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Teaching speculative design

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Abstract
Speculative design is an emerging form of critical material engagement with possible futures. Designers working speculatively call attention to current and future sociotechnical dilemmas, and aim to provoke debate about the moral, political and ethical implications of sociotechnical innovation. Despite the popularity of speculative design and its presence in a variety of domains, there are very few resources that address it as a pedagogical practice. We attempt to fill this gap by presenting the structure, reasoning and outcomes of a graduate course on speculative design we taught during the academic year 2022-3. The article describes class activities and outcomes, discusses the benefits and challenges of teaching speculative design (especially in a design-engineering program), and concludes by identifying the most considerable obstacles awaiting those who want to integrate speculative design into the curriculum. As such, the article provides a useful resource for those interested in understanding the benefits of speculative design as a critical pedagogical practice, and for those who wish to bring that understanding into the classroom.

Keywords Speculative design · Design education · Social issues · Design politics · Critical pedagogy

Introduction

Speculative design (SD) is an emerging form of critical material engagement with possible futures. What makes it a distinct designerly practice is the way it approaches the future not as a subject of prediction but as a space of critique, offering experience of possible futures as means to provoke questions about the direction society is heading in, considerations of alternative paths, and deeper understandings of the consequences of any given future trajectory. The goal of SD, therefore, is to call attention to (or anticipate) future sociotechnical

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dilemmas and stir debates about the social, political, moral and ethical implications of scientific and technological innovation. More broadly, SD asks about "the kinds of futures people really want" (Dunne & Raby, 2013, p. 6), offering designers ways to engage audiences in acts of "social dreaming" (p. 189).

The popularity of SD, as evident in its presence in a variety of domains and sectors, makes it easy to forget that it was consolidated as a pedagogical practice to begin with. Many of the examples that illustrate SD in foundational texts by Dunne and Raby (2013) and Auger (2013) were created as part of the curriculum at the Royal College of Art (RCA) and elsewhere, and even the most recent attempt to define the state of the art in the field (Mitrović et al., 2021) took place within speculativeEDU, a European project with a clear pedagogical purpose. To a large extent, then, designing speculatively is wedded to the teaching of design as a future-oriented practice sensitive to power relations. As such, there are deep affinities between teaching SD and other critical pedagogical practices within design studies (Keirl, 2017; van Amstel & Gonzatto, 2020), futures studies (Barendregt et al., 2024; Facer & Sriprakash, 2021), and beyond (Freire, 1970; Giroux, 2020). Despite this fact of origin, there are very few resources that address teaching SD (Encinas et al., 2023). Even speculative design work that was created as part of a learning trajectory, when presented in design publications, appears disconnected from the learning processes that led to its production. So while the pedagogical benefits of SD are increasingly recognized (Encinas et al., 2023; Helgason et al., 2019, 2020), the question of how to actually teach SD lags behind.

No doubt part of the difficulty of suggesting how to teach SD has to do with the way the field itself is dynamic, diverse, "messy" and heterogeneous (Encinas et al., 2023; Lindley & Green, 2022). It is also quite intuitive to simply extend the benefits of SD as a *design* practice to SD as a *pedagogical* practice, essentially treating the two as a single phenomenon. However, we also detect a persistent reluctance by those active in the field to provide much beyond general guidelines for how to engage with SD from a pedagogical perspective. Lindley and Green (2022), for instance, warn that attempts to formalize SD would ultimately lead to the decline of its utility, and Encinas et al. (2023) insist that their contribution should not be framed "as a guide or a recipe in itself" (p. 5) because they do not want to "over-determine" how their suggestions can be applied (p. 2). As a consequence, while the literature provides recommendations for SD emphases (Lindley & Green, 2022), productive tensions (Encinas et al., 2023), tactics (Auger, 2013; Malpass, 2017), and evaluation metrics (Eriksson et al., 2022), there are only a few suggestions for SD curricula (Beach & Fox, 2022; Culén & Stevens, 2022; Kuijer & Robbins, 2022; Tost et al., 2022).

While we agree that SD should not be fixed into a set of rigid rules, and its application should always be situated and contextualized, we find that keeping a certain degree of vagueness may not necessarily promote the practice but merely add to its mystique and thus reinforce the reasons why some outside of the field find it to be too abstract. Our aim, then, is not to suggest an/the ultimate way to teach SD but instead to describe our efforts with enough detail to allow others to get a sense of how SD can be taught and thus help promote a conversation about SD as a pedagogical practice in more concrete, transferable and impactful ways. For this purpose we describe the structure, rationale and outcomes of a masters-level course on SD we taught in the Fall semester (Sept.-Nov.) of the academic year 2022-3. We start by engaging with the benefits of teaching SD as argued in the relevant literature, and then we describe in detail the course itself. Next we provide an analysis of course outcomes, reviews and reflections, and conclude with a discussion of the benefits and

the challenges we encountered. In all, we hope this article will provide a useful resource for those interested in understanding the benefits of SD as a critical pedagogical practice, and for those who wish to bring that understanding into the classroom.

The benefits of SD as a pedagogical practice

Recent work emanating from the speculativeEDU project (Encinas et al., 2023; Helgason et al., 2019; Mitrović et al., 2021), alongside a special issue in Interaction Design and Architecture(s) Journal (IxD&A, No.51, 2022), suggest that some change has taken place since Ward (2013) expressed his surprise over "how little has been written about the role of fiction and speculation as part of design education". Of the 36 responses to a recent survey of design educators that teach SD (Helgason et al., 2019), the two main motivations for developing and delivering courses on SD were the promotion of trans- or interdisciplinarity, and the integration of "practical and critical skills" – the latter being a central motivation for critical and signature pedagogies in design (Bull, 2015; McLain, 2022; Osmond & Tovery, 2015; Shreeve, 2015). To these motivations, Auger et al. (2021, p. 209) add a few more:

> As a pedagogical tool, speculative design – at its best – opens students' minds to brave new worlds: to critical and creative interventions, transgression and change, as well as the possibility of applying design principles and tools in very different contexts and types of projects. The speculative approach allows students to create a set of tools and a language for understanding the consequences of their design practice. It is particularly stimulating as an educational tool because it foregrounds criticism, self-reflection, and a move away from familiar practices.

In what follows we expand on these.

Deepening the understanding of the contexts and consequences of design

Those engaging with SD as a pedagogical practice agree that it is a valuable means to unpack the complex contexts and consequences of design. In the description of a workshop they organized at the ACM's Designing Interactive Systems (DIS) conference in 2020, Helgason et al. (2020) suggest that teaching SD can lead students "to a deeper understanding of … the contextual, political and cultural factors that influence the activity of design, and in turn, consideration of the potential implications and effects caused by bringing new products and services into the world" (p. 386). More concisely, engaging with speculation may "assist students in understanding how technical forms have ideological implications" (Nooney & Brain, 2019, p. 219; see also Culén & Stevens, 2022). In the same spirit, and in a relatively early account of teaching SD, Lukens and DiSalvo (2012) suggest that engaging with SD helps students develop a better understanding of technology, its use and effects, nourishing students' "technological fluency" by "providing them with a new perspective from which to consider the discourse about technology they encounter in everyday life" (p. 24). Designing speculatively, it follows, offers students ways to understand the consequences of sociotechnical innovation: "With every prediction, in user behaviour, social organisation, technological advancement, material invention, economic trend comes

a series of unintended consequences. CSD [critical speculative design] is a way to give form to those consequences" (Ward, 2021, p. 193).

SD exhibits two qualities that make it particularly useful for considering the social contexts of technology. First, the nature of the issues SD engages with require an inter- or transdisciplinary approach, asking designers to reach a more comprehensive yet nuanced view of the world, one which, naturally, demands accessing (and assessing) knowledge from diverse fields. Second, SD shares the broader design discipline's strength for making things tangible. This means that SD can help make complex issues more concrete and accessible, and therefore available for discussion, reflection and action. This is why it is more common to find SD projects that engage with topics that are difficult to perceive or grasp, challenge our familiarity with the world or stretch our imagination – topics that inherently situate design or technology in larger contexts. As Encinas et al. (2023, p. 9), conclude:

> The processes of creating speculative designs can encourage interrogation of prevailing assumptions and invite exploration of other, alternative states of being and doing. These activities can lead to a deeper understanding of, for example, the contextual, political and cultural factors that influence the activity of design, and in turn, consideration of the potential implications and effects caused by bringing new products and services into the world.

Nourishing critical reflexivity

SD pluralizes the future by providing material evidence that any particular future is only one of many possibilities. From a pedagogical standpoint this observation helps to shed light on design as an essentially political activity – how design functions as a mechanism for choosing and materializing futures, an act that is neither neutral nor innocent. In a recent chapter, Ward (2021) argues that an education in SD "provides a space for young designers to deconstruct the different mechanisms that exist within design practice" (pp. 190–191). Culén and Stevens (2022) argue that SD offers "an opportunity for students to reflect on the larger and more complex issues through a critical lens" (p. 26), while Boer and Jenkins (2022) argue that SD can bolster design students' "creative self-awareness", giving them "the ability to see a problem as more completely their own" (p. 273; 276). This may include developing critical reflexivity on specific design practices and roles, the values that orient design, and on design as a field of practice more broadly (Helgason et al., 2019). It also means contemplating the designer's agency and responsibility (Encinas et al., 2023, p. 4). Kender and Purgathofer (2022) found that engaging with SD was particularly useful to help their students understand "the connection design has with power" (p. 263). Helgason et al. (2020) add that SD "encourage[s] interrogation of prevailing assumptions and invite[s] exploration of other, alternative states of being and doing" (p. 386), thus encouraging students to challenge mainstream design's assumptions and conventions around such notions as ease of use, acceptability and consumability (see also Helgason et al., 2019). This may lead students to develop novel languages and tools to deconstruct existing design practices and orientations (Ward, 2021).

The critical reflexive gaze nourished by SD should also be directed at SD itself, as Lindley and Green (2022) argue, "it is our responsibility as educators to contextualize the meth-

ods and techniques we are passing on to students complete with an account of how these techniques fit into wider societal structures.… Only when furnished with this information will our students be fully empowered to not only work with Speculative Design, but to make Speculative Design work for them in the world" (p. 42; 45). Helping students develop critical reflexivity, then, can be seen as a crucial step toward opening up discussions about design as future-making (Yelavich & Adams, 2014) and the designer's role more broadly (Ward, 2021; Auger et al., 2021), suggesting that designers can not only be expert problem solvers but also expert trouble makers (Kartak et al., 2021).

Developing a personal stance on design ethics and politics

Compared to more theoretical considerations of the political and ethical responsibilities of designers, SD invites students to put themselves "at the heart of issues" (Veiga, 2022, p. 79) – to engage with ethics in a visceral, embodied, practical way, one that is felt precisely because it is grounded in materiality, interactivity and relationality (Guida & Tranti, 2022; Nooney & Brain, 2019). In this drawing together of 'head', 'hand' and 'heart', SD can be seen to be closely aligned with the development of signature pedagogies in design (McLain, 2022; Osmond & Tovey, 2015; Shulman, 2005). For educators, this is an opportunity to encourage students to inquire, experiment and express possible alternative views experientially, instead of merely 'demonstrating' the usability and feasibility of their designed things (Lukens & DiSalvo, 2012; Pérez-Orrego et al., 2022).

Because SD takes a position on the world and is enacted as an intervention (that is, an act of design that seeks to destabilize the existing reality), design students engaging with SD are more likely to develop a personal stance – to "think differently", "grow as designers, considering values, methods, and practice in general in more sophisticated ways" (Beach & Fox, 2022, p. 113), and develop a more sophisticated understanding of their role as "agents of the public imagination" (Farias et al., 2022). On this account, Ward (2021) concludes that SD "has been at the forefront (in design educational terms) of questioning dominant power dynamics, demanding that students unravel the roles and responsibilities of the profession" (p. 177), and so, "declaring what they wish to achieve, for who, and why, helps bring into focus the role they wish the work to play in the world" (p. 190). This is confirmed by Encinas et al. (2023, p. 10) who write that "One of the most striking themes that emerged from our study [a survey of SD in education] was the desire to use speculative designs as a vehicle to implement transformation and to create impact on the world through activism and action". Engaging with SD, we can say, invites students to take "intellectual risks" (Pérez-Orrego et al., 2022) and bridge the political and the everyday with design.

Becoming a more complete designer

Lastly, the literature suggests that an education in SD can also help students develop additional skills. Some of these appear to be fairly standard learning objectives for design education, including "project-based skills and competencies, communication through design, the development of usable designs, research skills, lateral thinking skills, and the creative presentation of research insights" (Helgason et al., 2019, p. 7). Other skills, however, are rarer or even marginalized in current design education. These include complexity thinking or the management of complexity (Helgason et al., 2019; Kender & Purgathofer, 2022; Lukens &

DiSalvo, 2012), long-term thinking (Encinas et al., 2023; Helgason et al., 2019), poetics and rhetoric (Malpass, 2016; Wong & Khovanskaya, 2018). This last skill is served by the way that speculative designs are often conceived as platforms for communication, storytelling or as rhetorical devices (Wong, & Khovanskaya, 2018).

Perhaps the most important skill designers pick up when designing speculatively is the ability to unleash the imagination and not only in pursuit of future products or business niches but as a way to navigate multiple temporal possibilities (Kender & Purgathofer, 2022; Nooney & Brain, 2019). This is because, at its core, SD is distinctively imaginative, set in motion by 'what if?' questions that call for broad (and bold) contemplations of the possibilities and consequences of design (Beach & Fox, 2022; Boer & Jenkins, 2022; Lukens & DiSalvo, 2012). If we understand SD as an imagination-driven thought exercise (Barendregt & Vaage, 2021), it becomes clear that designing speculatively requires a wide range of skills – from contextualization to conceptualization, from making to staging. The imagination is central to all of these operations, but crucially, for SD to be impactful, the speculative inquiry must find sites that make it relevant to the everyday lives of those encountering the designs. From this perspective, learning how to construct what Auger (2013) calls "perceptual bridges" – "a bridge to exist between the audience's perception of their world and the fictional element of the concept" (p. 12) – appears to be the central task in SD education.

Developing strategies to engage imaginatively with complex issues has an additional benefit for students. Because SD is not centered on solutioning, it provides students with opportunities to grapple with uncertainty, as it is encountered in both the contexts and outcomes of the design project. Simply stated, because there is no single way to speculate and communicate a complex sociotechnical issue, SD requires creative experimentation and the ability to work without a fixed starting point and clear end goal. To be successful, students must develop personal resilience and, ultimately, grow the confidence needed to engage with challenging, multifaceted topics – very much in line with signature pedagogies in design (Osmond & Tovey, 2015).

A structure for teaching speculative design

Despite the growing popularity of SD and its increasing presence in higher education, there are few indications of how to teach it. So while the existing literature provides some recommendations for teaching speculative design and illuminates key areas for educators to focus on when building a course curriculum, these remain often scattered and abstract, and are difficult to translate into a detailed curriculum. The very lack of formalized methods for teaching SD is what exacerbates the tendency of the practice to focus on 'shiny' designed objects as the ultimate bearers of value (Tonkinwise, 2014) – what Mitrović et al. (2021, p. 84) call "the RCA aesthetic" – whereas we argue that SD's greatest value lies in its processes and their capacity to encourage students to develop critical reflexivity and a robust position in regards to design as politics. On the other hand, forcing SD into existing frames, structures or methods for teaching design appears crude and risks neutering the practice of its imaginative criticality. Might there be a middle way?

In this section we describe the structure we developed for teaching speculative design and the questions and assumptions that guided it. We also provide a few illustrative exam-

ples of outcomes, evaluate the process as a whole in Sect. 4, and reflect on what we have achieved (or not) in the conclusion.

Overview

The course, designated an elective, took place over 7 weeks during the Fall semester of the academic year 2022-23 (Sep.-Nov. 2022). The course was allocated 3 credits in line with the European Credit Transfer and Accumulation System (ECTS) which are equivalent to 28 h spent in the classroom and 56 h dedicated to self-study. Both the time and the credits allocated to the course served as hard requirements for course design and therefore influenced some of the choices we made. Because the 32 participating students were enrolled in three different MSc programs – Design for Interaction, Strategic Product Design, and Integrated Product Design – there were no strict prerequisites in terms of previous knowledge or experience, and so the class included students with different educational background and design skills, and with no previous knowledge of SD.

The structure of the course (Fig. 1) resulted from a combination of the practical requirements mentioned above and the overarching ambition to provide students with a contextual understanding of the emergence and significance of SD and a few practical tools to design speculatively. In this vein, we built the course on what we thought would be a familiar design process structure that proceeds from contextual inquiry to materialization, presentation and evaluation, yet would be distinct in terms of the scope and strategies implied in each step.

We set the course's three learning objectives as follows: (1) becoming familiar with the origins, significance, and application of speculative design; (2) being able to critically analyze speculative design examples; and (3) being capable of designing speculative artefacts in response to important social issues. Each weekly meeting served as a clearly defined step in the overall process, commencing with an introduction and concluding with a final exhibition during which four 'experts' were invited to provide students with feedback on their final outcomes. During class students received short lectures, were engaged in small group activities, and provided peer feedback. Projects were done in groups of two. In what follows we describe each of the steps, illustrated with examples of student work (where relevant).

Introduction to speculative design

The course began with a brief introductory lecture that sought to locate SD in the wider landscape of contemporary design. In addition to drawing distinctions between foresight

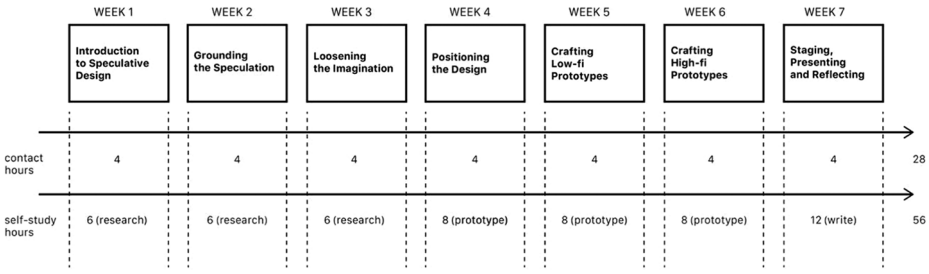

Fig. 1 Overview of course structure including weekly topics and expected time investment

and speculation, we identified what speculative design is not, that is, not a form of corporate foresight or systematic prediction (Wong & Khovanskaya, 2018). The lecture provided students with references to the history and genealogy of SD from the futures studies side (futurology, anticipation, foresight) and from the design side (Italian Radical Design, Radical Architecture). We also discussed more established forms of technology critique emanating from the philosophy of technology and critical theory (Marx, Heidegger, Winner, Feenberg). In familiarizing students with notable examples of SD we aimed to introduce them to the major figures working in the field, to provide them with a few starting points to dive into the literature on their own, and to demonstrate how to critique SD outcomes as part of a broader 'crit' practice (key signature pedagogy in design according to Shreeve (2015); see also Williams and Stables (2017)). The lecture was accompanied by a small selection of key readings – mostly those recognized in the discipline as essential building blocks (including Dunne and Raby (2013) and Auger (2013)).

Grounding the speculation

Both futurists and designers recognize that the work of the imagination must be situated and grounded in real world conditions, for severing the ties between the imagination (and, by extension, the speculation) and the world-as-it-exists risks producing fanciful, far-fetched or fantastic results (Savransky et al., 2017, p. 12; see also Bendor, 2018, ch.5). Auger (2013) sees the grounding of the speculation as part of an "ecological approach" to SD that situates the design in "a familiar or logical reality" (p. 13). Mulgan (2021) identifies a similar requirement for what he terms "exploratory social science" that "combines depth and rigour on the one hand with openness and imagination on the other" (p. 14). What these expressions have in common is a view of the necessity of some constraints on the work of the imagination, situating the thinking and acting through which speculation unfolds in a recognizable terrain. This dynamic, however, is fragile: for speculation to be successful it must both emerge from a particular state of affairs and go beyond or exceed that situation: "We do not 'transcend' the problems that provide us with the ground from which to jump. We must stay faithful to this ground, to what enables us to jump, to speculate, at the very moment that we make our jump" (Halewood, 2017, p. 58).

Based on these insights we required students to be concrete and reflect real world situations, values, interests and identities in their design. We helped them do this by introducing a theme (not a design brief but something more general): urban futures. In the course guide, the theme was articulated as follows:

> As context for the assignment we will speculate about urban futures. Not only are cities home to the majority of humanity but they are also considered key sites for crucial climate action, hubs of social and technological innovation, and hotbeds of cultural creativity and experimentation. While we celebrate the diversity and vibrancy of urban life we also recognize that cities are not necessarily prosperous or equitable, that they are sites of incredible affluence but also of inequality, and that they are home to both privileged and marginalized communities. Cities are spatially and socially uneven. The course invites you to consider urban futures from all of these perspectives and more; to consider the futures of urban infrastructure, the lifeworlds that

make cities an exciting place to live, and the cultural flows that make them potent sites for cultural and economic exchanges.

Importantly, we encouraged students to not only respond to potential issues but strive to explore them further; we implored them to engage with urban futures speculatively.

In practice, grounding the speculation required students to gain some familiarity with a specific urban issue by conducting literature searches and stepping into the world to identify everyday situations that may be interesting topics for speculation. We placed no hard criteria for allowable topics, recognizing that in an introductory course the passion a student may have towards a specific topic is no less important than the degree to which their design work is based on rigorous empirical studies. As long as students were able to convey a specific urban situation with clarity and detail, and capable of articulating what in that situation attracted their critical attention, the topic was allowed.

To make sure students invested sufficient time in research we asked them to create a research plan that includes both literature and fieldwork. Some examples of the topics students chose are the mediating influence of screens on everyday social interactions; gentrification and its reliance on accessibility to green space; the influence of superfast delivery; pollution; road rage; the regulation of tourism; micromobility; more-than-human cities; and more.

Loosening the imagination

Although designers enjoy a reputation for being creative and thinking 'outside the box', exercising the imagination in ways that point to speculative – yet grounded – futures is not trivial. Our students often expressed anxieties around this, confessing unease with moving beyond the observable present. This may be, in part, due to the way engineering students are trained in other courses to remain close to the 'problem' by sticking to observable 'facts'. But it may also be a symptom of a wider, societal inability to move beyond plausibility to consider possibility, a symptom of what Ghosh (2016) and Mulgan (2020) describe more broadly as a "crisis of imagination". Either way, the imagination is akin to a muscle that needs to be exercised and developed.

In order to give students a sense of the playfulness of the imagination we conducted several rounds of the generative card game, The Thing From The Future, which was developed by the Situation Lab (n.d.). This led to a discussion of what those creating allohistorical accounts (alternative or counterfactual histories) call the "minimal rewrite" rule: the injunction to be parsimonious while straying from known facts in order to retain a measure of plausibility and thus persuasiveness (Prendergast, 2019). On this account, too much imagination is as counterproductive as too little imagination for neither creates the 'right' (affective) distance between the existing and imagined world. Dunne and Raby (2001) famously describe this tension: "The challenge is to blur the boundaries between the real and the fictional, so that the conceptual becomes more real and the real is seen as just one limited possibility among many" (p. 65).

We concluded the week's activities by discussing scenario analysis and exercising the development of 2×2 scenario spaces – a popular practice in strategic foresight (Wack, 1985) and in environmental modelling (Wilkinson & Eidinow, 2008). Developing scenarios provided students with a structured way to work with multiple futures, encouraged them

to identify the most important drivers that would affect possible futures (in their specific contexts), and provided both constraints and possibilities with which to begin to develop narratives that would, in turn, convey each of the four possible futures that emerge from the scenario matrix. In the example provided in Fig. 2, students plotted social equality against the state of mobility technologies to produce four possible futures for on-demand services.

Positioning the design

Once students created the scenarios, the course's focus shifted from understanding the context to considering the design. The aim of this week's activities was to help students relate their intentions as speculative designers to the kind of experiences they will create for others. In order to attune students to the potential effects of SD we discussed the latter as a form of communication – not a means for problem solving but a medium for engaging audiences with complex sociotechnical conundrums and provoking new thinking about the world. This is where the strength of design as a means to make tangible, that is, to give concrete form to abstract notions, comes through. As Malpass (2017) writes, "the design of objects – and the scenarios that they exist in – can be employed to create a descriptive comprehension of complex issues" (p. 42), or, as Pierce (2021) puts it, both conventional and alternative design can be understood as "material prefigurations" (p. 2).

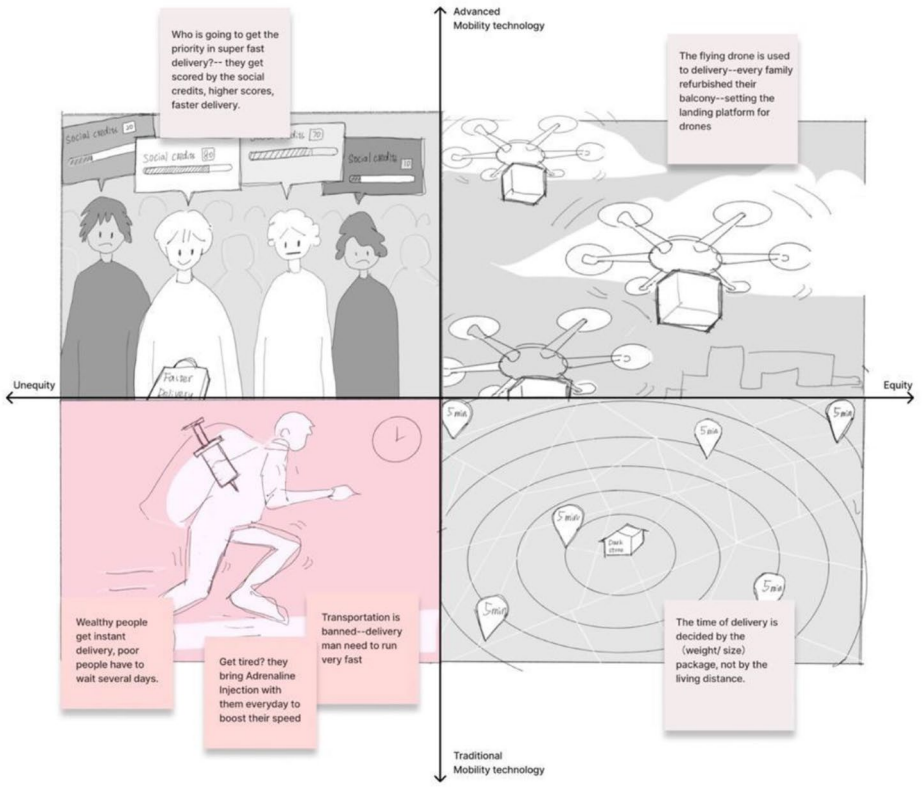

Fig. 2 *Scenario matrix for the project* Faster Than Faster

To assist students in selecting and articulating the desired effects they would like to achieve with their designs, we provided them with a simple matrix, illustrated by some of the iconic speculative projects discussed in class, and asked them to situate their current design direction in the two-dimensional space (see Fig. 3; for an alternative matrix see Tost et al., 2022)). On the vertical axis we drew a distinction between raising awareness of future possibilities and anticipating plausible futures. The aim here was to help students consider and make explicit the kind of futures they want to conjure and communicate. In reference to the futures cone (Voros, 2003), *raising awareness* is akin to introducing new ways of considering a range of possible futures that may otherwise remain hidden, latent, or unspecified, while *anticipating futures* works to prepare individuals, groups or organizations for plausible or likely futures. This is often done with an explicit action-orientation ("design-based foresight" in Poli's (2019) terms). On the horizontal axis we directed students' attention to the experiences SD evokes by distinguishing provocative from inspiring effects. Here, *provocation* is meant to captivate, shock or otherwise create a moment that can potentiate new thinking about futures, while *inspiration* retrieves a more action-oriented approach, one that lends itself to additional related activities. Taken together, the two axes unfolded four quadrants that move from the more imaginative (lower left) to the more pragmatic (upper right).

The ability to situate their design intentions within the matrix allowed students to start imagining the design strategies they can enact, but do so with a clearer understanding of the ethical and political implications of their work. Figure 4, for instance, shows a sketch with

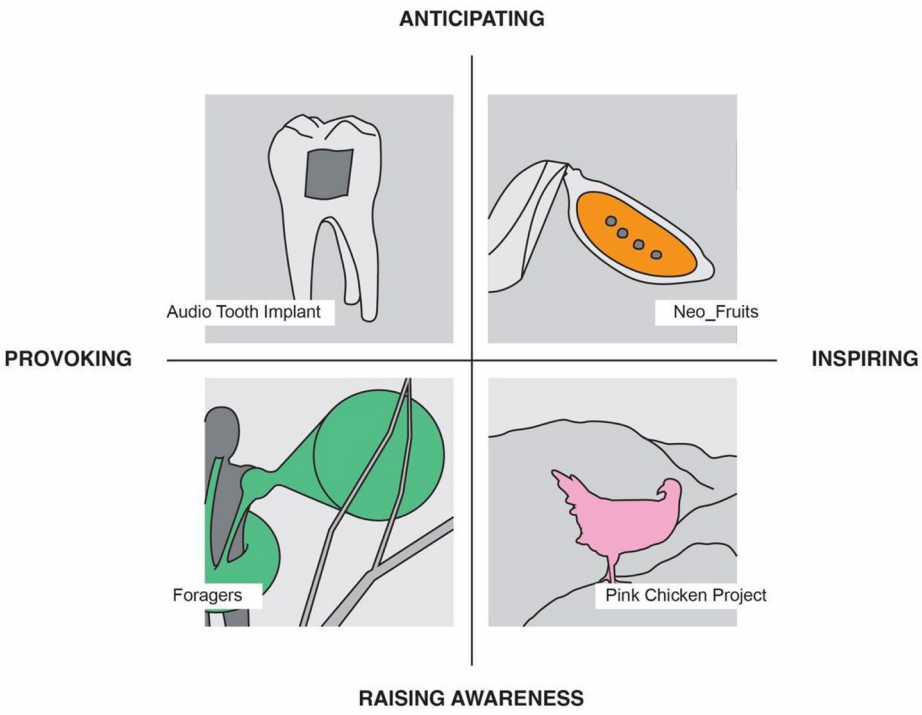

Fig. 3 *Positioning matrix exemplified by speculative design projects*: Audio Tooth Implant *by Auger & Loizeau (top left);* Neo_Fruits *by Meidan Levy (top right);* Designs for an Overpopulated Planet: Foragers *by Dunne & Raby (bottom left); and* Pink Chicken Project *by Nonhuman Nonsense (bottom right)*

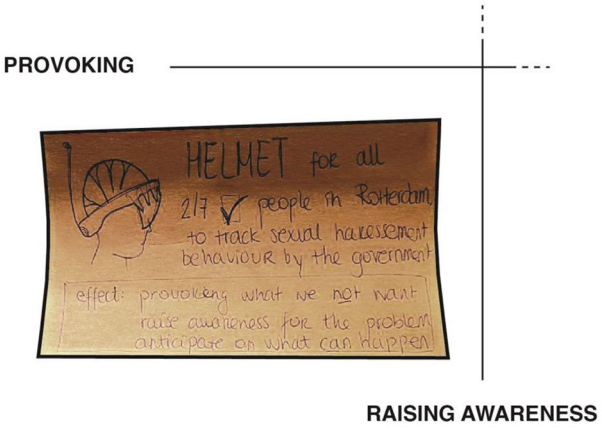

Fig. 4 An example of project positioning. The proposal that all citizens wear a monitoring helmet is intended to provocatively raise awareness of the problem of sexual harassment

a note from a student that, positioning their work between 'provoking' and 'raising awareness', imagined a scenario in which every citizen in Rotterdam would be required to wear a monitoring helmet that detects and prevents sexual harassment on the street. The concept is intentionally disturbing to encourage a reaction to the topic.

If we understand SD as a particular way to intervene in the world, that is, to evoke, enact or redirect "thinking and doing" (Jones, 2002), each matrix quadrant raises questions about the design's orientation, its relation to the problems to which it responds, and about possible consequences. Simply stated, reflecting on the positioning of the speculation immediately retrieves considerations of the designer's role and responsibility – of their capacity to function as "agents of the public imagination" (Farias et al., 2022) and, by extension, promote change.

Crafting low-fidelity prototypes

To kick start the process of material making we asked students to bring to class an artefact that they would consider emblematic of the context and phenomenon they were investigating. In class, we conducted a ready-made prototyping exercise: we provided students with a variety of prototyping materials and invited them to add, modify or enhance the object they brought to class in order to illustrate their design intentions more clearly (see Fig. 5). The aim here was to use a familiar object and then add to it something that would render it unfamiliar (Lupetti et al., 2023). This kind of low-stake activity helped to not only ease students' anxieties about the quality of their crafted artefacts but also to demonstrate to them that it does not take fully fleshed, beautiful objects to create what Auger (2013) calls "perceptual bridges" – linking "the audience's perception of their world and the fictional element of the concept" (p. 12). The insight we wanted to impart to students was that sparking audience imagination does not require fancy prototypes or design pyrotechnics. All it takes to induce acts of make-believe or compel the suspension of disbelief is to create a situation in which there is sufficient space for audiences to invest their imagination – a sense of unfinishedness that invites audiences to complete the artefact interactively (Bendor, 2018).

In the project Green Crimes (Fig. 5), for instance, students attached wires, small metal parts and handmade paper labels on a tin can, a spray can and teeth hygiene products. This

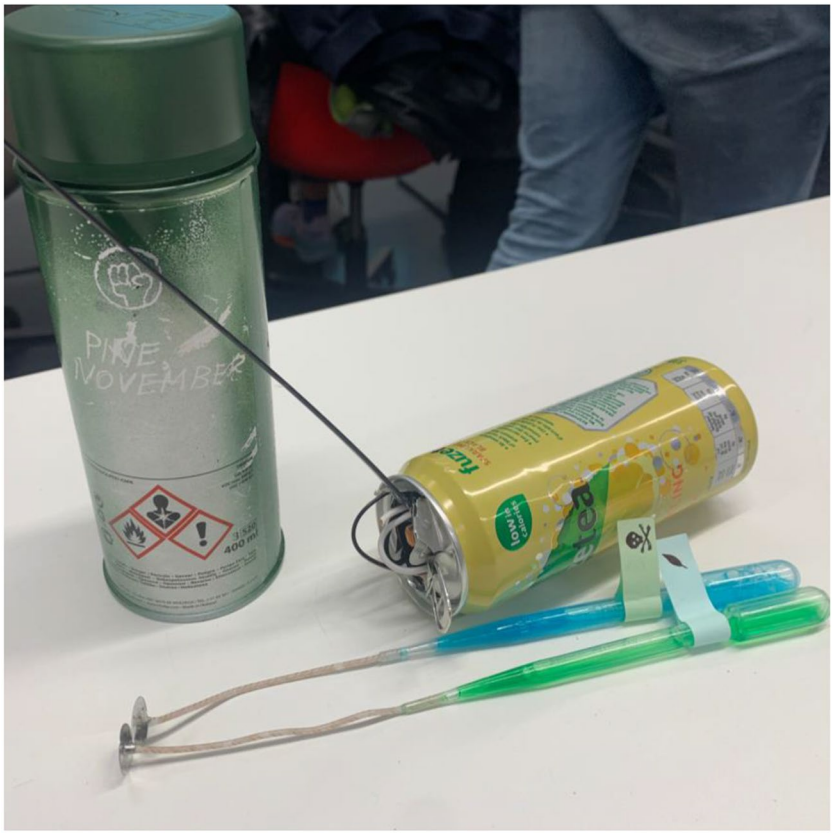

Fig. 5 *Low-fidelity prototype developed for the project* Green Crimes

way, students not only crafted an effective prototype in a very short time, but also experimented with a frugal aesthetic that was also coherent with their concept.

In class, students shared their objects, performed the way they could be used, and received feedback from their peers. Peer review was based on the extent to which interacting with the ready-made artefacts reflected the positioning discussed in the previous week (so the situating of the artefact in one of the four quadrants), and on the kind of experience it evoked. The analysis of the artefacts' effectiveness was contextualized by some of the core tactics used by speculative designers: "para-functionality" (Dunne, 2005), ambiguity (Gaver et al., 2003), defamiliarization (Dunne & Raby, 2001), "meaningful presence" (Hällnas & Redström, 2002), and Satire (Malpass, 2017). Based on feedback, students were asked to improve their prototype – add richness and details to the artefacts – but also reconsider what the artefact 'does' in terms of desired effects, communicative qualities, and so forth.

Crafting high-fidelity prototypes

In the following week, based on their initial design directions and sharpened by peer review, students created and brought to class prototypes of higher detail and fidelity. Some proto-



Fig. 6 *A more intuitive prototype in the project* Anti-Pollution Mask



Fig. 7 *A less intuitive prototype in the project* Collect It Yourself

types 'spoke for themselves' in the sense that their use and meaning were intuitive, while others required significant explanations. Figure 6 depicts a mask that, by including visibly flowers on the inside, makes evident the intention to 'improve the experience of breathing air'. In contrast, Fig. 7 depicts a jacket equipped with different kinds of devices whose functionality and purpose are much harder to infer.

During class students conducted several rounds of peer review using forms we provided. These included project title, maximum 5 keywords, a brief statement of the issue at hand, the design's intention (using the 4-quadrant matrix we introduced earlier; see Fig. 3), and a list of design tactics they used (again, drawing from the previous week's discussion and

inspired by Dunne and Raby (2013) and Malpass (2017)). Following peer review we discussed the question of diegetic consistency, or how to make sure that the experience created when interacting with the artefact gives rise to "a world whose different elements fit together consistently" so as to maintain a sense of believability (Bendor, 2018, p. 113). This would be crucial for the success of the final exhibition.

Staging, presenting and reflecting

During the last class we held a mini-exhibition that included presentations, demonstrations and discussion. Final design outcomes were diverse, but we can classify them into three groups: static installations that conveyed their meaning more like artworks, as in the project *Moving On* (Fig. 8). Artefacts that conveyed their meaning by leveraging or subverting the logic of product design, as in the project *Identity Deception Kit* (Fig. 9). And future situations that conveyed their meaning as an unfolding of dynamic situations, as with the project *Homo Localis* (Fig. 10). The discussion of final outcomes was aided by 4 'experts': designers that practice SD in various sectors but were not associated with the masters program. Experts were invited to act as 'critical friends' and provide students with constructive feedback and tips (see also Shreeve, 2015).

The last part of the course consisted of a reflection session during which we invited students to share their experiences of the course, the challenges they faced, and the lessons they learned. Student projects were graded based on the staging of the final prototype and a written report that included a personal reflection on the process, approach and the topic.



Fig. 8 *The project* Moving On *produced a static installation that called upon audiences to reflect on the planned obsolescence of urban bicycles*



Fig. 9 *The project* Identity Deception Kit leveraged the forms and aesthetics of familiar beauty products to create a self explanatory yet provocative prototype



Fig. 10 *The project* Homo Localis *staged 'citizen watching' as a disturbing form of urban future tourism*

Evaluating course outcomes

To help us evaluate the course we required students to include in their written report a reflection on their work and what they have learned in the course. Written reflections were analyzed through an inductive thematic analysis "on the wall" (Braun & Clarke, 2006; Sanders & Stappers, 2012): we printed the reflection section from all 16 reports, highlighted relevant passages, and then clustered them according to common themes. In what follows, direct citations from student reports are reproduced in italics.

Overall course assessment

Students received the course positively. Highlights included statements such as "*probably the best course in my master yet*", or "*Thank you for this course. I really feel like I learned a lot every week*". Students particularly appreciated the combination of theoretical contents offered by the readings and the practical explorations done in the projects, much in line with the findings of Helgason et al. (2019), and meeting a key objective of critical and signature pedagogies in design (Bull, 2015; McLain, 2022; Osmond & Tovery, 2015; Shreeve, 2015). In this vein, one student team mentioned they liked "*the balance between reading lots of papers and diving deep into the topic and the practical assignment*". Other students expressed their appreciation for "*the rapid feedback on ideas/prototypes*" and the exhibition/symposium "*which added many reflections about speculative design which are valuable to think as a designer*". Reflecting on their project, one student summarized their experience: "*Wauw, what a rollercoaster it was! I truly loved working on this project. […] I had some hick-ups, but maybe that's the way it had to be"*.

Despite this generally positive feedback, few students were critical of the course while providing suggestions for improvement. This line of feedback was also centered on the balance between theory and practice. As one student explained: "*time management in this course was really tricky. Especially towards the end, when we were still expected to do some readings while already being heavily invested in our prototypes was hard*". Students provided actionable suggestions for improving the course, such as making some readings available as audio-books or podcasts, making smaller groups when discussing the readings (complementing discussions with the entire class), and communicating the course theme in advance. We suspect some of the more negative comments reflect the difficulty students experienced because SD is so radically different from the solutioning that drives more mainstream design approaches. We expand on this below.

Understanding design is political

In both final outcomes and reflections students confirmed what others have argued were the benefits of engaging with SD. Students reported that they acquired a better understanding of the multiple contexts in which design operated, and that they developed a sensitivity to the solutionism that is often present in mainstream design. Every solution, they pointed out, effectively blocked other possibilities and in this sense design may equally promote or undermine the status quo. Students also stated that they developed a better grasp of the values that shape design interventions – even if often in latent ways – and, as consequence, have become more conscious of their own roles as motivated, intentional translators of scientific and technical knowledge into material artefacts that function in the 'real world'. In the words of one student team, "*Designers should position themselves in relation to the issue according to their values"*. Confirming the findings of Encinas et al. (2023), students appeared to appreciate the action-orientation of SD: *"We can be critical all we want, but that can lead to desensitisation quickly if all we do is 'raise awareness' and ask for people to care about and discuss the topics that we think are important. Action should follow from discussion and insights, what otherwise is the purpose of the speculation?"*

Designing speculatively allowed students to open up spaces for debate on design's complicity in business-as-usual politics (Bardzell & Bardzell, 2013), and on how, inversely,

design may work to undermine forms of prejudice and empower the public to play a more active role in pursuit of more equitable and just futures. Such debates on the politics of design were reflected in some students' choice to maintain a kind of openness in their design, arguing that design should avoid prescribing solutions and instead promote the capacity of users to envision and pursue their own interests. In the words of one student team, "*our design shows people what is possible, but it is up to them to judge whether that future is desirable and to what extent their actions and attitude contribute to that future*". As another student wrote, this strategy was not free of difficulty: *"What I'm most proud of is the fact that I made my design ambiguous and therefore a bit open-ended. I find that very difficult as a designer, because I prefer to convey completely what I think"*.

Meaningful learning experience

Student reflections made it clear that the course provided them with a meaningful pedagogic experience. Naturally, we would like to think that this had to do with our teaching skills and attitude towards students, but we believe that it was equally (if not more) due to the characteristics of SD itself. The absence of an all-consuming drive to solve a problem meant that students were free to develop their own understanding of the value of design and, consequently, perceive their own work as something other than sophisticated problem solving. As one student team wrote, *"This course gives us knowledge of speculative design but, more importantly, a critical way of thinking. We gain this mindset of not only design to answer but also design to question"*. Another team echoed this insight: *"it was an interesting approach to design because the goal was not to solve the issue but to let others critically reflect on it"*. It was a "*direction totally different than the one we are normally working in*".

Working outside the strict boundaries of a brief (and thus without the pressure to solve a problem) presented students with a safe space for experimentation and, consequently, opportunities for growth. Students were able to work in more open-ended ways, provoking questions instead of seeking answers: *"For us, it was fruitful to design artefacts that make people, and even ourselves, feel uncomfortable. Especially since we're so used to designing things for people's needs"*. Furthermore, because there was no brief or problem to solve, students leveraged projects as platforms for self-expression. *"In the end, we found that speculative design has the power to allow imagination to happen"*. We can say that students were intrinsically motivated to engage with specific issues and positioned themselves accordingly, and this, as Niemiec and Ryan (2009) explain, increases the chances that activities become playful, explorative and engaging.

Skills and challenges

The benefits of teaching students to engage with SD also hint at the challenges that await teachers. The first challenge has to do with encouraging and nourishing the kind of mindset that allows students to inquire and experiment in an open-ended manner. While many design approaches focus on identifying and then solving a problem (as reflected, for instance, in the famous 'double diamond' design model), SD works the other way around: designers question solutions in order to arrive at new understandings of the problem. This posed significant challenges to students accustomed to working with a more-or-less solid design brief. Some students complained about a lack of clear design goals, making it difficult to decide *"where*

to start and where to stop?". As another team reflected: *"Normally when we start a project, a (tangible) solution must and will come out that is desirable, credible and feasible. Therefore, our goal is to leave the audience with no questions or speculative thoughts. However in this course, this was not the desired outcome"*.

A few students found the sometimes abstract and conceptual nature of speculations difficult to grasp and even more so to apply. This was also expressed as a difficulty to take a stance on the issues and abandoning the sense that they are working towards an objectively desirable solution. As one student confessed, "*finding a subjective mindset was quite challenging at first*". At times we had to convince students that designing 'subjectively' is not problematic but actually part of what makes SD interesting. We recognize that this challenge may be more common in design-engineering programs than in art-design programs in which taking a position is perhaps more intuitive, but nonetheless, we think that identifying design as an essential political practice requires that designers abandon false notions of neutrality and become more comfortable with taking and communicating a personal stance.

The question of how to communicate design outcomes posed another challenge. Designers are often trained to describe and extoll their work in direct relation to the problem space they operate in. The benefits of the design, in this mode, are communicated in direct relation to the problems the design seeks to solve. This becomes much more difficult when there is no single, clear problem to solve, and when, as Elsden et al. (2017) point out, the aim of the design is to stage a possible reality. In their reflections students testified to the difficulty of staging and acting out (or simulating) the design: "*the last afternoon we ended up in a theater, where almost every duo performed a play on their design. Giving a presentation this way is not in our nature*", wrote one student team. Since we did not anticipate how difficult it would be for students to create an experience that communicates their design effectively, we did not provide them with sufficient guidance or exercises. In hindsight this was a mistake, and in future classes we intend to make better use of role playing (Boess et al., 2007), and draw a few useful tips from such approaches as Object Theater (Buur & Friis, 2015), and Theater of the Oppressed (Boal, 2019).

Lastly, one of the challenges students found the hardest to overcome was the question of how to achieve a balance between representing an issue comprehensively and authentically, and achieving the rhetorical effect they sought. As one student team wrote, "*speculative futures can easily become too complex, which can make designing difficult and the message almost incomprehensible*". Another way to state the challenge is to point out that pursuing simplicity in design is harder than it may appear. This is not necessarily a problem of SD (see, for instance, Maeda, 2006), but it is more pronounced when it comes to designing speculatively. This was sometimes expressed as a difficulty to maintain a degree of ambiguity in the design outcome, a tendency to over-explain the meaning of the design, and a difficulty to balance fictionality and plausibility. We tried to address these challenges by exposing students to what we considered instructive examples of SD, but this, of course, is all but straightforward.

Conclusion

In this article we describe the structure, reasoning, and outcomes of a graduate course on speculative design (SD), offered to masters-level industrial design students. Our analysis of course outcomes and student reflections provide evidence of the benefits and challenges implicated in teaching such a course. Here, in conclusion, we would like to offer a few reflections on our own experience teaching SD.

One of the things that strikes us the most is how teaching SD allowed us to engage students with design as a discipline, going far beyond the specific techniques and histories of SD itself. The ability to think critically about the contexts and consequences of design resonated with students, who were quick to take the opportunity to reflect on their role as "agents of the public imagination" (Farias et al., 2022). Considerations of design's ability to intervene in material culture and evoke the imagination of users were present throughout the course, and while self-reflection is never easy nor painless, students were keen to delve deeper into the social functions and meaning of design even if this ultimately spelled a kind of disillusionment with the discipline as a whole. We argue that this is a sign of a mature view of one's activities and position in the world, and as such, teaching SD appears to us as a valuable way to help students grow into more conscious and conscientious practitioners – a considerable distance from how Papanek (1984) described designers as mere extension of the PR industry.

To a large extent, the format we used to structure the course helped us not only move through the different steps of a proposed SD process (and we acknowledge that there is more than one way to do so), but also to deepen our students' engagement with the practice. Key literature and examples gave students a sense of what SD can be, but through the movement from grounding to defining to experimenting to staging students developed a sharper view of SD as a practice that engages real world phenomena through the tools and capabilities of the imagination. We argue that this is perhaps the largest benefit of the course structure we detail above: it provides students with a clear path to navigate the twin demands of SD as a form of realist intervention and as a carrier of imagination. How to navigate this terrain was a task left to students, who seemed to mostly relish the autonomy we provided them even if it appeared a bit risky or scary at first. At the end of the course students felt they grew as designers – not only as speculative designers – and that was more than we hoped to achieve.

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Declarations

Competing interests The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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