQuest	'Speculative design'	All fields
ACM Digital Library	'Speculative design'	All fields

Table 3. Additional parameters of the search

Searching criteria	Description
Date	The search does not have a date range parameter to capture all available sources at the time of the search (June 2024)
Type of publication	Publications must be primary sources such as articles, case studies, and conference papers. However, literature reviews and books were also included
Quality of publication	Publications must be peer-reviewed
Language	Publications must be in the English language

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

were included, as were literature reviews and books to include summaries and interpretations. To meet academic standards of quality and reliability, the search was filtered to include only peer-reviewed publications. Lastly, to avoid misinterpretations due to language barriers, the search was restricted to works published in English.

The search yielded a total of 2351 references, drawn from the following databases: Scopus (n = 705), Web of Science (n = 446), JSTOR (n = 53), ProQuest (n = 381) and ACM Digital Library (n = 766). After removing 667 duplicate publications, the dataset was reduced to 1684 publications, which were then subjected to the screening phase.

3.2 Screening

During the screening phase, 1684 publications were assessed based on two specific inclusion criteria: (1) the term 'speculative design' had to appear in the title, abstract or keywords of the publication and (2) the publication had to be classified as either empirical studies, conceptual papers or literature reviews. The first criterion confirmed that sources explicitly framed their work as speculative design, promoting consistency in the dataset and reducing ambiguity during the analysis. The second criterion permitted an exploration of speculative design from three different methodological perspectives: empirical studies include practical applications of speculative design; conceptual papers offer theoretical insights; and literature reviews synthesise and summarise existing bodies of knowledge. Together, these three approaches contribute to a well-rounded analysis of the field. At the end of this phase, 1226 publications that did not meet these criteria were excluded, leaving a total of 458 publications for the full-text review and eligibility phase.

3.3. Full-text review and eligibility

In the full-text review phase, 458 publications were assessed based on the following inclusion criteria (Table 4):

(1) Publications must focus on the *application or conceptualisation of speculative design methods*. In empirical studies, publications should demonstrate the practical application of speculative design methods, even when the term is used as an umbrella for related approaches such as design fiction or critical design. In conceptual papers, publications should explore and theorise the application of speculative design, providing new insights, frameworks or models that explain how this design approach can be or has been applied. In literature reviews, publications should critically analyse existing works that focus on the application of speculative design, summarising its application and drawing connections between different applications. Publications that mentioned speculative design without foregrounding its application were excluded.
(2) Publications must provide *details about the process* of how speculative design was applied. Publications lacking sufficient detail about the process were excluded (i.e., brief or null description of how they were conducted). In doing this, publications must engage with a practical or theoretical application of speculative design. For example, works that primarily focused on developing toolkits or publications that concentrated solely on reflective commentary were excluded.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 4. Eligibility criteria for the full-text review

Criterion	Inclusion	Exclusion
Focus	Publication focuses on the application or theorisation of speculative design methods	Speculative design is only mentioned without foregrounding its application
Detail	Publication must provide sufficient details about how speculative design was applied	Brief or limited descriptions of how speculative design was applied. Focus primarily on isolated elements of speculative design, such as the development of toolkits to prompt imaginative thinking or reflective commentary on prototypes that overlook the process by which they were created.

After applying the inclusion criteria, 406 references were excluded, leaving a total of 52 publications eligible for data analysis and synthesis (see Appendix for the full list of included studies).

3.4. Data inclusion, analysis and synthesis

Inductive thematic analysis was conducted on the 52 eligible publications to identify the core constructs of the speculative design process, following the six steps described by Braun and Clarke (2006). This offered a flexible, systematic framework for identifying, analysing and reporting patterns (themes) within the identified sources. All selected publications were reviewed by the lead author for immersion in the content. This provided a general understanding of the existing speculative design literature, with a particular emphasis on its processes. In this initial stage, notes were taken to capture initial thoughts on potential codes, with a primary focus on identifying any related speculative design activities mentioned in the sources, whether explicit or implicit. The coding stage involved identifying and labelling sections of the text that referred to specific aspects of the speculative design process, informed by the notes. An inductive (data-driven) approach was employed to guarantee coverage of relevant themes, allowing themes to emerge directly from the data. This coding formed the foundation for identifying the commonalities in the phases involved in the speculative design process. NVivo qualitative data analysis software was used to support this systematic coding.

After coding the data in all the selected publications, broader themes that connect the codes were searched. Codes were grouped into potential themes that reflect potential phases of the speculative design process across the publications. In this phase, six initial themes were identified. The identified themes were reviewed and refined to more accurately represent the data. This process involved re-reading the selected publications to confirm that the themes were supported by the data and to verify that no relevant information was overlooked. Some themes were merged to ensure clarity and focus. The final set of themes was carefully defined and named to ensure each theme accurately reflected its essence within the speculative design process.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 5. Final themes summary

Number of publications	Theme	Definition
52	Selection for speculation	Identifying and reframing complex, hidden or emerging challenges and problems
50	Speculative exploration	Imaginative exploration of reality-alternative scenarios, often with a future focus, using speculative tools
42	Speculative transformation	Development of tangible prototypes and fictional narratives that bring speculative ideas to life.
43	Speculative provocation	Stimulating critical dialogue and challenging assumptions

4. Results

4.1. Themes

Each of the four final themes, Table 5, was carefully described to encapsulate its distinct role within the process. Following Braun and Clarke's (2006) guidelines, the names of themes were selected to be concise, clear and impactful, giving the reader an immediate understanding of their content. Additionally, thorough consideration was given to the naming process to avoid overlaps and maintain specificity, with attention to each theme representing its unique concept.

In the methods section, four main themes were identified within the speculative design process. These themes include:

4.1.1. Selection for speculation

The theme named *selection for speculation*, identified in all 52 included publications, highlights the importance of intentionally identifying and selecting issues for speculation. In speculative design, an 'issue' can refer to a topic of concern, debate or discussion. These issues might not be immediately visible and often diverge from industry and market demands. The findings suggest that narrowing down broad issues into a specific area for exploration is an essential step in guiding subsequent speculative activities.

The included publications reveal four distinct approaches to explicitly selecting a specific issue for speculation, as shown in Table 6. The first approach involved *gaining an understanding of current issues within a specific topic*, commonly entangled with existing complex social, technological or environmental systems, from which one will then be selected. Thirty-one publications followed this approach through activities such as open discussions with stakeholders to help uncover underlying concerns, interaction with objects to explore concepts, raising awareness of potential trends, reviewing existing data, gathering insights directly from participants, walking through urban spaces as a way to identify issues, referencing past experiences, and brainstorming methods to map and focus on an existing issue. For instance, in *What Not to Wear: Exploring Taboos in Clothing Through Speculative Design* (Arora *et al.* 2023), participants reflected on personal experiences with clothing and the taboos associated with it, further prompted by Indian media clips covering these topics. This setting allowed participants to

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

connect with real-world social themes, stimulating reflection on different perspectives and encouraging a specific focus for further exploration.

The second approach to selecting an issue involved *future-oriented questions*, aimed at uncovering issues that do not exist yet but could emerge over time. Thirteen publications employed this approach, using activities such as 'what if' questions to stimulate participants' imagination about possible futures and to reflect on the implications of emerging technologies for society. A representative example of this approach is *Should robots blush?* (Park *et al.* 2021). In the study, participants were invited to imagine a future where robots could get embarrassed in a social environment. This setting prompted participants to wonder about situations that might trigger embarrassment and ways in which it may be displayed in robots. Each participant approached these questions differently, based on their unique interpretations of social norms and future technologies, which helped them select an issue area for further exploration.

In contrast, the third approach, identified in six publications, involved selecting issues based primarily on the researchers' own interests and expertise, often without structured methodologies or external criteria. Whereas the previous approaches centred on gaining understanding, future-oriented questions or analysing existing systems, this approach was instead driven by the researcher's personal curiosity, domain knowledge or prior research experience to frame the speculative inquiry. For instance, Ouzounian, Haworth, and Bennett (2017) employed speculative design as a creative strategy to imagine how social media could inspire new forms of musical interaction, guided largely by their own disciplinary expertise and curiosity.

Finally, the fourth approach concentrated on projecting potential *issues arising from existing systems, values, and beliefs* if they persist. Rather than imagining entirely new scenarios, this approach critically examined current phenomena that were not yet seen as problematic but could pose significant challenges in the future. Two publications used this approach to explore the long-term implications of certain phenomena if they were to continue unchanged. For example, in *On Futuring Body Perception Transformation Technologies: Roles, Goals and Values* (Turmo Vidal *et al.* 2023), participants were prompted to reflect on how technology might transform bodily experience, surfacing hopes and concerns grounded in present-day values and assumptions.

Table 6. Selection for speculation overview

Number of publications	Approach to selecting a speculative issue	References
31	Understanding current issues	
13	*Insights from participants*	Ashby *et al.* 2023; Ringfort-Felner *et al.* 2023; Kafer 2023; Arora *et al.* 2023; Garcia 2023; Phutane *et al.* 2023; Tsekleves *et al.* 2022; Grafström *et al.* 2022; Almohamed *et al.* 2020; Biggs & Desjardins 2020; Nooney & Brain 2019; Gorkovenko & Taylor 2019; Andalibi *et al.* 2018

Continued

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 6. Continued

Number of publications	Approach to selecting a speculative issue	References
7	*Reviewing existing data*	Kolovson *et al.* 2024; Alfrink *et al.* 2023; Thorp *et al.* 2022; Mendez Gonzalez *et al.* 2020; Fox *et al.* 2019; Stals *et al.* 2019, Kozubaev 2016
3	*Potential trends*	Eghtebas *et al.* 2023; Paul Pinto *et al.* 2021; De Haas *et al.* 2019
3	*Walking methods*	Bendor & Lupetti 2024; Marji *et al.* 2023; Kwon *et al.* 2023
2	*Open discussions with stakeholders*	Cho *et al.* 2023; Light 2021
1	*Interaction with objects*	Kaur *et al.* 2022
1	*Referencing past experiences*	Kender & Purgathofer 2022
1	*Brainstorming*	Aljuneidi *et al.* 2024
13	Future-oriented questions	
9	*'What if' questions*	Park *et al.* 2021; Auger 2013, 2014; Dunne & Raby 2013; Barendregt & Vaage 2021; Zolyomi & Snyder 2024; Søndergaard & Hansen 2016; Cassim, Kolkman, & Helmer 2018; Jung *et al.* 2023
4	*Emerging technologies implications*	Lawson *et al.* 2015; Maestre *et al.* 2023; Hohendanner *et al.* 2023; Zhu *et al.* 2024
6	Researchers' interests and expertise	Straand & Jevnaker 2023; Darby *et al.* 2018; Ouzounian *et al.* 2017; Lindström & Ståhl 2023; Di Lodovico 2023; Hollanek & Nowaczyk-Basińska 2024
2	Questioning existing systems, values and beliefs	Hsueh *et al.* 2023; Turmo Vidal *et al.* 2023
52	Total	

4.1.2. Speculative exploration

The *speculative exploration* theme, identified across 50 of the 52 publications, centres on the imaginative process of envisioning fictional, often future-oriented, realities within speculative design. Rather than aiming to predict the future, this theme focuses on envisioning 'what the future could be', embracing fictional futures or worlds that serve as a paramount mechanism to confront the conventionalities of everyday life. These imagined scenarios provide a counterpoint to the existing world, prompting individuals to consider how their lives might change under alternate possibilities. It functions as a space for deep thinking about ethics, political systems, social beliefs, values, fears and hopes, encouraging the re-evaluation of our existing reality through a fresh perspective.

The reviewed publications revealed a variety of activities designed to stimulate the envisioning of fictional realities, as shown in Table 7. One common activity, reported in 18 publications, involved *concept development* of possible technologies, providing a foundation for further exploration. This included thinking about characteristics, functions and societal roles of hypothetical technologies, artefacts

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

or products to explore their integration into everyday life, their potential to disrupt existing systems, or their role in reshaping social dynamics. For instance, Fox *et al.* (2019) analysed existing menstrual tracking applications and legal policies to iterate a range of products that represent the potential implications of intimate data collection practices within legal and administrative contexts. From this exploration, three speculative products were further designed.

Another common activity was *scenario-building techniques*, identified in 16 publications, which offered a concrete context for exploration and enabled participants to consider new possibilities. This approach allows abstract concepts to be situated within the sociocultural, economic, or environmental dimensions of a speculative world, facilitating the visualisation of their impact on everyday life. Unlike brainstorming, which focuses on generating ideas, and concept development, which produces speculative concepts, scenario-building integrates multiple elements into a cohesive vision of a plausible future. A compelling example of this approach is Kozubaev's (2016) work, which explored alternative worlds by building scenarios centred on personal identity and privacy in public spaces. In one scenario, an individual's level of privacy is directly linked to their social and legal status, forcing them to rely on anti-surveillance technologies to remain anonymous. However, the use of such technologies is restricted in certain areas by law, creating tension between individual agency and the regulation of public spaces. This layered scenario allowed participants to explore how surveillance, legal systems and personal identity might intersect in alternative futures.

One way to navigate through fictional worlds is the *cone of possibilities* model, which categorises distinct types of futures. In line with this model introduced earlier, nine publications based their exploration on the cone of possibilities, considering multiple outcomes in probable, preferable and non-preferable futures to help participants imagine different potential scenarios. For example, in *Future of Intimate Artefacts: A Speculative Design Investigation* (Kaur *et al.* 2022), participants were prompted to envision different trajectories of intimacy and technology, explicitly engaging with probable, preferable and non-preferable futures to surface diverse perspectives on how intimate practices might evolve.

Four publications employed *brainstorming methods* to generate ideas about future possibilities. For instance, Almohamed *et al.* (2020) used 'magic machines' workshops with newly arrived Iraqi refugees to stimulate creative thinking about technologies that could address settlement challenges. Participants were encouraged to brainstorm without constraints, using the metaphor of magic to envision radical and imaginative solutions for issues such as language barriers, employment and social integration. This approach fostered divergent thinking and future-oriented ideation, producing a wide range of speculative concepts, from supernatural devices for instant translation to wearable technologies for job training.

Finally, three publications focused on *contrasting futures* (utopian or dystopian), offering a broad spectrum for exploration. Among them, Turmo Vidal *et al.* (2023) employed a speculative design approach to envision body perception transformation technologies in the year 2053, deliberately contrasting utopian and dystopian scenarios. Through workshops and creative exercises, participants developed paired visions to explore tensions between empowerment and control. While one concept was envisioned to enhance well-being and creativity from a utopian perspective, its dystopian counterpart illustrated how the same technology could enforce capitalist control by manipulating emotions and productivity.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 7. Speculative exploration overview

Number of publications	Ways to explore a speculative issue	References
18	Concept development of possible technologies	Zhu *et al.* 2024; Zolyomi & Snyder 2024; Ringfort-Felner *et al.* 2023; Alfrink *et al.* 2023; Lindström & Ståhl 2023; Hsueh *et al.* 2023; Maestre *et al.* 2023; Cho *et al.* 2023; Grafström *et al.* 2022; Fox *et al.* 2019; Andalibi *et al.* 2018; Darby *et al.* 2018; Cassim *et al.* 2018; Ouzounian *et al.* 2017; Søndergaard & Hansen 2016; Lawson *et al.* 2015; Auger 2014, 2013
16	Scenario-building techniques	Bendor & Lupetti 2024; Hollanek & Nowaczyk-Basińska 2024; Straand & Jevnaker 2023; Phutane *et al.* 2023; Kafer 2023; Kwon *et al.* 2023; Hohendanner *et al.* 2023; Marji *et al.* 2023; Arora *et al.* 2023; Park *et al.* 2021; Light 2021; Biggs & Desjardins 2020; De Haas *et al.* 2019; Gorkovenko & Taylor 2019; Nooney & Brain 2019; Kozubaev 2016
9	Cone of possibilities model	Kolovson *et al.* 2024; Ashby *et al.* 2023; Garcia 2023; Di Lodovico 2023; Kaur *et al.* 2022; Barendregt & Vaage 2021; Mendez Gonzalez *et al.* 2020; Stals *et al.* 2019; Dunne & Raby 2013
4	Brainstorming	Aljuneidi *et al.* 2024; Eghtebas *et al.* 2023; Jung *et al.* 2023; Almohamed *et al.* 2020
3	Contrasting futures (utopian and dystopian)	Turmo Vidal *et al.* 2023; Kender & Purgathofer 2022; Paul Pinto *et al.* 2021
50	Total	

This exploration of positive and negative futures underscores how speculative design can reveal both desirable possibilities and cautionary tales for emerging technologies.

4.1.3. Speculative transformation

The theme named *speculative transformation*, identified across 42 of the 52 publications, describes methods to transform speculative abstract concepts into tangible representations. This theme highlights the importance of using prototypes as key media for communicating, engaging and interacting with envisioned ideas and scenarios. This theme also involves the development of narratives that support the plausibility of the speculative prototypes, providing context that makes them more meaningful and relatable to audiences. In speculative design, narratives and prototypes, often referred to as probes, play a significant role by bridging the imagined realities with the current one. By placing probes within the same space as the audience, designers and researchers foster a more vivid and immersive experience. This encounter parallels a visit to a museum, where the audience becomes immersed in the context proposed, engaging with the objects not as products for consumption but as prompts for active imagination and reflection on the potential worlds they represent. The intention is to redirect the focus of design from purely commercial applications to social implications. Consequently, speculative

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

prototypes embrace contradictions, dilemmas, imperfections and cognitive glitches that mirror the complexity of the issues they represent. This approach triggers creative and critical responses, encouraging audiences to interpret the social narratives embedded in the object.

The reviewed publications applied different prototyping methods to materialise the imagined speculative concepts, as shown in Table 8. Among these, 12 publications featured *high-fidelity prototypes*, detailed and polished representations that closely resemble finalised products. Their quality enables plausible and immersive experiences, allowing audiences to engage and interact with speculative concepts as though they were part of our current reality. The work of Biggs and Desjardins (2020) illustrates the value of materialising speculation through physical artefacts. This involves a mechatronic wearable for cyclists that automatically shortens when passing through areas projected to be affected by future sea level rise, illustrating how tangible design can make future scenarios more immediate and experiential. The combination of high-fidelity and embodied interaction immersed users in an imagined future, effectively raising awareness of environmental issues. This tangible experience functions as a 'perceptual bridge' (Auger 2014), linking speculative futures with present-day realities.

In contrast, ten publications featured low-fidelity prototypes using simple, accessible materials to rapidly produce objects that communicate the core ideas of the envisioned concept. For example, Park *et al.* (2021) conducted speculative design workshops where participants created physical models of 'embarrassed robots' from everyday materials such as paper, plasticine, balloons and basic electronics. These low-fidelity prototypes served as tangible provocations, prompting exploration of how robots might express social emotions.

In addition to high and low-fidelity prototypes, the reviewed publications employed a variety of other formats to represent imagined concepts and engage audiences. Ten publications used *audiovisual formats* such as videos, photographs and audio recordings to help audiences visualise and hear the potential impacts of fictional worlds. For instance, Kolovson *et al.* (2024) created three speculative videos to depict future scenarios for sports tracking technologies in U.S. college athletics. These videos combined narrative storytelling, props, and visual effects to dramatise tensions between athlete privacy, performance optimisation and power dynamics, enabling stakeholders to reflect on the ethical and practical implications of emerging technologies.

Five publications created *printed materials* such as catalogues, posters, and magazines, prompting audiences to consider the broader social context of the concepts. Unlike simple conceptual images that often focus on aesthetics and features, these formats go beyond by offering the fictional reality's context, values, and social norms. In *What Not to Wear: Exploring Taboos in Clothing Through Speculative Design* (Arora *et al.* 2023), the topic of clothing taboos is addressed by proposing a futuristic, non-gendered one-piece garment that covers the entire body, including a face mask. Through a series of photographs, the garment was shown not only as a piece of clothing but also within various contexts such as social gatherings, family life and even mourning, suggesting a world where clothing fosters equality but at the cost of personal expression. Although this project did not present the garment to the audience, the photographs effectively provoked discussion and reflection on the social values and implications of such scenarios.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Finally, five publications utilised *digital platforms* to develop websites or applications that offered interactive experiences, enabling audiences to explore both functionalities of the concepts and their implications within imagined settings. While these transformations of speculative concepts are not fully realised physical prototypes, they still serve to bring elements of fictional realities into the present, allowing participants to envision and engage with speculative worlds. One notable case is the study by Lawson *et al.* (2015), which created fictional interactive websites for speculative products. These sites mimicked real-world start-up aesthetics and marketing rhetoric, allowing participants to navigate product pages and critically reflect on the ethical and social implications of pet quantification technologies.

In conjunction with the materialisation of the speculative concepts, 13 of the publications developed *narratives and stories* to contextualise the prototypes, helping audiences immerse themselves in and engage with the speculative realities represented by the prototypes (Lawson *et al.* 2015; Søndergaard & Hansen 2016; De Haas *et al.* 2019; Almohamed *et al.* 2020; Grafström *et al.* 2022; Thorp *et al.* 2022; Alfrink *et al.* 2023; Arora *et al.* 2023; Kafer 2023; Marji *et al.* 2023; Ringfort-Felner *et al.* 2023; Hollanek & Nowaczyk-Basińska 2024; Kolovson *et al.* 2024). These narratives offer context that extends beyond physical prototypes, providing snapshots of the imagined societies, their cultural norms and values. Among these, Ringfort-Felner *et al.* (2023) collaborated with an automotive company to explore

Table 8. Speculative transformation overview

Number of publications	Prototyping methods	References
12	High-fidelity prototypes	Bendor & Lupetti 2024; Zhu *et al.* 2024; Aljuneidi *et al.* 2024; Marji *et al.* 2023; Lindström & Ståhl 2023; Barendregt & Vaage 2021; Biggs & Desjardins 2020; Cassim *et al.* 2018; Søndergaard & Hansen 2016; Auger 2014, 2013; Dunne & Raby 2013
10	Low-fidelity prototypes	Zolyomi & Snyder 2024; Kafer 2023; Ashby *et al.* 2023; Di Lodovico 2023; Kaur *et al.* 2022; Paul Pinto *et al.* 2021; Light 2021; Park *et al.* 2021; Almohamed *et al.* 2020; Ouzounian *et al.* 2017
10	Audiovisual formats (videos, photographs, audio recordings)	Kolovson *et al.* 2024; Cho *et al.* 2023; Arora *et al.* 2023; Phutane *et al.* 2023; Alfrink *et al.* 2023; Mendez Gonzalez *et al.* 2020; De Haas *et al.* 2019; Stals *et al.* 2019; Darby *et al.* 2018; Kozubaev 2016
5	Printed materials (catalogues, posters, magazines)	Ringfort-Felner *et al.* 2023; Thorp *et al.* 2022; Kender & Purgathofer 2022; Tsekleves *et al.* 2022; Fox *et al.* 2019
5	Digital platforms (websites and applications)	Hollanek & Nowaczyk-Basińska 2024; Hohendanner *et al.* 2023; Nooney & Brain 2019; Andalibi *et al.* 2018; Lawson *et al.* 2015
42	Total	

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

the future of self-driving cars. Their study envisioned a fictional world set in 2035 and developed 24 prototypes embedded within detailed stories about societal norms and everyday practices. This narrative-driven approach supported participants in considering how emerging technologies might reshape mobility, well-being and social life, while provoking critical reflection on the ethical and cultural implications of automation.

4.1.4. Speculative provocation

The *speculative provocation* theme, identified across 43 of the 52 publications, highlights the intentionality of speculative design to stimulate critical thinking through debate, discussion and reflection on potential societal, ethical, and behavioural implications of technology. Unlike traditional design approaches, where feedback is often oriented towards product development, speculative design focuses on challenging and questioning existing values and beliefs to uncover problems that might not align with market or industry priorities. The provocation takes the form of a positive critique, employing wishful thinking to enhance current reality by highlighting its weaknesses. Pointing out deficiencies and limitations without corresponding actions to change them could be seen as purposeless. Nevertheless, this inspires a change from within the audience, encouraging their ability to dream, not necessarily of a better or worse future but simply a different one (Dunne & Raby 2013).

Often, participants involved in the activities within this theme are everyday people rather than industry experts and stakeholders, fostering a more inclusive and democratic approach to design. This diversity allows for finding problems that might be overlooked in market-driven processes due to their focus on profitability. By engaging with speculative prototypes, audiences are stimulated to become more critical consumers, demanding more meaningful and ethical outcomes from industry and society. When deliberating sensitive issues, individuals typically participate as citizens, readily considering ethical, social, and moral aspects. However, when assuming the role of consumers, these general beliefs are often set aside, leading to behavioural contradictions. For instance, individuals acting as citizens might be concerned about increasing landfill waste, yet as consumers, they might purchase five coffees per week in disposable cups. This incoherence demonstrates the inherent misalignment between beliefs and actions. Speculative design helps bridge this gap, stimulating reflection through fictional worlds to facilitate critical debates on significant issues that challenge the citizen–consumer dichotomy.

The reviewed publications revealed the implementation of a range of methods that encourage the questioning of current assumptions and collect the audience's thoughts on speculative concepts (Table 9). *Group discussions* featured prominently, with 21 publications facilitating collective critique spaces, where participants engaged in open-ended conversations to collaboratively explore and refine ideas. These discussions were less rigidly moderated, fostering an exploratory environment for collective meaning-making through dialogue and critique. In *Magic Machines for Refugees* (Almohamed *et al.* 2020), the group discussions centred on the challenges refugees face with current technologies and government services in the host community. This approach fostered an atmosphere of openness, allowing refugee participants to freely share their concerns and provide valuable

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

insights into their settlement experiences. This illustrates how speculative design stimulates critical thinking by encouraging reflection and discussion on the societal and ethical implications of technology, helping to identify current problems as well as those that might arise in the future.

In contrast, six publications encouraged *individual reflection* activities, enabling participants to process their thoughts independently. These activities allowed for critical engagement with speculative concepts at one's own pace, offering insights into personal interpretations, emotional responses and cognitive associations that were not influenced by group dynamics. For example, Fox *et al.* (2019) designed the *Vivewell* speculative product catalogue to provoke personal reflection on the future of menstrual tracking. Through this fictional catalogue featuring speculative products, participants were invited to reflect on the futures of intimate tracking, considering the ethical, legal and social implications of pervasive data collection technologies.

Other studies adopted qualitative methods, such as *interviews* and *focus groups*, identified in six publications, to gain deeper qualitative insights into the speculative prototypes. Interviews allowed one-on-one conversations to capture personal reflections, detailed thoughts, and contextualised opinions, while focus groups provided a more structured discussion format for participants to collectively share and shape their interpretations of speculative prototypes. Among these, Biggs and Desjardins (2020) conducted semi-structured interviews with six cyclists to explore their embodied experiences and perceptions of climate change through the speculative wearable prototype *High Water Pants*. These interviews revealed nuanced reflections on seasonal changes, environmental awareness and personal memories tied to local geographies.

A total of five publications utilised a *debate* structure, which differs from group discussions by structuring interactions around opposing viewpoints. This approach encourages participants to present, defend and debate contrasting perspectives, fostering more argumentative and critical engagement. For instance, De Haas *et al.* (2019) introduced a speculative euthanasia-triggering implant as a way to provoke debate around autonomy and end-of-life decisions in dementia. Participants were invited to critically engage with the ethical, legal and emotional dimensions of the scenario, debating whether such a device should exist and who should be responsible for its activation.

Evaluation methods such as surveys and questionnaires were applied in four publications, providing participants with structured feedback on their perceptions of speculative concepts. These tools were particularly useful for gathering systematic responses that could be analysed across participants. Tsekleves *et al.* (2022) exemplify this through their use of surveys to assess responses to speculative transport prototypes designed to support ageing populations in Malaysia. The collected feedback offered nuanced insights into desirability and ethical considerations, informing design refinement and policy discourse.

Finally, the use of *manifestos* was recorded in only one publication (Ashby *et al.* 2023), where participants formalised their reflections in a statement. This method encouraged articulation of a shared vision around the possible implications of emerging technologies, allowing for a collective expression of ideological positions, societal critiques or aspirational futures. The publication involved a speculative design workshop in which artists collaboratively articulated a manifesto on the uncertain futures of AI in creative practice. They developed principles around

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 9. Speculative provocation overview

Number of publications	Provocation methods	References
21	Group discussions	Aljuneidi *et al.* 2024; Bendor & Lupetti 2024; Lindström & Ståhl 2023; Cho *et al.* 2023; Maestre *et al.* 2023; Arora *et al.* 2023; Marji *et al.* 2023; Turmo Vidal *et al.* 2023; Phutane *et al.* 2023; Kafer 2023; Barendregt & Vaage 2021; Light 2021; Park *et al.* 2021; Mendez Gonzalez *et al.* 2020; Almohamed *et al.* 2020; Gorkovenko & Taylor 2019; Nooney & Brain 2019; Søndergaard & Hansen 2016; Auger 2014, 2013; Dunne & Raby 2013
6	Individual reflection	Hollanek & Nowaczyk-Basińska 2024; Garcia 2023; Di Lodovico 2023; Fox *et al.* 2019; Stals *et al.* 2019; Kozubaev 2016
6	Interviews and focus groups	Kolovson *et al.* 2024; Alfrink *et al.* 2023; Ringfort-Felner *et al.* 2023; Grafström *et al.* 2022; Biggs & Desjardins 2020; Lawson *et al.* 2015
5	Debate	Zhu *et al.* 2024; Thorp *et al.* 2022; Paul Pinto *et al.* 2021; De Haas *et al.* 2019; Darby *et al.* 2018
4	Evaluation (surveys and questionnaires)	Jung *et al.* 2023; Hohendanner *et al.* 2023; Kaur *et al.* 2022; Tsekleves *et al.* 2022
1	Manifestos	Ashby *et al.* 2023
43	Total	

authenticity, diversity and the role of AI in artistic processes, reflecting critical engagement and aspirational thinking about the future of art and technology.

4.2. Speculative design in practice

The application of the four core themes was further analysed in the 52 publications to identify their common combinations used by researchers when conducting studies or conceptual work involving speculative design, as shown in Tables 10 and 11. A significant finding is that the majority of publications, representing 67.3% of the total sample, utilised all four identified themes in their speculative design processes. This suggests that covering all four themes is a widely adopted standard within the field. However, exceptions to this norm were identified, with 25% of the publications incorporating three themes and 7.7% of the publications incorporating two themes. 'Speculative transformation' was the most excluded theme, omitted in 19.2% of the publications, followed by 'speculative provocation', which was absent in 17.3% of the publications.

5. Discussion

Through a systematic literature review of 52 publications, this paper has addressed the research question of '*What design phases and/or methods are utilised by researchers when conducting studies or conceptual work involving speculative*

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 10. Themes identified in each publication

Year	Title	Authors	S. S.	S. E.	S. T.	S. P.
2024	Exploring the roles of	Zhu et al.	✓	✓	✓	✓
2024	An emotion translator:	Zolyomi et al.	✓	✓	✓	✗
2024	Using speculative design to	Kolovson et al.	✓	✓	✓	✓
2024	Teaching speculative design	Bendor et al.	✓	✓	✓	✓
2024	Griefbots, deadbots, postmortem	Hollanek et al.	✓	✓	✓	✓
2024	Disclose: negative body-	Aljuneidi et al.	✓	✓	✓	✓
2023	Designing physical and virtual	Kwon et al.	✓	✓	✗	✗
2023	Speaking with my screen	Phutane et al.	✓	✓	✓	✓
2023	Exploring the tensions of	Di Lodovico	✓	✓	✓	✓
2023	Fashion futuring: Intertwining	Garcia	✓	✓	✗	✓
2023	Cripping data visualisations:	Hsueh et al.	✓	✓	✗	✗
2023	It's like with the pregnancy	Maestre et al.	✓	✓	✗	✓
2023	Leading transformation in an	Straand et al.	✓	✓	✗	✗
2023	Articulating (uncertain) AI futures	Ashby et al.	✓	✓	✓	✓
2023	Co-speculating on dark	Eghtebas et al.	✓	✓	✗	✗
2023	Exploring the reflective space	Hohendanner et al.	✓	✓	✓	✓
2023	On futuring body perception	Turmo Vidal et al.	✓	✓	✗	✓
2023	Design fiction in a corporate	Ringfort-Felner et al.	✓	✓	✓	✓
2023	Black mirror: a novel application	Jung et al.	✓	✓	✗	✓
2023	Speculating surveillant futures	Kafer	✓	✓	✓	✓
2023	Contestable camera cars: a	Alfrink et al.	✓	✓	✓	✓
2023	Blueprints of Tomorrow: Co-	Marji et al.	✓	✓	✓	✓
2023	What not to wear: exploring	Arora et al.	✓	✓	✓	✓
2023	Areca: a design speculation	Cho et al.	✓	✓	✓	✓
2023	Un/Making the plastic straw:	Lindström	✓	✓	✓	✓
2022	Future of intimate artefacts: A	Kaur et al.	✓	✓	✓	✓
2022	Exploring the use of speculative	Tsekleves et al.	✓	✗	✓	✓
2022	Insights for educational	Kender et al.	✓	✓	✓	✗
2022	Oskarrr: data-driven design	Thorp et al.	✓	✗	✓	✓
2022	A speculative design approach	Grafström et al.	✓	✓	✗	✓
2021	Should robots blush?	Park et al.	✓	✓	✓	✓
2021	Collaborative speculation:	Light	✓	✓	✓	✓
2021	Speculative design as thought	Barendregt et al.	✓	✓	✓	✓
2021	The creation of dystopias as	Pinto et al.	✓	✓	✓	✓
2020	Magic machines for refugees	Almohamed et al.	✓	✓	✓	✓
2020	High water pants: Designing	Biggs et al.	✓	✓	✓	✓
2020	Participatory construction of	Mendez et al.	✓	✓	✓	✓

Continued

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Table 10. Continued

Year	Title	Authors	S. S.	S. E.	S. T.	S. P.
2019	A 'speculative pasts' pedagogy	Nooney et al.	✓	✓	✓	✓
2019	UrbanIxD: From ethnography to	Stals et al.	✓	✓	✓	✓
2019	Design as a provocation to	De Haas et al.	✓	✓	✓	✓
2019	Vivewell: Speculating near-	Fox et al.	✓	✓	✓	✓
2019	Audience and expert perspectives	Gorkovenko et al.	✓	✓	✗	✓
2018	Not alone: Designing for self-	Andalibi et al.	✓	✓	✓	✗
2018	Speculative requirements:	Darby et al.	✓	✓	✓	✓
2018	Designs for flies + of mice and	Cassim et al.	✓	✓	✓	✗
2017	Speculative designs: Towards	Ouzounian et al.	✓	✓	✓	✗
2016	Stop Nigmas: Experimental	Kozubaev et al.	✓	✓	✓	✓
2016	PeriodShare: A bloody	Søndergaard et al.	✓	✓	✓	✓
2015	Problematising upstream	Lawson et al.	✓	✓	✓	✓
2014	Living with robots: A	Auger	✓	✓	✓	✓
2013	Speculative design: Crafting	Auger	✓	✓	✓	✓
2013	Speculative everything:	Dunne et al.	✓	✓	✓	✓

Table 11. Themes combination overview

Theme combination	Number of publications	%
Four themes (selection for speculation + speculative exploration + speculative transformation + speculative provocation)	35	67.3
Three themes	13	25
Excluding speculative transformation	6	11.5
Excluding speculative provocation	5	9.6
Excluding speculative exploration	2	3.9
Two themes (selection for speculation + speculative exploration)	4	7.7
Total	52	100

design?' The findings reveal some commonalities in how speculative design is applied, despite inconsistencies in the methods and processes guiding its application. While speculative design is dynamic and adaptable, some researchers argue that the absence of a shared framework makes its application unclear (De Haas *et al.* 2019; Tsekleves *et al.* 2022; Ringfort-Felner *et al.* 2023; Bendor & Lupetti 2024; Zhu *et al.* 2024). Despite this, four recurring themes – selection for speculation, speculative exploration, speculative transformation, and speculative provocation – were identified, with 67.3% of the studies covering all four themes. This suggests

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

that these themes represent a widely adopted standard within the field. However, 32.7% of the publications represent an exception to this norm by omitting one or more of these themes, particularly 'speculative transformation' and 'speculative provocation', raising questions about whether these omissions compromise the core purpose of speculative design. This concern is reinforced by the varied definitions found in the literature, many of which highlight transformation and provocation as essential to the critical and imaginative function of speculative design.

The exclusion of 'speculative transformation' may reflect the assumption that intangible outputs, such as descriptions, sketches, and drawings, are often sufficient to stimulate critical thinking about the sociocultural implications of technology. However, these abstract representations rely on participants' imagination, which could lead to different interpretations, potentially impacting the depth and quality of reflection and debate. Conversely, materialising speculative concepts through tangible artifacts can foster a deeper level of engagement, allowing participants to physically interact with these future settings, touching, feeling, and experiencing them, rather than relying solely on imagination (Tsekleves *et al.* 2022). While abstract representations can provide a common basis for discussion, the omission of 'speculative transformation' raises concerns about how well audiences can connect with and critically engage with future scenarios. Without direct interaction with future scenarios – whether tangible, auditory or visual – the immersive and provocative potential of speculative design may be diminished. Similarly, 'speculative provocation' was the second most excluded theme, omitted in 17.3% of the publications. This finding raises the important question of whether projects that do not explicitly engage with provocation and critique can still be considered speculative design. While such projects may use speculative methods like the cone of possibilities or forecasting techniques to explore future scenarios, overlooking speculative design's critical dimension risks reducing the work to mere exploration rather than genuine speculation.

5.1 Reviewing the process of speculative design

The findings from the review indicate a consistent application of a speculative design process that includes all four identified themes: selection for speculation, speculative exploration, speculative transformation and speculative provocation. This process often begins with **selecting** a relevant issue within an area of interest to expand understanding, question aspects of the status quo, or cover diverse topics from societal concerns to emerging technologies. Following this, participants are guided to imagine alternative realities, envision future scenarios and develop speculative concepts in response to the selected issue, enabling them to **explore** the world from new perspectives. By confronting the conventionalities of everyday life, these scenarios offer a counterpoint to the existing world and inspire participants and researchers to envision how the future might unfold in divergent ways. Consequently, the speculative concepts and ideas from the previous phase are often **transformed** into tangible representations, such as prototypes or artefacts, to help participants and researchers to visualise and engage directly with these imagined scenarios. This approach triggers creative and critical responses, encouraging personal interpretations of the social context of the object and its implications within their scenarios. These objects become a form of critique, exposing narrow

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

assumptions, sparking debate, raising awareness, offering new perspectives and inspiring actions regarding the role of products in everyday life. The interaction with these representations **provokes** critical thinking by recognising that our reality is just one of the many modes of existence, enabling a deeper discussion on how such futures might affect values, beliefs and assumptions. This invites participants to confront challenging questions about the ethics, sustainability and societal impact of potential developments.

Some publications suggested a visual representation of the speculative design process, with most aligning with the four identified themes (Figure 5). For instance, Bendor and Lupetti (2024) proposed a seven-phase speculative design program to teach students the application of this practice over a structured seven-week period, with each week dedicated to one phase. The process began with an introduction to speculative design to immerse students in the field, followed by an exploration of the brief to design for urban futures based on the current contexts, values and interests. This *grounded the speculation* and aligned with the 'selection for speculation' theme. Next, futuring activities such as 'the thing from the future' card game and scenario-building exercises helped students *loosen their imagination.* In the fourth phase, students identified and positioned their speculations within a matrix that considered the type of experience they aimed to evoke, whether to raise awareness or anticipate plausible futures, provoke or inspire. These phases align with the 'speculative exploration' theme while also introducing a more intentional approach to exploring possibilities, encouraging students to reflect on the impact of their speculative work. The fifth and sixth phases focused on *developing low and high-fidelity prototypes*, respectively, aligning with the 'speculative transformation' theme. These two stages of prototyping enabled iteration and improvement within the process. Finally, students presented their prototypes in an *exhibition* setting, fostering discussion and reflection, aligning with the 'speculative provocation' theme.

Marji *et al.* (2023) suggested a similar yet slightly shorter six-phase framework to involve participants in visualising future urban settings. The first phase involved *city walks* that encouraged participants to observe and reflect on the current urban context and its challenges. This approach aligns with the 'selection for speculation' theme, as it enabled participants to identify and choose the issues that captured their attention. In the second phase, participants engaged with a series of *'what if' scenarios* that challenged their assumptions about the city and its wicked problems, such as technological dependence, overpopulation and climate change, to prompt the exploration of alternative futures. The third phase centred on brainstorming and *generating speculative concepts* for the city's future. Together, these two phases encouraged the exploration of alternative possibilities, corresponding to the 'speculative exploration' theme. In the fourth phase, participants developed *tangible artefacts* or narratives to represent the speculative concepts previously generated, emphasising the role of objects and the stories they embody, aligning with the 'speculative transformation' theme. In the fifth and sixth phases, participants *presented their artefacts* and narratives to the group and engaged in *collective discussion* and reflection on the potential urban futures explored. This underscores the value of objects and narratives as catalysts for dialogue, aligning with the 'speculative provocation' theme.

Ringfort-Felner *et al.* (2023) applied speculative design within an industry context to explore the potential social implications of future technologies,

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

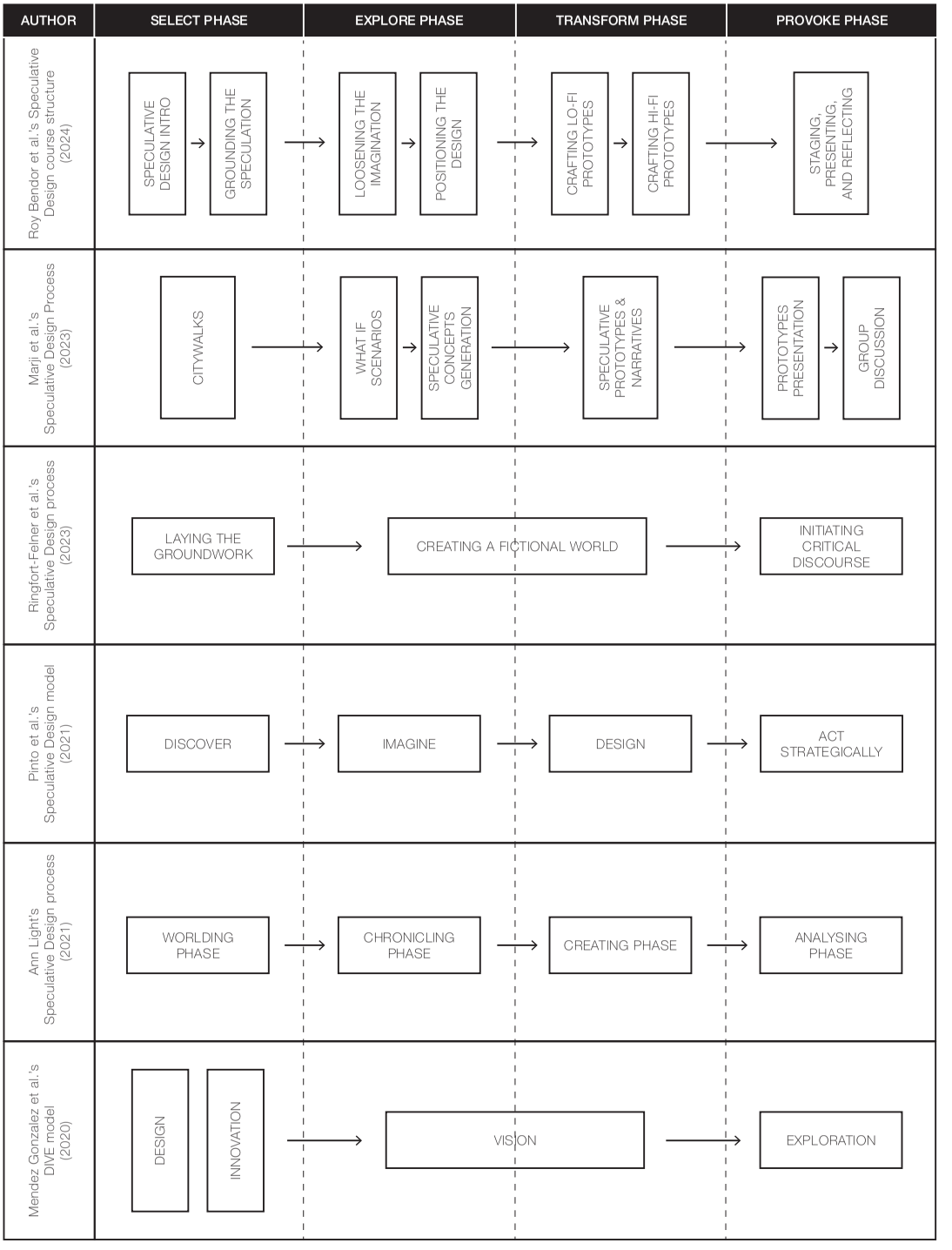

Figure 5. Comparison of different speculative design processes' frameworks.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

especially in self-driving cars. This study highlights the value of design fiction in corporate settings. It introduces the method by recognising the importance of 'speculative design approaches such as design fiction' (p. 2093). It was included in this study as it explicitly contributes to an understanding of speculative design methods, even though its focus is upon design fiction. Distinct from the two previously discussed multi-phase speculative design processes, this empirical study structured the process into three main phases: *laying the groundwork*, *creating a fictional world* and *initiating critical discourse*. The initial phase aimed to establish a shared understanding between academic researchers and industry participants. This involved defining concepts of speculative methods, like design fiction and more importantly, discussing the project objectives and identifying specific aspects of self-driving cars to speculate upon. The second phase involved developing fictional scenarios and extending them into prototypes and narratives. Note that the themes 'speculative exploration' and 'speculative transformation' were grouped in this phase. The process concluded with presenting the speculative outcomes to lay audiences, collecting their insights and assessing the desirability and acceptability of the envisioned futures of autonomous vehicles.

Pinto *et al.* (2021) suggested a four-phase process to explore potential dystopian futures in higher education. In the initial phase, *discover*, participants analysed current trends and identified current challenges within universities, providing a solid foundation for envisioning dystopian futures. During the *imagine* phase, participants envisioned a 2035 dystopian future scenario that reflects the concerns about the potential impacts of identified trends and challenges. In the following phase, *design*, participants created low-fidelity prototypes to represent their future vision, facilitating the discussion and reflection on the potential implications of these futures. In the final phase, the insights from the *reflection and discussion* were used to identify actions that can prevent the realisation of the dystopian future envisioned.

Light (2021) also proposed a four-phase process, but it focused instead on exploring fictional pasts rather than future ones. This process begins with the *worldling* phase by providing participants with a unique and fictional past scenario such as the United Kingdom still committed to the Catholic Church, the absence of a Russian Revolution, the collapse of Silicon Valley into the San Andreas Fault, the Axis Powers winning WW2 and the persistence of Brazilian Rubber Monopoly, discussing their potential impact on the present and selecting an issue to focus on. In the *chronicling* phase, participants trace and narrate events that unfolded from the imagined past to a fictional present. During the *creating* phase, participants made a tangible representation that expresses the values of their fictional present scenario. Finally, the *analysing* phase served as a space for reflection and discussion about the prototype and the world it represented.

Similarly, the DIVE model by Mendez Gonzalez *et al.* (2020) applied a four-step process to explore alternative futures for non-governmental organisations. The DIVE model is a structured design-led process that assists small- and medium-sized enterprises in navigating potential futures. The first step, *design*, focuses on analysing and understanding the present to identify an area of interest that can lead to meaningful contributions. The second step, *innovation*, considers potential external context factors such as political, social, and economic, that may shape the organisation's future. Note that the first steps together align with the 'selection for speculation' theme due to their analytical focus on the organisation's internal

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

and external factors, respectively. The third step, *vision*, involves the creation of a future-oriented statement that describes what the organisation aims to achieve in the future. This vision is later materialised into prototypes, sketches and narratives that help visualise these futures. Note that the 'speculative exploration' and 'speculative transformation' themes were grouped in this step. The last step, *exploration*, engages participants in discussions about the envisioned futures, allowing refinement of ideas and strategies.

Despite the unique structuring of each speculative design process, notable similarities emerge across the reviewed studies, highlighting a consistent methodological engagement with the four identified core themes. This reflects a shared understanding of speculative design as a process that, in general, produces reflective, imaginative and discursive forms of knowledge (Auger 2013; Dunne & Raby 2013; Malpass 2017). Although speculative design was not originally developed as a research method, its adoption across disciplines such as urban planning, human–computer interaction, fashion and healthcare demonstrates its increasing value as a tool for generating research insights. The kind of knowledge it generates when used in research is often experiential, as participants engage through imagining, making or immersing themselves in future possibilities, valuing lived and embodied knowledge (Biggs & Desjardins 2020; Ringfort-Felner *et al.* 2023). It is also discursive, as it stimulates interpretation, debate, and reflection, making it particularly relevant for exploring meanings and values (Auger 2013; Dunne & Raby 2013; De Haas *et al.* 2019; Almohamed *et al.* 2020). Finally, it is propositional, as it presents potential (un)preferred future scenarios that serve to question existing norms and reveal new ways of (not) being (Kaur *et al.* 2022; Turmo Vidal *et al.* 2023). Compared to other contexts, such as artistic provocation or activist engagement, which often prioritise open-ended expression or social disruption, or commercial foresight, which typically seeks actionable, strategic, and predictive insights, research-oriented speculative design places greater emphasis on engaging participants in imagining future possibilities and engaging in critical reflections grounded in context-specific concerns (Dunne & Raby 2013), functioning as a generative and analytical tool within research. Speculative design, when used as a research method (and potentially in other contexts like industry), benefits from being supported by a clear structure or framework that provides greater methodological rigour that satisfies standards of transparency and reproducibility (De Haas *et al.* 2019; Tsekleves *et al.* 2022; Ringfort-Felner *et al.* 2023; Bendor & Lupetti 2024; Zhu *et al.* 2024). A structured process can help both designers and non-designers to systematically navigate complex, abstract and often unfamiliar topics through future scenarios to provoke critical thinking, facilitating consistent generation of experiential, discursive and propositional knowledge.

5.2. Synthesising a framework for communicating the core of speculative design

The recurring presence of all four themes suggests they represent core phases of the speculative design process, which ideally includes each of them (Figure 6). The select phase focuses on identifying and framing complex, hidden or emerging issues; the explore phase enables imaginative exploration of the past, future or alternative realities, the transform phase involves developing tangible prototypes and fictional narratives that bridge speculative ideas with the current reality and the

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

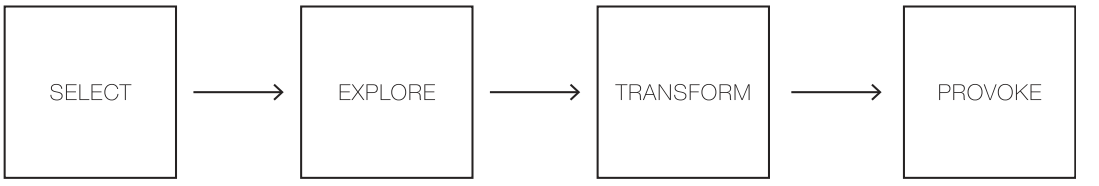

Figure 6. Speculative design process.

provoke phase fosters critical reflection and discussion essential to speculative design. This alignment across definitions implies that these interconnected phases form the core structure of a speculative design process, each one essential for expanding the problem space.

These four core phases can be further synthesised in a framework that visually represents the speculative design process. Based on Stachowiak's (1973) work on general model theory, the development of this framework should consider the three foundational characteristics of a model, which are mapping, reduction and pragmatism. *Mapping* focuses on a representation of something in reality, *reduction* involves simplifying it and including only relevant features, making the model more understandable, and *pragmatism* concentrates on the specific purpose or function of the model, making it applicable to certain contexts but not necessarily in others. The widely adopted Double Diamond framework (The British Design Council 2005) is an example of the application of these three characteristics. The Double Diamond represents the problem-solving design process (mapping), showcasing four phases that together enable the exploration of a problem and its solution, disregarding the specific activities within each phase (reduction). The Double Diamond was created to facilitate people outside the design field to understand the intricacies of the design process and to establish consistency in the designerly problem-solving approach (pragmatism). The Double Diamond highlights the practical and representational nature of design thinking and lays a foundation for how models can serve as tools for the explanation and exploration of the design domain.

For speculative design, *mapping* involves structuring the interconnection of the four identified sequential core phases – select, explore, transform and provoke. This sequence serves as a roadmap to guide designers and non-designers through the highly diverse speculative design journey, moving from identifying an issue to encouraging critical reflection. *Reduction* focuses on defining the objective of each core phase without suggesting specific design methods or tools, allowing flexibility for practitioners to adapt based on the issue's unique context and their preferences about the methods to use in each phase. This aligns with the notion of speculative design as an umbrella term that combines several methods and practices with the aim to imagine alternative worlds, emphasising its open approach over prescriptive techniques (Mitrović *et al.* 2021). For instance, in the explore phase, one might choose to use the 'cones of possibilities' model, while another might prefer the 'thing from the future' card game or counterfactual scenarios. Although the methods and tools may vary, all options allow exploring issues from an imaginative perspective unconstrained by present-day realities. Finally, *pragmatism* highlights the framework's purpose to represent the intricacies of speculative design in a way that facilitates its comprehensiveness and adoption, particularly in research contexts,

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

by both designers and non-designers alike, thereby broadening its accessibility and relevance.

The speculative design framework should not only be limited to representing the consequential phases of its process, but it should also indicate the thinking mode required for each phase, akin to the Double Diamond. These thinking modes are divergent thinking and convergent thinking. Divergent thinking focuses on expanding boundaries and understanding, while convergent thinking involves synthesising, analysing, framing and selecting options (Goldschmidt 2016). This systematic shift between these two thinking modes allows designers and non-designers to strategically expand and constrain their decision-making throughout the process. Based on this understanding, the select and transform phases can be categorised as convergent thinking, while the explore and provoke phases can be considered as divergent thinking. The select phase concentrates on narrowing down the multiple possibilities of reality, identifying and framing a clear and specific issue that will anchor subsequent phases. Similarly, the transform phase focuses on selecting and refining ideas from the previous phase, translating some of the abstract concepts into tangible representations. On the other hand, the explore phase encourages the generation of a wide range of ideas from multiple perspectives, while the provoke phase stimulates critical reflection, discussion, and debate, prompting diverse responses and insights from different angles. This pattern of diverging and converging activities also resonates with the approach suggested by Ann Light (2021) in the speculative design process (Figure 7).

Based on the findings, a speculative design framework, named the i*nverted double diamond*, emerged as a way to synthesise and reflect the core phases and modes of thinking inherent in this design approach (Figure 8). The framework visually reflects the role of speculative design as the 'Side B' to traditional design practices, adopting a mirrored double diamond structure that contrasts with the problem-solving focus of affirmative design (Dunne & Raby 2013). While the inverted double diamond is grounded in insights from the speculative design literature, its application can extend to related approaches that share a similar focus on problem exploration, such as design fiction, critical design, speculative enactments and material speculation. However, the emphasis and execution of

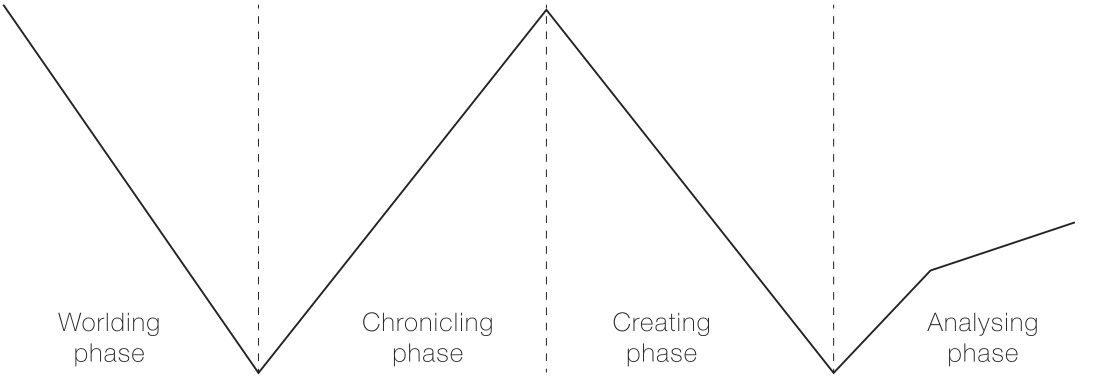

Figure 7. Adaptation from Ann Light's Pattern of diverging and converging activities in the speculative design process, 2021.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

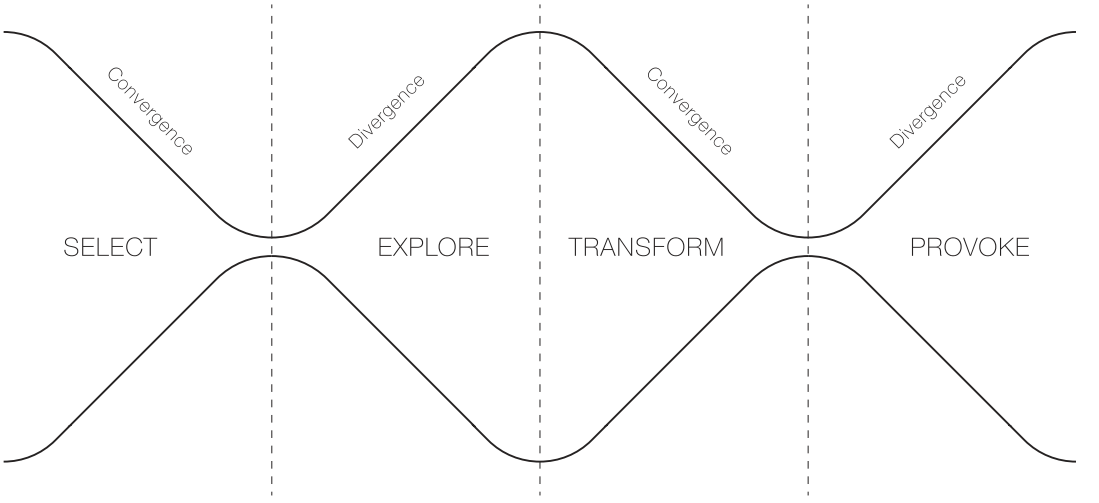

Figure 8. Inverted Double-Diamond Framework.

each phase may vary depending on the specific goal of each approach. For instance, in design fiction, the explore and transform phases may be more prominent, focusing on generating diverse plausible futures and building compelling narratives and worlds around probes to provide rich contextual grounding. In contrast, critical design may foreground the provoke phase, emphasising how probes challenge dominant norms and stimulate ethical or philosophical reflection. Speculative enactments may blur the boundaries between the transform and provoke phases, happening simultaneously, as participants are immersed in performing scenarios that unfold through lived interaction. Material speculation or fictional objects may centre more heavily on the transform phase, creating objects that reflect potential realities or alternative futures as tools for critical reflection. We do not suggest that the inverted double diamond prescribes a universal process for all speculative, future-oriented or fictional practices; rather, it proposes a flexible structure that can be interpreted and adapted according to the related approach and the intentions of the practitioner, designer or researcher, while still maintaining a shared conceptual foundation.

The inverted double diamond offers a way to conceptualise the speculative design process, facilitating its understanding and adoption for a wider range of stakeholders, designers and non-designers alike, across diverse industries, who are interested in problem exploration and strategic planning of emerging issues (Auger 2013). For practitioners, a structured framework could provide clearer methods for integrating speculative design approaches into design workflows, making it easier to apply speculative design in industry contexts. For policy-makers, it could serve as a tool to anticipate and evaluate the societal impact of emerging technologies, offering a structured manner to explore long-term implications and ethical considerations. For educators and researchers, a well-defined framework could support teaching and academic inquiry, enabling more consistent application in education and research. Addressing this gap offers an opportunity for speculative design to be more consistently applied and

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

understood, enhancing its relevance and impact on industry, academia and policymaking.

6. Conclusion

This paper has addressed the research question of '*What design phases and/or methods are utilised by researchers when conducting studies or conceptual work involving speculative design?*' It has used a systematic literature review to investigate the purpose and process of speculative design. By exploring the common phases and methods used in speculative design, it has identified four core themes – selection for speculation, speculative exploration, speculative transformation and speculative provocation – that consistently appear across speculative design applications. These findings were synthesised to propose the inverted double diamond framework as a visual representation of the speculative design process. The proposed framework begins with the 'select' phase, focusing on a specific issue, often complex, hidden or emerging. This is followed by the 'explore' phase, which encourages examining the issue from multiple perspectives, often future-oriented, that extend beyond the constraints of current reality. Insights and ideas generated in this phase are then transformed into physical representations in the 'transform' phase, bridging speculative scenarios with present realities. Finally, in the 'provoke' phase, these speculative artefacts, often referred to as 'probes', stimulate critical thinking, challenging and questioning established norms, beliefs and values. The inverted double diamond framework offers a clear foundation for the speculative design process while respecting its adaptability. In doing so, it helps to mitigate the ambiguity surrounding speculative design's practice.

A significant finding of this systematic review is that the majority of publications consistently incorporated all four constructs, suggesting a shared and implicit understanding of speculative design's core phases. This finding underpins the proposal of the inverted double diamond framework, which aims to propose a common process for speculative design practices. By offering a simple and clear structure, this framework may serve to provide a better understanding of the process of speculative design. However, this study has some limitations. The inductive coding process used to analyse the publications, while grounded in existing literature, involves a degree of subjective interpretation. Additionally, this review focused exclusively on academic, peer-reviewed literature published in English, which introduces a potential language and regional bias and may limit the representativeness of global speculative design practices. It also only included studies that explicitly used the term 'speculative design', leaving out of scope work that may employ related approaches such as critical design, design fiction, among others. As such, it may not fully capture how speculative design is applied in industry or other practical contexts, nor the broader conceptual landscape shared across related speculative practices. While this literature review led to the development of the inverted double diamond framework, further research is needed to refine and validate its application, particularly in real-world settings. Future studies could expand the scope to include related approaches that fall under the speculative design umbrella to build a more comprehensive understanding of speculative methods across contexts. Future studies could also explore its implementation outside academia to assess its adaptability, value and impact within industry and organisational contexts.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

In conclusion, this study expands the understanding of speculative design by providing a clear framework for its practical application, addressing a significant gap in the field. By proposing a common ground for its process, speculative design has the potential to become a more widely adopted and valuable tool for problem-finding. This work lays the groundwork for future theoretical and practical advancements in the field, offering a pathway to further integrate speculative design into diverse contexts.

Acknowledgements

This research has been supported by the Queensland Government Department of Transport and Main Roads (TMR) in partnership with the ARC Training Centre for Behavioural Insights for Technology Adoption (IC210100008). We thank Jean Sandall for her valuable contribution to this work. AI-assisted tools were used for language enhancement, with all edits reviewed and approved by the first author.

References

References marked with an asterisk (*) were included in the final systematic review sample.

*Alfrink, K., Keller, I., Doorn, N. & Kortuem, G. 2023 Contestable camera cars: A speculative design exploration of public AI that is open and responsive to dispute. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI 23)*. Association for Computing Machinery. https://doi.org/10.1145/3544548.3580984

*Aljuneidi, S., Gerstenberg, R. & Hassenzahl, M. 2024 DisClose: Negative body-related self-disclosure to mediate intimacy over distance. In *Proceedings of the 35th Australian Computer-Human Interaction Conference (OzCHI 23)*, pp. 114–127. Association for Computing Machinery. https://doi.org/10.1145/3638380.3638391

*Almohamed, A., Zhang, J. & Vyas, D. 2020 Magic machines for refugees. In *Proceedings of the 3rd ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS 20)*, pp. 76–86. Association for Computing Machinery. https://doi.org/10.1145/3378393.3402256

*Andalibi, N., Marcu, G., Moesgen, T., Forte, A. & Mullin, R. 2018 Not alone: Designing for self-disclosure and social support exchange after pregnancy loss. In *Proceedings of the CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery. https://doi.org/10.1145/3170427.3188473

*Arora, S., Kaur, S., Kar, R., Sharma, S. & Eden, G. 2023 What not to wear: Exploring taboos in clothing through speculative design. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23)*, pp. 1–14. Association for Computing Machinery. https://doi.org/10.1145/3563657.3595972

*Ashby, S., Hanna, J., De Rooij, A., Kasprzak, M., Hoekstra, J. & Bos, S. 2023 Articulating (uncertain) AI futures of artistic practice: A speculative design and manifesto sprint approach. In *Proceedings of the 13th Conference on Creativity and Cognition*, pp. 312–318. Association for Computing Machinery. https://doi.org/10.1145/3591196.3596819

*Auger, J. 2014 Living with robots: A speculative design approach. *Journal of Human-Robot Interaction* **3**, pp. 20–42. https://doi.org/10.5898/JHRI.3.1.Auger.

*Auger, J. 2013 Speculative design: Crafting the speculation. *Digital Creativity* **24**, pp.11–35. https://doi.org/10.1080/14626268.2013.767276.

*Barendregt, L. & Vaage, N. S. 2021 Speculative design as thought experiment. *She Ji: The Journal of Design, Economics, and Innovation* **7**, pp. 374–402. https://doi.org/10.1016/j.sheji.2021.06.001.

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

*Bendor, R. & Lupetti, M. L. 2024 Teaching speculative design. *International Journal of Technology and Design Education*. https://doi.org/10.1007/s10798-024-09908-3.

*Biggs, H.R. & Desjardins, A. 2020 High water pants: Designing embodied environmental speculation. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI 20)*, pp. 1–13. Association for Computing Machinery. https://doi.org/10.1145/3313831.3376429

Bosch, T. 2012 Sci-fi writer Bruce Sterling explains the intriguing new concept of design fiction. *Slate*. https://slate.com/technology/2012/03/bruce-sterling-on-design-fictions.html

Braun, V. & Clarke, V. 2006 Using thematic analysis in psychology. *Qualitative Research in Psychology* **3**, pp. 77–101. https://doi.org/10.1191/1478088706qp063oa.

Bray, K. & Harrington, C. 2021 Speculative blackness: Considering Afrofuturism in the creation of inclusive speculative design probes. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference (DIS 21)*, pp. 1793–1806. Association for Computing Machinery. https://doi.org/10.1145/3461778.3462002

Brown, T. & Katz, B. 2011 Change by design. *Journal of Product Innovation Management* **28**, pp. 381–383. https://doi.org/10.1111/j.1540-5885.2011.00806.x.

*Cassim, J., Kolkman, F. & Helmer, M. 2018 Designs for flies + of mice and men: Design approaches to *Drosophila melanogaster*. In *Advances in Experimental Medicine and Biology* **1076**, pp. 289–305. Springer. https://doi.org/10.1007/978-981-13-0529-0_16

*Cho, H., Lee, J., Ku, B., Jeong, Y., Yadgarova, S. & Nam, T.-J. 2023 ARECA: A design speculation on everyday products having minds. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS 23)*, pp. 31–44. Association for Computing Machinery. https://doi.org/10.1145/3563657.3596002

Coulton, P., Burnett, D. & Gradinar, A. 2016 Games as speculative design: Allowing players to consider alternate presents and plausible futures. In *Design Research Society Conference 2016*. Design Research Society. https://doi.org/10.21606/drs.2016.15

*Darby, A., Tsekleves, E. & Sawyer, P. 2018 Speculative requirements: Design fiction and RE. In *Proceedings of the 2018 IEEE 26th International Requirements Engineering Conference (RE 2018)*, pp. 388–393. IEEE. https://doi.org/10.1109/RE.2018.00-20

*De Haas, M., Jun, G.T. & Hignett, S. 2019 Design as a provocation to support discussion about euthanasia: The plug. *Proceedings of the 20th Congress of the International Ergonomics Association (IEA 2018). Advances in Intelligent Systems and Computing* **826**, pp. 137–152. Springer. https://doi.org/10.1007/978-3-319-96065-4_17

*Di Lodovico, C. 2023 Exploring the tensions of self-tracking wearable technologies through design. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* **14011**, pp. 30–46. Springer. https://doi.org/10.1007/978-3-031-35596-7_3

Dorst, K. & Cross, N. 2001 Creativity in the design process: Co-evolution of problem–solution. *Design Studies* **22**, pp. 425–437. https://doi.org/10.1016/S0142-694X(01)00009-6.

*Dunne, A. & Raby, F. 2013 *Speculative Everything: Design, Fiction, and Social Dreaming*. MIT Press.

Dunne, A. & Raby, F. 2009 A/B. (accessed 11 September 24) https://dunneandraby.co.uk/content/projects/476/0.

*Eghtebas, C., Klinker, G., Boll, S. & Koelle, M. 2023 Co-speculating on dark scenarios and unintended consequences of a ubiquitous(ly) augmented reality. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS 23)*, pp. 2392–2407. Association for Computing Machinery. https://doi.org/10.1145/3563657.3596073

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

*Fox, S., Howell, N., Wong, R. & Spektor, F. 2019 Vivewell: Speculating near-future menstrual tracking through current data practices. In *Proceedings of the 2019 Designing Interactive Systems Conference (DIS 19)*, pp. 541–552. Association for Computing Machinery. https://doi.org/10.1145/3322276.3323695

*Garcia, C. C. 2023 Fashion futuring: Intertwining speculative design, foresight and material culture towards sustainable futures. *Futures* **153**. https://doi.org/10.1016/j.futures.2023.103242.

Getzels, J. W. & Csikszentmihalyi, M. (eds.) 1975 From problem solving to problem finding. In *Perspectives in Creativity*. Routledge.

*Gorkovenko, K. & Taylor, N. 2019 Audience and expert perspectives on second screen engagement with political debates. In *Proceedings of the 2019 ACM International Conference on Interactive Experiences for TV and Online Video (TVX 19)*, pp. 70–82. Association for Computing Machinery. https://doi.org/10.1145/3317697.3323352

*Grafström, A., Holmgren, M., Linge, S., Lagerberg, T. & Obaid, M. 2022 A speculative design approach to investigate interactions for an assistant robot cleaner in food plants. In *Adjunct Proceedings of the 2022 Nordic Human-Computer Interaction Conference*. Association for Computing Machinery. https://doi.org/10.1145/3547522.3547682

Goldschmidt, G. 2016 Linkographic evidence for concurrent divergent and convergent thinking in creative design. *Creativity Research Journal* **28** (2), pp. 115–122. https://doi.org/10.1080/10400419.2016.1162497.

Grant, M. J. & Booth, A. 2009 A typology of reviews: An analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal* **26**, pp. 91–108. https://doi.org/10.1111/j.1471-1842.2009.00848.x.

*Hohendanner, M., Ullstein, C., Buchmeier, Y. & Grossklags, J. 2023 Exploring the reflective space of AI narratives through speculative design in Japan and Germany. In *Proceedings of the 2023 ACM Conference on Information Technology for Social Good (GoodIT 23)*, pp. 351–362. Association for Computing Machinery. https://doi.org/10.1145/3582515.3609554

*Hollanek, T. & Nowaczyk-Basińska, K. 2024 Griefbots, deadbots, postmortem avatars: On responsible applications of generative AI in the digital afterlife industry. *Philosophy & Technology* **37**; https://doi.org/10.1007/s13347-024-00744-w.

*Hsueh, S., Vincenzi, B., Murdeshwar, A. & Ciolfi Felice, M. 2023 Cripping data visualizations: Crip technoscience as a critical lens for designing digital access. In *ASSETS 2023 - Proceedings of the 25th International ACM SIGACCESS Conference on Computers and Accessibility*. Association for Computing Machinery. https://doi.org/10.1145/3597638.3608427

Iskander, N. 2018 Design thinking is fundamentally conservative and preserves the status quo. *Harvard Business Review* [online]. Available at: https://hbr.org/2018/09/design-thinking-is-fundamentally-conservative-and-preserves-the-status-quo [Accessed 11 Sep. 24].

Jakobsone, L. 2017 Critical design as approach to next thinking. *Design Journal* **20**, pp. 4253–4262. https://doi.org/10.1080/14606925.2017.1352923.

Johannessen, L., Keitsch, M. & Pettersen, I. 2019 Speculative and critical design — features, methods, and practices. In *Proceedings of the Design Society: International Conference on Engineering Design*, **1**, pp.1623–1632. Cambridge University Press. https://doi.org/10.1017/dsi.2019.168

*Jung, K.S., Makam, N., Jung, S.D., Kim, S. & Kim, S. 2023 Black mirror: A novel application of speculative design to facilitate context-aware design thinking. In *Proceedings of the Design Society*, pp. 787–796. Cambridge University Press. https://doi.org/10.1017/pds.2023.79

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

*Kafer, G. 2023 Speculating surveillant futures past – A case study of the south side speculations project. *Media Practice and Education* **24**, pp. 199–215. https://doi.org/10.1080/25741136.2023.2207869.

*Kaur, J., Devgon, R., Goel, S., Singh, A., Monteiro, K. & Singh, A. 2022 Future of intimate artefacts: A speculative design investigation. In *Proceedings of the 13th Indian Conference on Human-Computer Interaction*, pp. 57–66. Association for Computing Machinery. https://doi.org/10.1145/3570211.3570216

*Kender, K. & Purgathofer, P. 2022 Insights for educational practice from a thematic analysis of student experiences with speculative design mini-projects about personal issues. *Interaction Design and Architecture* **51**, pp. 249–269. https://doi.org/10.55612/s-5002-051-011

Kochanowska, M., Gagliardi, W. & Ball, J. 2022 The double diamond model: In pursuit of simplicity and flexibility. *Springer Series in Design and Innovation 16*, pp. 19–32. Springer. https://doi.org/10.1007/978-3-030-79879-6_2

*Kolovson, S., So, S. & Munson, S.A. 2024 Using speculative design to understand preferred futures for the design and use of tracking data in U.S. college sport teams. In *Proceedings of the ACM on Human-Computer Interaction*, 8. Association for Computing Machinery. https://doi.org/10.1145/3641028

*Kozubaev, S. 2016 Stop Nigmas: Experimental speculative design through pragmatic aesthetics and public art. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction (NordiCHI 16)*. Association for Computing Machinery. https://doi.org/10.1145/2971485.2993921

*Kwon, N., Jacobs, N., Mullagh, L., Cavada, M., Markovic, M., Wainwright, B., Chekansky, K. & Cooper, R. 2023 Designing physical and virtual walkshop methods for speculative Internet of Things research. In *Springer Series in Design and Innovation*, pp. 392–405. Springer. https://doi.org/10.1007/978-3-031-20364-0_34

*Lawson, S., Kirman, B., Linehan, C., Feltwell, T. & Hopkins, L. 2015 Problematising upstream technology through speculative design: The case of quantified cats and dogs. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI 2015)*, pp. 2663–2672. Association for Computing Machinery. https://doi.org/10.1145/2702123.2702260

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J. & Moher, D. 2009 The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology* **62**, pp. 1–34. https://doi.org/10.1016/j.jclinepi.2009.06.006.

*Light, A. 2021 Collaborative speculation: Anticipation, inclusion and designing counterfactual futures for appropriation. *Futures* **134**. https://doi.org/10.1016/j.futures.2021.102855.

Lindley, J. & Green, D. P. 2021 The ultimate measure of success for speculative design is to disappear completely. *Interaction Design and Architecture* **51**, pp. 32–51. https://doi.org/10.55612/s-5002-051-002.

*Lindström, K. & Ståhl, Å. 2023 Un/making the plastic straw: Designerly inquiries into disposability. *Design and Culture* **15**, pp. 393–415. https://doi.org/10.1080/17547075.2023.2187080.

*Maestre, J.F., Groves, D.V., Furness, M. & Shih, P.C. 2023 "It's like with the pregnancy tests": Co-design of speculative technology for public HIV-related stigma and its implications for social media. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems.* Association for Computing Machinery. https://doi.org/10.1145/3544548.3581033

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Maher, M. L. & **Poon, J.** 1996 Modeling design exploration as co-evolution. *Computer-Aided Civil and Infrastructure Engineering* **11**, pp. 195–209. https://doi.org/10.1111/j.1467-8667.1996.tb00323.x.

Malpass, M. 2017 *Critical Design in Context: History, Theory, and Practices*. Bloomsbury Academic.

Malpass, M. 2013 Between wit and reason: Defining associative, speculative, and critical design in practice. *Design and Culture* **5**, pp. 333–356. https://doi.org/10.2752/175470813X13705953612200.

*__Marji, N.__, **Thibault, M.** & **Shawash, J.** 2023 Blueprints of tomorrow: Co-designing speculative urban futures. In *Proceedings of the 26th International Academic Mindtrek*, pp. 305–308. Association for Computing Machinery. https://doi.org/10.1145/3616961.3616980

Mazé, R. & **Redström, J.** 2009 Difficult forms: Critical practices of design and research. *Research in Design Journals* **1**, pp. 28–39.

*__Mendez Gonzalez, P.A.__, **Castañeda Mosquera, S.**, **Bernal Tinjaca, M.P.**, **Mejía Sarmiento, R.**, **Morales Rubio, R.A.**, **Giraldo Manrique, J.C.** & **Baquero Lozano, S.** 2020 Participatory construction of futures for the defense of human rights. In *Proceedings of the 16th Participatory Design Conference 2020 – Participation(S) Otherwise – Volume* **2**, *(PDC 20)*, pp. 10–16. Association for Computing Machinery. https://doi.org/10.1145/3384772.3385155

Mitrović, I. 2015 *Introduction to Speculative Design Practice – Eutropia, a Case Study*. 1.0 ed. Croatian Designers Association; Split: Arts Academy, University of Split.

Mitrović, I., **Auger, J.**, **Hanna, J.** & **Helgason, I.** 2021 *Beyond Speculative Design: Past – Present – Future*. Speculative Edu.

*__Nooney, L.__ & **Brain, T.** 2019 A 'speculative pasts' pedagogy: Where speculative design meets historical thinking. *Digital Creativity* **30**, pp. 218–234. https://doi.org/10.1080/14626268.2019.1683042.

*__Ouzounian, G.__, **Haworth, C.** & **Bennett, P.** 2017 Speculative designs: Towards a social music. In *Proceedings of the 43rd International Computer Music Conference and the 6th International Electronic Music Week (ICMC/EMW 2017)*, pp. 121–126. Michigan Publishing.

*__Park, S.__, **Healey, P.G.T.** & **Kaniadakis, A.** 2021 Should robots blush? In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI 21)*. Association for Computing Machinery. https://doi.org/10.1145/3411764.3445561

*__Phutane, M.__, **Jung, C.**, **Chen, N.** & **Azenkot, S.** 2023 Speaking with my screen reader: Using audio fictions to explore conversational access to interfaces. In *Proceedings of the 25th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 23)*. Association for Computing Machinery. https://doi.org/10.1145/3597638.3608404

Pierce, J. 2021 In tension with progression: Grasping the frictional tendencies of speculative, critical, and other alternative designs. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI 21)*. Association for Computing Machinery. https://doi.org/10.1145/3411764.3445406

*__Pinto, J. P.__, **Ramírez-Angulo, P. J.**, **Crissien, T. J.** & **Bonett-Balza, K.** 2021 The creation of dystopias as an alternative for imagining and materializing a university of the future. *Futures* **134**. https://doi.org/10.1016/j.futures.2021.102832.

Prado de O. Martins, L. 2017 Questioning the "critical" in speculative & critical design. *Parede [online]. Available at:* https://medium.com/a-parede/questioning-the-critical-in-speculative-critical-design-5a355cac2ca4 [Accessed 2 Jul. 25].

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

*Ringfort-Felner, R., Neuhaus, R., Doerrenbaecher, J., Grosskopp, S., Theofanou-Fuelbier, D. & Hassenzahl, M. 2023 Design fiction in a corporate setting – a case study. In *Designing Interactive Systems Conference (DIS 2023)*, pp. 2093–2108. Association for Computing Machinery. https://doi.org/10.1145/3563657.3596126

*Søndergaard, M. L. J. & Hansen, L. K. 2016 PeriodShare: A bloody design fiction. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction (NordiCHI 16)*. Association for Computing Machinery.

Stachowiak, H. 1973 *Allgemeine Modelltheorie*. Springer.

*Stals, S., Smyth, M. & Mival, O. 2019 UrbanIxD: From ethnography to speculative design fictions for the hybrid city. In *Proceedings of the Halfway to the Future Symposium 2019 (HTTF 2019)*. Association for Computing Machinery. https://doi.org/10.1145/3363384.3363486

Stanford d.school. 2018 *Design Thinking Bootleg*. Stanford d.school.

Sterling, B. 2009 Cover story: Design fiction. *Interactions* **16**, pp. 20–24. https://doi.org/10.1145/1516016.1516021.

*Straand, I. & Jevnaker, B. 2023 Leading transformation in an uncertain world: A case for strategic speculative design. In *Proceedings of the European Conference on Management, Leadership and Governance*, pp. 380–387. Academic Conferences International Limited. https://doi.org/10.34190/ecmlg.19.1.1947

The British Design Council 2005 *The Double Diamond: A Universally Accepted Depiction of the Design Process*. The British Design Council.

*Thorp, J., Richards, D., Dunn, N., Gorkovenko, K. & Stead, M. 2022 OSKARRR: Data-driven design speculations for the future of domestic waste. In *With Design: Reinventing Design Modes (IASDR 2021)* (ed. G. Bruyns & H. Wei), pp. 2821–2835. Springer. https://doi.org/10.1007/978-981-19-4472-7_182.

Tonkinwise, C. 2014 How we intend to future: Review of Anthony Dunne and Fiona Raby, *Speculative Everything: Design, fiction, and social dreaming*. *Design Philosophy Papers* **12**, pp.169–187. https://doi.org/10.2752/144871314X14159818597676.

*Tsekleves, E., Lee, C. A. L., Yong, M. H. & Lau, S. L. 2022 Exploring the use of speculative design as a participatory approach to more inclusive policy identification and development in Malaysia. *Design Studies* **81**. https://doi.org/10.1016/j.destud.2022.101118.

Tsekleves, E., Yong, M. H., Lee, C. A. L., Giga, S., Hwang, J. S. & Lau, S. L. 2019 Rethinking how healthcare is conceptualised and delivered through speculative design in the UK and Malaysia: A comparative study. *Design Journal* **22**, pp. 429–444. https://doi.org/10.1080/14606925.2019.1595430.

*Turmo Vidal, L., Manuel Vega-Cebrian, J., D'Adamo, A., Roel Lesur, M., Mahdi Dehshibi, M., Diaz Duran, J.R. & Tajadura-Jimenez, A. 2023 On futuring body perception transformation technologies: Roles, goals and values. In *Proceedings of the 26th International Academic Mindtrek*, pp. 169–181. Association for Computing Machinery. https://doi.org/10.1145/3616961.3616991

*Zhu, L., Wang, J. & Li, J. 2024 Exploring the roles of artifacts in speculative futures: Perspectives in HCI. *Systems* **12**, 194. https://doi.org/10.3390/systems12060194.

*Zolyomi, A. & Snyder, J. 2024 An emotion translator: Speculative design by neurodiverse dyads. In *Proceedings of the Conference on Human Factors in Computing Systems (CHI 24)*. Association for Computing Machinery. Association for Computing Machinery. https://doi.org/10.1145/3613904.3642210

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Appendix

Summary table: Included studies

Year	Title	Authors	Paper Type	Source Type
2024	Exploring the Roles of Artifacts in Speculative Futures: Perspectives in human–computer interaction	Zhu et al.	Literature review	Journal
2024	An Emotion Translator: Speculative Design by Neurodiverse Dyads	Zolyomi et al.	Empirical	Conference Proceedings
2024	Using Speculative Design to Understand Preferred Futures for the Design and Use of Tracking Data in U.S. College Sport Teams	Kolovson et al.	Empirical	Journal
2024	Teaching speculative design	Bendor et al.	Conceptual	Journal
2024	Griefbots, Deadbots, Postmortem Avatars: on Responsible Applications of Generative AI in the Digital Afterlife Industry	Hollanek et al.	Conceptual	Journal
2024	DisClose: Negative Body-Related Self-Disclosure to Mediate Intimacy over Distance	Aljuneidi et al.	Empirical	Conference Proceedings
2023	Designing Physical and Virtual Walkshop Methods for Speculative Internet of Things Research	Kwon et al.	Empirical	Conference Proceedings
2023	Speaking with My Screen Reader: Using Audio Fictions to Explore Conversational Access to Interfaces	Phutane et al.	Empirical	Conference Proceedings
2023	Exploring the Tensions of Self-tracking Wearable Technologies Through Design	Di Lodovico	Conceptual	Conference Proceedings
2023	Fashion futuring: Intertwining speculative design, foresight and material culture towards sustainable futures	Garcia, C.C.	Empirical	Journal
2023	Cripping Data Visualisations: Crip Technoscience as a Critical Lens for Designing Digital Access	Hsueh et al.	Conceptual	Conference Proceedings
2023	'It's like With the Pregnancy Tests': Co-design of Speculative Technology for Public HIV-related Stigma and its Implications for social media	Maestre et al.	Empirical	Conference Proceedings
2023	Leading Transformation in an Uncertain World: A Case for Strategic Speculative Design	Straand et al.	Conceptual	Conference Proceedings
2023	Articulating (Uncertain) AI Futures of Artistic Practice: A Speculative Design and Manifesto Sprint Approach	Ashby et al.	Empirical	Conference Proceedings

Continued

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Continued

Year	Title	Authors	Paper Type	Source Type
2023	Co-Speculating on Dark Scenarios and Unintended Consequences of a Ubiquitous(ly) Augmented Reality	Eghtebas et al.	Empirical	Conference Proceedings
2023	Exploring the Reflective Space of AI Narratives Through Speculative Design in Japan and Germany	Hohendanner et al.	Empirical	Conference Proceedings
2023	On Futuring Body Perception Transformation Technologies: Roles, Goals and Values	Turmo Vidal et al.	Empirical	Conference Proceedings
2023	Design Fiction in a Corporate Setting – a Case Study	Ringfort-Felner et al.	Empirical	Conference Proceedings
2023	Black mirror: a novel application of speculative design to facilitate context-aware design thinking	Jung et al.	Empirical	Journal
2023	Speculating surveillant futures past–a case study of the south side speculations project	Kafer, G.	Empirical	Journal
2023	Contestable Camera Cars: A Speculative Design Exploration of Public AI That Is Open and Responsive to Dispute	Alfrink et al.	Empirical	Conference Proceedings
2023	Blueprints of Tomorrow Co-Designing Speculative Urban Futures	Marji et al.	Empirical	Conference Proceedings
2023	What Not to Wear: Exploring Taboos in Clothing Through Speculative Design	Arora et al.	Empirical	Conference Proceedings
2023	ARECA: A Design Speculation on Everyday Products Having Minds	Cho et al.	Empirical	Conference Proceedings
2023	Un/Making the Plastic Straw: Designerly Inquiries into Disposability	Lindström, K.	Empirical	Journal
2022	Future of Intimate Artefacts: A Speculative Design Investigation	Kaur et al.	Empirical	Conference Proceedings
2022	Exploring the use of speculative design as a participatory approach to more inclusive policy-identification and development in Malaysia	Tsekleves et al.	Empirical	Journal
2022	Insights for Educational Practice from a Thematic Analysis of Student Experiences with Speculative Design Mini-Projects about Personal Issues	Kender et al.	Empirical	Journal
2022	OSKARRR: Data-Driven Design Speculations for the Future of Domestic Waste	Thorp et al.	Empirical	Conference Proceedings
2022	A Speculative Design Approach to Investigate Interactions for an Assistant Robot Cleaner in Food Plants	Grafström et al.	Empirical	Conference Proceedings

Continued

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Continued

Year	Title	Authors	Paper Type	Source Type
2021	Should Robots Blush?	Park et al.	Empirical	Conference Proceedings
2021	Collaborative speculation: Anticipation, inclusion and designing counterfactual futures for appropriation	Light, A.	Empirical	Journal
2021	Speculative Design as Thought Experiment	Barendregt et al.	Conceptual	Journal
2021	The creation of dystopias as an alternative for imagining and materializing a university of the future	Pinto et al.	Empirical	Journal
2020	Magic Machines for Refugees	Almohamed et al.	Empirical	Conference Proceedings
2020	High Water Pants: Designing Embodied Environmental Speculation	Biggs et al.	Empirical	Conference Proceedings
2020	Participatory construction of futures for the defense of human rights	Mendez et al.	Empirical	Conference Proceedings
2019	A 'speculative pasts' pedagogy: where speculative design meets historical thinking	Nooney et al.	Empirical	Journal
2019	UrbanIxD: From Ethnography to Speculative Design Fictions for the Hybrid City	Stals et al.	Empirical	Conference Proceedings
2019	Design as a provocation to support discussion about euthanasia: The plug	De Haas et al.	Empirical	Conference Proceedings
2019	Vivewell: Speculating Near-Future Menstrual Tracking through Current Data Practices	Fox et al.	Empirical	Conference Proceedings
2019	Audience and Expert Perspectives on Second Screen Engagement with Political Debates	Gorkovenko et al.	Empirical	Conference Proceedings
2018	Not Alone: Designing for Self-Disclosure and Social Support Exchange After Pregnancy Loss	Andalibi et al.	Empirical	Conference Proceedings
2018	Speculative requirements: Design fiction and RE	Darby et al.	Empirical	Conference Proceedings
2018	Designs for flies + of mice and men: Design approaches to *drosophila melanogaster*	Cassim et al.	Empirical	Book Chapter
2017	Speculative designs: Towards a social music	Ouzounian et al.	Empirical	Conference Proceedings
2016	Stop Nigmas: Experimental Speculative Design through Pragmatic Aesthetics and Public Art	Kozubaev, S.	Empirical	Conference Proceedings

Continued

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press

Continued

Year	Title	Authors	Paper Type	Source Type
2016	PeriodShare: A Bloody Design Fiction	Søndergaard et al.	Empirical	Conference Proceedings
2015	Problematising Upstream Technology through Speculative Design: The Case of Quantified Cats and Dogs	Lawson et al.	Empirical	Conference Proceedings
2014	Living With Robots: A Speculative Design Approach	Auger, J.	Conceptual	Journal
2013	Speculative design: crafting the speculation	Auger, J.	Conceptual	Journal
2013	Speculative everything: Design, fiction, and social dreaming	Dunne et al.	Conceptual	Book

https://doi.org/10.1017/dsj.2025.10030 Published online by Cambridge University Press