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Speculative designs in educational settings: Tension-patterns from a (mostly) European perspective

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SPECULATIVE DESIGNS IN EDUCATIONAL SETTINGS:

TENSION-PATTERNS FROM A (MOSTLY) EUROPEAN PERSPECTIVE

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ABSTRACT

The study of speculative designs (such as futures, critical design alternatives, or catalysts for reflection) is well documented in the design research community but the literature lacks attention to speculative designs in the service of a pedagogical practice. This paper reports on a two-year cross European research project investigating speculative designs in higher education contexts. We reflect on a broad data set including interviews, surveys, case studies and workshops involving educators and students. Our contribution draws on the results of this study to propose eight tension-patterns, each an interplay between opposing tendencies that educators and students need to address, more or less explicitly, when creating speculative designs. We then discuss how these tension-patterns can support the design and analysis of speculative designs in educational settings while accommodating different disciplinary, methodological and material constraints. Finally, we conclude by examining two important challenges for Speculative Design in education: balancing creativity and criticism and moving beyond specialized courses.

INTRODUCTION

In her acceptance speech at the National Book Awards in 2014, the critically acclaimed speculative fiction

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writer Ursula K. Le Guin highlighted the need for creative participants in the process of imagining how the realities of people could be different:

Hard times are coming, when we'll be wanting the voices of writers who can see alternatives to how we live now, can see through our fear-stricken society and its obsessive technologies to other ways of being, and even imagine real grounds for hope. We'll need writers who can remember freedom—poets, visionaries—realists of a larger reality. (Le Guin 2014)

Le Guin's call to arms was directed towards the literary community but her message holds much significance for those in other creative fields such as design. The kind of objects that "see alternatives to how we live now", such as futures, include texts but also products, interventions, performances, props, etc. These objects of speculation, or speculative designs as we refer to them in this paper, exist in heterogeneous contexts for a range of purposes, sometimes other than Le Guin's ideal of imagining "real grounds for hope".

Speculative designs are part of technological projects (Savov 2018); Tanenbaum 2014), energy projects (Ardern et al. 2017), artistic projects (Dunne & Gaver 1997) and military projects (Niiler 2017). NGOs such as the Red Cross (Smith 2017) and Greenpeace (Greenpeace International 2014), multinational companies such as Ikea (Near Future Laboratory 2015) and Mozilla (Thorne & Rogers 2016), and political bodies such as the UK Government (Bruce 2019) and the European Commission (EU Policy Lab 2018) are but a few among the many organisations that employ speculative designs in order to materialise and deal with possibility. Designing speculations is no longer only a niche interest within a few art and design disciplines - it has spread its influence on a broad range of professional and industrial settings.

The amount of speculative work within the design research community is also increasing rapidly. The literature shows a wealth of approaches that critically examine the possibilities of designing technologies beyond industrial or market constraints. Work framed through approaches such as Critical Design (Dunne 2005, Malpass 2017), Speculative Design (Dunne & Raby 2013, Mitchell et al. 2020), Adversarial Design (DiSalvo 2012), Design Fiction (Bleecker 2009, Encinas et al. 2018, Encinas et al. 2016), Discursive Design (Tharp & Tharp 2019), Material Speculations (Wakkary et al. 2015), Reconstrained Design (Hanna et al. 2017) and many others (Blythe & Encinas 2016, Blythe & Encinas 2018, Blythe et al. 2018) is increasingly present in design research, sometimes in specific tracks within conferences such as GROUP (Barkhuus et al. 2020) or NordiCHI (Bratteteig & Sandnes 2020). It is important to note that the boundaries between these design approaches are blurred by the very objects they generate. Objects of Critical Design, Speculative Design, Adversarial Design or Design Fiction might be enclosed in different thematic or theoretical 'Russian dolls' depending on how the designer situates and approaches her research interest. The main proponents of these labels are themselves often quite open in defining the scope and character of their practices and the kind of objects they comprise and, rather unsurprisingly, lively discussions arise as to which one falls under another (Bardzell & Bardzell. 2013, Pierce et al 2015). In the present work we resort to the term "speculative designs" to refer to objects designed under the rubric of the aforementioned approaches, and related ones that might function primarily as a critical alternative, a possible future or a catalyst for reflection in any form (from imaginary narratives to theatre performances to physical prototypes to collages or storyboards, etc.). Our aim is to use the term 'speculative designs' in an inclusive manner, acknowledging that there is a broad range of approaches, each with their own emphasis, and that these approaches continue to evolve.

However, while examples of speculative designs and approaches are thoroughly explored, discussed and evolved, there is not enough attention paid in the literature to speculative designs as objects in the service of a pedagogical practice. In particular, discussions of their use from the perspective of educators are hard to find (Helgason et al. 2020). This is a particularly notable gap given that speculative designs are frequently developed within educational settings and speculative objects are increasingly present in the curriculums of technology and design educational programs mainly in Europe (Maxwell et al. 2019), South (Brandalise & Eira 2020) and North (Dunagan et al. 2019) America and Asia (Mitrovic et al. 2021, Helgason et al. 2021, Helgason et al. 2022)

In this paper, we joint other academic efforts in filling this research gap (Culén & Stevens 2022) by focusing on the role, motivations and characteristics of speculative designs in technology and design educational settings at undergraduate, postgraduate and (to a lesser extent) professional levels. Our study is based on work conducted during the two-year research project (Mitrovic et al. 2021) and consists of insights extracted from interviews, surveys, case studies, workshops and conversations with students and educators who see the process and outcome of their work as speculative designs. Our main contribution is a structured and practical schema to support educators developing pedagogical activities that hinge on speculative designs. We intentionally avoid over-determining how this schema should be used in order to allow educators and design researchers to arrive at its most appropriate uses. We arrived at this schema through personal immersion into the outputs and experiences of the project (which are detailed in Mitrovic et al. 2021), and through discussion amongst

ourselves as authors. We propose 8 tension-patterns, each an interplay between opposing tendencies that educators and students need to address, more or less explicitly, when designing speculations. We see the tension-patterns as effective for teachers and educators to figure out which methods to use and how they can be argued for in a project. Also, they are generative and can open paths of critical reflection that lead to informed experimentation. Finally, we hope that the tension-patterns we propose serve students and educators to balance their need for creativity and criticism and to better conceptualise, deploy and evaluate not only speculative designs, but also the debates that surround them and the audiences that encounter them.

BACKGROUND

The corpus of data that serves as the foundation of this article is the result of the work of the European Commission funded Speculative Edu (Mitrovic et al. 2021). SpeculativeEdu began in 2018, at a point where Speculative, Critical and related design practices were maturing and becoming widely discussed both inside and outside of academia (Mitrovic et al. 2021). The project offered a timely opportunity to take stock of how the domain had developed so far and to consider where it was heading as an educational approach into the future. We applied four information gathering approaches to examine and share knowledge and practices about speculative designs, and to collectively work towards developing novel educational techniques, activities and contexts. These were online surveys, interviews, case studies and conference workshops involving educators and students from countries mainly in Europe, but also from South and North America and Asia. The following section synthesizes the findings of formal and informal information gathering activities and highlights the most relevant insights that informed the tension-patterns schema that we present in the following section. More detail about our processes, results, research methods for data gathering and analysis can be found herein Mitrovic et al. 2021.

SYTHESIS OF RESEARCH FINDINGS

People who participated in our project activities contributed with varied insights on the motivations, outcomes, history and future directions of educational practices involving the making, presenting and reflecting upon speculative designs. It is not surprising to see speculative design used within design and also art disciplines, for example, in Interaction Design, Product Design, Graphic Design, Communication Design, Information Design, Interior Design and Fashion Design. However, it also seems that speculative design and related approaches are finding their way into other domains, such as, informatics, humanities, management studies and interdisciplinary disciplines, such as Futures Studies.

We argue that speculative design as a broad collection of approaches offers much to both design-based education as well as to other educational domains where a future-oriented lens is required for examining potential scenarios. The following five themes derive from our immersion in, and interpretation of, the work of the project and they serve as the jumping off point for the schema of tension-patterns that we propose in the next section (for a detailed account see Mitrovic et al. 2021).

DISCIPLINARY AND METHODOLOGICAL FLEXIBILITY AS A PREREQUISITE

Students and educators shared with us their views on the importance of taking a multidisciplinary stance to the process of learning and inquiry. This was seen as a way to equip students to meaningfully work and contribute to society in a yet unknown future and, also to develop the ability to work within various industries and with a range of stakeholders. As a practice, speculative design lends itself to a myriad of methods, and can be tailored to the disciplinary curriculum and the particular skills that educators aim to develop with their students. For example, storytelling, comics, science-fiction, film, architectural and urban designs, exhibitions and many other mechanisms are used to examine and articulate ideas.

We learned from our study that the knowledge involved in teaching and learning through speculative designs resists reduction in terms of defining a canon of suggested literature. Educators can make use of such “disciplinary fluidity” as so that students can reflect and develop their own context of interest.

DEVELOPING BOTH PRACTICAL AND CRITICAL SKILLS TO DEAL WITH UNCERTAINTY

Educators indicated that speculative design work can be used in the service of two main categories of skills development: practical and critical. Practical skills include project-based competencies, the ability to communicate through design, to materialize designs, to carry out research, and apply lateral thinking. Critical skills include the ability to examine existing design practices, and to reflect critically on the application of design methodologies and strategic or long-term thinking to deal with complexity, controversy, uncertainty, and societal, technological and cultural change.

QUESTIONING THE VALUES UNDERPINNING DESIGN THEORY AND PRACTICE

Educators are looking to speculative design to support inquiry into the values underpinning different design

practices within educational settings, such as in Human Computer Interaction (HCI). Many speculative designs can promote alternative values to those ascribed to "mainstream" or "commercial" design and students were often encouraged to question ideas such as design as need-seeking or problem-solving, or design for comfort and convenience, for example in considering the implications of the climate emergency.

A strong emphasis on social and environmental justice and participatory citizenship was very present in our conversations during the SpeculativeEdu project. Students and educators often showed a desire to go beyond a critical reflection on the roles of technology in society to consider implications and consequences and take a more proactive role in shaping the future through design.

EVALUATION METRICS TARGET BOTH DESIGN PROCESS AND DESIGN PRACTICE

We invited educators to suggest appropriate assessment metrics for evaluating student work involving speculative designs. Two categories emerged: Process and Practice, that illustrate the plurality of evaluative frames (Baumer et al. 2020) employed by educators. Some examples of process assessment metrics are "Depth and criticality in research documentation and analysis", "Team working, participation, experimentation and risk taking" and "Communication to, and engagement with, intended audience and publics". Practice assessment metrics included "analysis of possible impact and consequences of the designed output.", "Breadth and depth of worldbuilding and storytelling." And "quality and comprehensiveness of the proposal, presentation, exhibition or demonstration.". For a more thorough account of these metrics see Helgason et al. 2021.

EDUCATIVE SPECULATIVE DESIGNS ARE PERCEIVED AS CRITICAL ENGAGEMENTS

Issues of agency and responsibility derived from the use of speculative designs in education emerged from our project. We identified a tension here. There is a well stablished optimistic view of speculative designs as playing a transformative role in society, or at least supporting the training of practitioners of the future to use skills leading to transformation. At the same time, practices involving speculative designs are, rightfully, criticized as sometimes lacking political commitment, needing to be decolonized from its western history and emancipated from the current economic and socio-political system.

The desire to transition toward top-level influence was clear in some of the responses, for example in urban planning and government organizations, with a stronger influence on the "real world" and impact on more mainstream practice and educational approaches. There was an awareness expressed around the limitations of showing work only in "white cube" gallery spaces, and a desire to create broader impact in society and in professions. Comments often mentioned a need to include speculative designs in more curriculum subject areas such as policy making, psychology, social and anthropological studies, economics, business and management. However, some of our respondents were very skeptical of design practices that involved the creation of speculative designs but that lack the aim of transforming design education as a whole.

TENSION-PATTERNS: AN ACTIONABLE SCHEMA

Speculative designs are finding their place within the curricula of educational programs in different geographical regions and disciplines and adapting to new realities and calls for change (Mitrovic et al 2021). Educational practices involving speculative designs are becoming more critical towards themselves by looking outwards beyond the gallery and engaging with communities to produce "lasting" and "effective" outcomes (as in the change that communities identify) but also inwards towards the designers' own intentions, motives and expectations. These practices, according to practitioners and students, seem not to be only about creating futures but also, and importantly, about foregrounding the perspective (e.g. socio-cultural context) from which those futures are created. The focus is not only on the speculative design as an object, but also on how such an object relates to the context where it is produced and disseminated.

Informed by our exposure to the ideas and views of many practitioners and educators during the lifetime of the project, and the period since its conclusion, we propose a structured and practical schema that we hope can be helpful to educators and students entangled in pedagogical endeavours that involve speculative designs. We intentionally avoid over determining how these patterns should be employed by educators, and we invite them to find their own appropriate uses. They can act as continuous points of reflection and/or can be mobilized at particular moments of the design process.

WHY TENSION-PATTERNS?

The schema that we present here is not intended to be definitive or absolute, and it should be seen as our interpretation of what we have learned during the SpeculativeEdu project. It is offered as a contribution to the Nordes community to use and adapt as appropriate. In considering a suitable format, we are drawn to the notion of "pattern" developed by Christopher Alexander, Sara Ishikawa and Murray Silverstein (1977) as it is a well-known concept widely used and adapted in design research since its introduction in the

late 1970s (Allison et al. 2018, Bergström et al. 2010, Chung et al. 2004, Greenberg et al. 2014). In their celebrated book, Alexander et al describe patterns as fluid problems and their accompanying flexible solutions in architecture and urban planning. Some patterns focus on materials, infrastructure, life experiences and many others, having in common their broad applicability depending on context, community and purpose:

"The patterns are still hypotheses, all 253 of them—and are, therefore, all tentative, all free to evolve under the impact of new experience and observation" [ibid, p. xv].

One example is Carnival (pattern #58):

"[Problem]Just as an individual person dreams fantastic happenings to release their inner forces which cannot be encompassed by ordinary events, so too a city needs its dreams…[Solution] Set aside some part of the town as carnival - mad sideshows, tournaments, acts (…) which allow people to reveal their madness".

In common with Alexander's et al. patterns, the tension-patterns below are research-informed hypothesis that attempt to highlight complex issues present in design practice. Each tension-pattern represents an interplay between opposing tendencies that educators and students need to address, more or less explicitly, when creating speculative designs. Each tension pattern is not a binary or a dichotomy but rather a spectrum, or a dial that can be "tuned" in one direction or another. We, however, do not attempt to provide a "solution", a preferred way to balance the tension-pattern, but rather show how different projects have done so using different design materials, methods and processes. In this way, we hope that our contribution is not framed as a guide or a recipe in itself, but rather as an extra set of active ingredients to strengthen the coupling of an educational initiative with the (technical-social-cultural) context and communities where it happens. We will further expand on how these tension-patterns can be implemented in educational activities in the Discussion section below.

Each tension-pattern includes a short description that covers the tension-pattern´s spectrum as the conflicting tendencies that motivate it (the range of the tension-pattern as a dial between two opposing tendencies). Two case studies from our research project's dataset follow, as examples where the tension-pattern is expressed and balanced differently. Finally, we identify three design research examples that, in our opinion, have addressed the particular tension-pattern more or less explicitly. We do so to place our contribution in the context of the research literature that design educators and students might be already familiar with and to highlight the many ways in which these tensions-patterns are present in the landscape of design research. We have chosen this presentation format for the purpose of clarity, but we would like to remark that more than one tension-pattern is present in any single speculative design (what we refer to as tension-language in the Discussion section). Importantly, and before we move on to the tension-patterns, we would like to acknowledge that this set of tension-patterns is not exclusive or exhaustive (it a product of the context where this research project happened) and we encourage students and educators to modify this collection to better suit their particular contexts.

These are the 8 tension-patterns we propose: Human Exclusion, Engagement, Use, Completion, Gain, Perspective, Time and Non-Human Inclusion.

TENSION-PATTERN: HUMAN EXCLUSION

This tension-pattern calls attention to how people do not share the same experiences of inclusion and access within societies. Entire groups of people are excluded from participation in (often crucial) activities and discourse, while others face lower barriers to acceptance and visibility. Speculative designs balance this tension-pattern in the spectrum of Body – Humankind by addressing (or not) issues of exclusion affecting individual persons, groups of people, communities, ethnicities or, in an extreme scenario, the entire human race. Cases from our research project's dataset include:

Black Future Heritage Spaces – *"Two-day workshop under the theme ""Black Futurism: Creating a More Equitable Future" to illuminate pathways for solving issues that disproportionately affect Black people today. On the first day we came up with a world building activity ("Fill-in-the-future"). On the second day, participants built objects that would exist in these worlds."* (Famodu 2019)

Rhyl Illegal town plan –" *This proposal explores the development of a "fictional town plan" and how this might be used as a platform or working structure to assemble and represent the voices and opinions of local community groups and individuals who are affected or implicated by town planning but seldom offered an opportunity to comment on the organization and direction of their communities, its architecture, its history and its future."* (Ward & Loizeau 2012)

These projects show how design excludes, to a greater or lesser degree and more or less explicitly, particular individuals or groups from accessing the possibilities that design introduces. Black Future Heritage spaces highlights exclusion as a consequence of one's body and Rhyl Illegal Town Plan rises above the individual to leverage design as a tool to avoid the exclusion of local communities. HCI work where speculative designs address exclusion regarding race, gender and aging populations (respectively) are:

- *Who Gets to Future? Race, Representation, and Design Methods in Africatown (Tran O'Leary et al. 2019)*

- Intimate Futures: Staying with the Trouble of Digital Personal Assistants through Design Fiction (Søndergaard & Koefed Hansen 2018)

- Solutionism, the Game: Design Fictions for Positive Aging (Blythe et al. 2015)

TENSION-PATTERN: ENGAGEMENT

This tension-pattern addresses how an audience interacts with a speculative design. Is it more appropriate to communicate to a larger audience observing the speculative design in a gallery setting, or to include a smaller group actively involved in the design process? Is the speculative design a digital experience? Will people live or work with the speculative design object once completed, and how deeply are they likely to be affected? This tension-pattern is balanced within a spectrum that holds, at one extreme, the audience as detached observers and, at the other, the audience as engaged participants. Naturally, this spectrum is not a binary and there are many intermediate ways to design for audience involvement (such as improvisational methods in design research) (Kang et al. 2021). Cases from our research project's dataset include:

Communicative Machines Speculating on Death – *"The students are prompted to work on visual and experience design related to thought-provoking themes: "death" was the one for the 2019–2020 course. The task was to design interactive and experiential devices (defined as "Communicative Machines") in a critical and speculative framework, not by conceiving possible futures but rather by reflecting on alternative presents. The main outputs are objects, installations or interactive devices intended as 'object personas'".* (Guido 2020) Students work was presented in an exhibition format at the end of the course.

Peek, a game for future storytelling – *"Peek is a playable science fiction novel/game helping people explore complex narrative spaces of the present up to the year 2060. In Peek, players are "Future Archaeologists" working with a future-viewing device called "the Peek". They must report back on their future-possible glimpses to the "World Government".* The game presents research into artificial intelligence (AI), machine learning and sustainability in a shared narrative format that participants can speculatively inhabit." (Raskov 2020). The game was designed to engage the non-expert public in teaching and general play sessions.

These cases show how engagement with an audience is purposefully designed. "Communicative Machines" set the stage through design and later invited the audience to visit a gallery exhibition and "Peek.." was designed to be received as a playable experience and takes the audience's participation as essential during (and after) the design process. Related work within HCI that addresses Engagement through workshops, public participatory activities and domestic deployments respectively comprise:

- The magic machine workshops: making personal design knowledge (Andersen et al. 2019)

- On Speculative Enactments (Elsden et al. 2017)

- Material Speculation: Actual Artifacts for Critical Inquiry (Wakkary et al. 2015)

TENSION-PATTERN: USE

This tension mirrors Engagement from the perspective of the designer and focuses on the capacity of the speculative object to provide support to a story. Speculative designs resolve this tension-pattern within a continuous spectrum that holds, at one extreme, a design object that functions as a prop that helps to structure a story, animating a script and connecting fictional objects in the mind of the viewer and, at the other, a design object that functions as a product, creating ad-hoc narratives when a person activates the object through use. Cases from our research project's dataset include:

Future Domestic Landscape – *"The course brief asked the students to imagine domestic life 20 years from now and critically design for this future context, using the format of design fictions, producing minimum one experience prototype and a 2–3 min long video narrative. Rather than recycling the broken imagination inherent in the technocentric, flat-pack Western rendition of "the smart home", we were interested in prototyping a plurality of highly diverse, sometimes conflicting, domestic futures".* (Umea Interaction Design 2017)

Tricky Design Probes – *"Believable design tools, which appear to be innocuous, but progressively engage designers in crossing boundaries of what should be acceptable. This is done by slowly derailing design research activities, leading to trigger reflection on the part of designers on their beliefs, practice, and the tools they use. Our probes raise issues at the intersection of design research and gender in urban service design, such as the use of pre-made algorithms to understand gendered patterns in urban movements."* (Beignon et al. 2020)

These cases emphasize that the result of their design process is a (speculative) product, however, these products are activated within different contexts of use. Stories and narratives, complete with actors, scenes, motivations and actions, bring life to products, revealing meanings and understandings of the world they belong to. Future Domestic Landscape presents a collection of items that illustrate stories of the meaning of "home", while Tricky Design Probes blur the boundary between prop and product through the actual use of the probes by designers. Related work within design research leveraging design for mainly narrative purposes to designs that engage people through actual use (respectively):

- Social Icebreakers Everywhere: A Day in the Life. (Mitchell et al. 2020)

- Metaprobes, Metaphysical Workshops and Sketchy Philosophy (Encinas et al. 2020)

- *Real-fictional entanglements: Using science fiction and design fiction to interrogate sensing technologies. (Wong et al. 2017)*

TENSION-PATTERN: COMPLETION

This tension-pattern addresses the degree of fidelity of a speculative design and its relation to the design process. This may be a fluid or contested situation depending on the motivation. Is the purpose of the speculative design object accomplished through a sketch, a prototype or a finished product? What is the primacy of making and when is it considered enough? Is the emphasis placed on the process leading to the speculative design or rather the speculative design itself once it is completed? The spectrum of this tension-pattern is a continuum that connects a focus on process at one end and a focus on outcome at the other. Cases from our dataset include:

Extreme Biopolitical Bistro – *"The Extreme Biopolitical Bistro offers a space to experience a biopolitical "care of the self" happening on our plates through collaborative dinner enactments and prototyping of elaborate data-driven menus. The Bistro works as a kitchen lab with various props performing the food research on nutrigenomics, microbiome, but also hardware, machine learning, and blockchain where anyone can come and discuss their concerns about the future".* (Dolejšová & Kera 2020) This takes the form of a pop-up event open to the general public.

Circular Geology – *"In several experiments, I generated rock strata out of the most distinctive artificial materials of our time: plastics, aluminium, and concrete. The resulting artificial rock samples represent the geological formation process of metamorphic, magmatic, and sedimentary rocks."* (Alt 2020) The design process was oriented towards producing an outcome that was later exhibited.

These cases demonstrate that on-going processes and their documentation can be prioritized as outcomes. In Extreme Biopolitical Bistro, the labs are both performative events and prototyping activities, producing published documentation of the processes and the issues discussed. In contrast, Circular Geology presents objects as outcomes that invite a consideration of the open-ended processes of transformation of natural and artificial materials. Related work within design research that addresses Completion as the interplay between process and outcome includes:

- Grand Visions for PostCapitalist Human-Computer Interaction (Feltwell et al. 2018)

- Pushing the Limits of Design Fiction: The Case for Fictional Research Papers (Lindley & Coulton 2016)

- Making multiple uses of the obscura 1C digital camera: reflecting on the design, production, packaging and distribution of a counterfunctional device (Pierce et al 2015)

TENSION-PATTERN: GAIN

Gain addresses value transactions, negotiations and exchanges embedded within speculative designs. These cases address questions of who benefits from the speculative designs and how transparent this is. Is it the designers or audiences who benefit, and how fair or equal is the gain for different groups? Is the project a commercial or a research effort? Are there clients? What is the role of money or other intangible tokens of exchange? The spectrum of this tension-pattern spans speculative designs aimed at accomplishing knowledge exclusively to commercial speculative designs produced in exchange for a form of monetary currency and all the variations present between these two extremes. Cases from our dataset include:

In Your Hands – *"A performance and accompanying video where remote-controlled roller skates place the artist's fate in the hands of the audience, creating a situation where ethical parameters are challenged. Humour and spectacle are used to lure the participants into the thrill of the event while distracting them from what is really happening, namely a subversive social experiment which questions how far people are willing to go to seek their own enjoyment".* (Macdonald & Kargotis 2007)

Man & Interior – *"Five fictional companies and their products and services were presented during the Biennale Interieur 2014 interior design trade fair in Kortrijk (Belgium). The companies were intended to provoke visitors and exhibitors to think about people's evolving needs and the ways in which future businesses could offer new types of products and services in new ways to respond to those needs".* (Baerten, 2014)

The question of who gains from a transaction or negotiation, and the costs and wider effects, is not always straightforward, so these projects encourage an examination of the processes at work. The audience watching In Your Hands must make choices about how to use the control that has been handed over by the artist, gaining responsibility as well as power. Alternatively, Man & Interior presents a more "realistic" collection of fictional new business offerings encouraging exhibition visitors to consider the implications of these product and service concepts if launched onto the market. Related work within design research where Gain is balanced at different points of its spectrum include:

- Low Power Web: Legacy Design and the Path to Sustainable Net Futures (Willis et al. 2020)

- Do-It-Yourself Medical Devices: Exploring Their Potential Futures Through Design Fiction (Stead et al. 2018)

- The IKEA Catalogue: Design Fiction in Academic and Industrial Collaborations (Brown et al. 2016)

TENSION-PATTERN: PERSPECTIVE

Perspective centers on understanding where the impact of a design project is situated and its relation to the geographical context in which it happens. These contexts could be limited to place-based communities or extended to those whose boundary relates to other commonalities or shared practices. There may be overlaps between communities located in the same physical spaces, or separated by geography, raising questions about shared or opposing concerns. The spectrum of Perspective ranges from local to global in relation to the topic addressed by the particular speculative design. Cases from our dataset include:

Speculative Development of Bratislava – *"By creating "hyper-unrealistic" speculative collages, we tackled the thin line between the acceptable manipulative nature of advertising and the need to inform the public about private development plans in the city with transparent visuals. For most locals, it's hard to imagine what the new district composed of various projects from different companies will look like. There is no proper visualization or 3D modelling of the entire future area. Residents can only use their imagination – or perhaps, travel to the future".* (Hamosova 2019)

Plasticful Foods – ***"****The Plasticful project has taken facts from the present day, and projected them into a possible future, to invite audiences to imagine that Plasticful Food may be a viable waste management practice within the coming decade. As we are already consuming large amounts of microplastic incidentally, and waste management procedures are not changing rapidly enough to contain the problem of global plastic pollution, eating our plastic waste may be our only option for plastic containment in the near future. Is this a future you would like? Or would you act to avoid this future?"* (Niño et al. 2020). The project takes a global outlook on waste management practices involving plastics.

Locality can be framed as physical but it also concerns the social relations between communities within a geographical area. Speculative Development of Bratislava is concerned with local urban development, utilising the visual language used to market this rapid city development in order to critique the relationship between the vision and the reality. On the other hand, Plasticful Food highlights a global environmental problem and promotes local understanding of the impact of daily human behaviour. Related work within design research that addresses Perspective by locating a speculative design in the spectrum between local and global includes:

- *WhatFutures: Designing Large-Scale Engagements on WhatsApp (Lambton-Howard et al. 2019)*

- *Vivewell: Speculating nearFuture Menstrual Tracking through Current Data Practices (Fox et al. 2019)*

- *Avoiding ecocidal smart cities: Participatory design for more-than-human futures. (Heitlinger et al. 2018)*

TENSION-PATTERN: TIME

This tension-pattern considers that although every speculative project is located in (and communicating aspects about) the present (as the moment in which it was created), it may thematically address the past (through counterfactual stories, for example), the present (through alternative presents) or the future (through visions). The spectrum of Time stretches from the past to the future in relation to the moment when a speculative design was produced. Cases from our dataset include:

From Fiction to Action — Design in a state of exception – *"Students analyzed historical and present strategies of civil rebellion and extrapolated them into certain futures. Using narrative and speculative design methodologies the group developed new perspectives on what design can be and in which fields it may extend. We conducted this project in the summer term 2017 – to the background noise of the G20 summit in Hamburg, a big protest of neo-Nazis in Halle (+ counter protests), the global rise of right-wing politics and increasing use of smart surveillance systems. The project outcomes reflect these events and how we and the students pictured a future state of exception".* (Naumann et al. 2017)

Ghosts That Walk the City Episode 1: Flights of Fancy - *"A 10-day speculative workshop was the first instalment of Ghosts that Walk the city - a narrative-based historical research project. It engaged with the unseen shadows along the Ahmedabad Heritage Walk to observe and represent the fringe, the underground and the marginal on it, culminating in an exhibition which brought together eight distinct visual narratives from 3rd and 4th-year architecture students. Using observation and speculation, this project through visual narratives explored key questions of commodity, age, power, market, authenticity, appropriation, politics, religion, control, beauty and identity and the roles they play in the construction of a grand narrative of Ahmedabad Heritage Walk. A deliberate shift from the singular narrative to identifying untold stories led to the question: 'Which stories make up 'histories'?"* (Trivedi & Jain 2019)

This tension-pattern mirrors Perspective but deals with context in a temporal sense rather than in a spatial sense. These cases show that tensions exist around the differing types of personal and collective investment into what has been, compared to what is yet to come. "From fiction to action…" is firmly located in its present by designing a future vision that is strongly linked to it and "Ghosts…" deals ambiguously with temporality to avoid creating singular narratives and questions how histories of the past and stories are intimately entangled. Examples of related work within design research that explicitly leverages speculative designs to address Time include:

- *Expanding Modes of Reflection in Design Futuring (Kozubaev et al. 2020)*

- *CHI and the future robot enslavement of humankind: a retrospective (Kirman et al. 2013)*

- *The Computer for the 21st Century (Weiser,2002)*

TENSION-PATTERN: NON-HUMAN INCLUSION

This tension emphasizes the involvement of other-than-human perspectives when making speculative designs. These projects investigate the agency of real beings such as fungi, insects or microbes, and the roles they play in alternative scenarios. Imaginary forms of life are also considered in this tension-pattern, and how they might interact with the human created world. Cases from our dataset include:

The Microbial Starter Kit – *"Microbes are the basis of our microbiome and form our immune system. However, because of the continuously increasing number of Caesarean sections, more and more children are missing out on these important microbes. By combining the knowledge of microbiology, medicine and childbirth, the microbial starter kit gives parents the prospect of passing on the mother's vaginal microbes to their child as well as strengthening the bond between them through an emotional ritual".* (Wieland 2020)

Equine Eyes –"*A set of design prototypes which are developed to help designers understand other nonhuman species so that they can design for and with other species. The project contains a set of wearable and useable headsets which test approaches to fostering inter-species connections with horses. The prototypes run counter to ACI's – Animal Computer Interaction- (and HCI's) scientism to create a set of outcomes which explore other ways of knowing, and other approaches to designing for and with other species".* (Hook 2020)

These cases show the complexity that arises from including non-human perspectives in human affairs. "The Microbial" attempts to bring back microbes into practices of childbirth and "Equine Eyes" focuses on building stronger human-horse connections. Related work within HCI where speculative designs serve the purpose of building narratives supporting non-human inclusion:

- *Ghosts in the Smart Home (Lindley et al. 2020)*

- *Designing with More-than-Human Food Practices for Climate-Resilience (Dolejšová et al. 2020)*

- *Design for collaborative survival: An inquiry into human-fungi relationships (Liu et al. 2018)*

DISCUSSION: TENSION-PATTERNS IN PRACTICE

As we look over the results of our inquiry representing a substantial collection of voices in the field, it is clear to us that approaches involving speculative designs in education remain an important and evolving domain, exhibiting a desire to reflect upon their history in order to face their future. Our study shows that this is a domain that is no longer in its infancy or led by one or two institutions; it is a broad and diverse field and as it enters a more mature phase, researchers, educators and practitioners should have knowledge and tools to critically develop its potentials.

As suggested by our participants, and if applied effectively, educational practices involving speculative designs can be pedagogically beneficial. They can offer the freedom to creatively explore and extrapolate from signals observed in the present, in order to ask questions about how the technologically augmented future - or indeed the present - could be, rather than merely how it should be. 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.

At the same time, the consideration of bringing speculative designs into education needs to acknowledge the (necessary) complexity that is integral to it. Our study shows that pedagogical activities involving speculative designs attempt to develop both practical and critical design skills in students, expose and question the values underpinning the subject of study and require disciplinary and methodological flexibility. In turn, speculative designs are evaluated through multiple and diverse metrics targeting both a student's design process and practice. We believe that the tension-patterns we propose can serve students and educators to navigate and respond to such complexity in two main ways that we describe below.

SELECTING DESIGN METHODS WITH TENSION-PATTERNS

Participants in our study reported on the importance of methodological and disciplinary flexibility when designing a course or other learning activity. Absolute assessments in terms of "right" and "wrong" are not appropriate terms to decide which methods to use. Instead, methods for creating speculative designs, should attain precision through relation and not through a criterion of objectivity - a method is valid through its relation to context, purpose and audience. For both students and educators, defining the methods is as important as defining and answering to the design brief (or other learning activity) because it reflects on the designer's ability to critically engage with the people and the context where the speculative design happens.

We see the tension-patterns we propose as effective for teachers and educators to figure out which methods to use and how they can be argued for in a project. They can open paths of critical reflection that lead to informed experimentation. For instance, recognising how the balance of a tension-pattern is influenced by certain design decisions might lead to choosing a different set of methods, eg. a co-design session might

be seen as a singular event in the design process or as a continuous form of engagement depending on how the tension-pattern of human exclusion is considered and balanced. Importantly, balancing a tension-pattern is a creative act and we hope that the cases and design research examples accompanying our tension-patterns above can serve as a first step to choosing suitable methods. The heterogeneity of these examples testifies to the range of methodological and creative possibility available.

FORMING A TENSION-LANGUAGE WITH TENSION-PATTERNS

Earlier we described our tension-patterns independent of each other for the purpose of clarity but, as we argued earlier, they can only be considered in relation to each other. Each tension-pattern is more or less present (or active) in a speculative design, and each is balanced more or less explicitly using certain design materials, methods or processes over others. The relational character of tension-patterns brings us back to the work of Alexander et al, in particular to their notion of Pattern Language. Alexander et al argue that a combination of patterns (from the 253 they propose) could be understood as a language to generate different elements in the built environment. For example, the combination of 10 patterns including "private terrace on the street (pattern #140)", "sunny place (#161)", "raised flowers (#251)", "different chairs (#251)" is "itself a language: it is one of a thousand possible languages for a porch, at the front of a house… this is the way the language, and its patterns, helped generate this porch" [Alexander et al. 1977, p.xxxv]. In a similar vein, we see the combination of the tension-patterns we propose as way of proposing a tension-language that help generate or analyse a speculative design within an educational setting. For example, the tension-pattern "Human Exclusion" in combination with the tension-pattern "Gain" can open a discussion around how a speculative design excludes a particular group of people because of how the designers have conceptualised who benefits or what is gained from the scenario in which this speculative design exists or where this particular speculative design is exhibited.

In common with Alexander's et al Pattern Language (or languages), tension-languages need to be highly contextual and dependent on the very particular elements that make up an educational project involving speculative designs. Where is it imparted? What is the cultural milieu of those involved? What are the expectations of students and tutors? What kind of funding does it have and who is providing it? A tension-language, as the deliberate combination of different tension-patterns, is intended to make all these aspects more explicit to those involved in the educational process and allows them to consider how to balance the tension-patterns through methodological and design decisions of their own choosing. As previously discussed, we expect that educators and designers will bring their own disciplinary knowledge to the implementation of their creative work, so we avoid being prescriptive when suggesting tension-patterns and the tension-languages that might result from combining them. It is our desire to convey the ideas emerging from our research in a way that the design research community can use and build upon them, without being restricted by disciplinary constraints. Hence, we welcome the addition of other patterns to expand and modify the language, drawing on other experiences and contexts and offer our contributions in the hope that they are useful and inspirational to both students and educators.

CONCLUSION: CHALLENGES FOR SPECULATIVE DESIGNS IN EDUCATION

We have reported on a two-year research project investigating the role, motivations and characteristics of speculative designs in technology and design educational settings at the university level. We ground our insights on interviews, surveys, case studies, workshops and discussions with students and educators who see the process and outcome of their work as speculative designs (Mitrovic 2021). One of the most striking themes that emerged from our study was the desire to use speculative designs as a vehicle to implement transformation and to create impact on the world through activism and action. This desire was supported by a discussion around the importance of reflecting on and questioning the values imbued within any design exercise. The complexity that accompanies a critical examination of values coupled with the will to impact the world is a problem that needs to be carefully negotiated by both educators and students. The line that separates the actual and the possible is a thin one, and speculative designs, like objects of design, thrive in the ambiguous, the artificial, the contradictory and the disputed. Designers creating speculative designs constantly negotiate multiple contexts that lack clear facts and objective truths and do so through a creative engagement with a multiplicity of design materials. The challenge rests on how to combine creativity and criticism for the purpose of learning. How to create a generative educational setting where a project can progress without criticism derailing productive creative trajectories. How to build and share "a set of processes, practices and questions that allow for both production and reflection, analysis and making, critique and creation." (Ward 2019). We hope that the tension-patterns we propose serve students and educators to balance their need for creativity and criticism and to better conceptualise, deploy and evaluate not only speculative designs, but also the debates that surround them and the audiences that encounter them.

Speculative designs as pedagogical tools in educational settings can help students and educators understand the

context and consequences of their design practice. However, it is necessary to consider whether the current format where many speculative designs are produced is appropriate for developing and designing according to such mechanisms. For example, how many weeks are enough to develop an understanding of the colonial past and present of design practice (Escobar 2018) and respond to it through speculative designs? Perhaps the main challenge of incorporating speculative designs in education today lies in doing so, not through specialised courses that restrict their creation to a particular practice (such as speculative design or critical design) but rather as a pedagogical tool present through a larger part of the educational curriculum. Perhaps educators and students together can be "realists of a larger reality", as Le Guin hoped, and the speculative designs produced within educational settings serve to "imagine real grounds for hope". Doing so, however, might involve more than a short, specialized course within a technology or design curriculum that lacks any other resources for critical thinking.

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