
This is an electronic reprint of the original article.
This reprint may differ from the original in pagination and typographic detail.

Meskus, Mianna; Tikka, Emilia

Speculative approaches in social science and design research: Methodological implications of working in 'the gap' of uncertainty

Published in:
Qualitative Research

DOI:
[10.1177/14687941221129808](https://doi.org/10.1177/14687941221129808)

Published: 01/04/2024

Document Version
Publisher's PDF, also known as Version of record

Published under the following license:
CC BY

Please cite the original version:
Meskus, M., & Tikka, E. (2024). Speculative approaches in social science and design research: Methodological implications of working in 'the gap' of uncertainty. *Qualitative Research*, 24(2), 209-228.
<https://doi.org/10.1177/14687941221129808>

Speculative approaches in social science and design research: Methodological implications of working in ‘the gap’ of uncertainty

Qualitative Research
2022, Vol. 0(0) 1–20
© The Author(s) 2022



Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/14687941221129808
journals.sagepub.com/home/qjr



Mianna Meskus 

Faculty of Social Sciences, Tampere University, Finland

Emilia Tikka

Department of Design, Aalto University, Finland

Abstract

Recent studies in design research and science and technology studies (STS) have investigated how speculative thinking might be applied in empirical contexts. A unifying feature of speculative approaches has been an interest in futures as mediated, shaped and conditioned by science and technology. Yet concrete methodological conditions of speculative research events remain under-explored. There is a need for a more nuanced understanding of speculation ‘as it works’. While speculation does not constitute a unified method or analytical grid with a defined set of elements, speculative research is not innocently playful or free of methodological constraints. Speculation denotes here philosophically driven knowledge production conducted with research participants on science, technology and futures. Based on experiences of two social science and two design research cases in cellular reprogramming and genomic engineering, we illustrate and theorize our methodological observations on what takes place in speculative practices with participants. Drawing on Whitehead’s and Stengers’ conceptual work on experiential practices of knowing, we develop the concept of ‘the gap’ to describe the mode of speculative engagement that shapes concrete relations and positioning in research events. Contingent and situated, the gap of speculative action builds on openness, uncertainty and hesitation. Achieving the gap is the aim of speculative engagement and also a methodologically elusive, risky part of the study process. The concept of the gap helps illustrate what researchers ask from participants in the name of speculative openness, and

Corresponding author:

Mianna Meskus, Faculty of Social Sciences, Tampere University, Kalevantie 4, Tampere 33014, Finland.

Email: mianna.meskus@tuni.fi

how participants position themselves in these encounters. It allows us to highlight how participants, in turn, invite researchers to reposition themselves and demand experiential involvement that may reconfigure the course of the study.

Keywords

social science, design research, speculative thinking, methodology, futures, uncertainty, the gap, experience, biotechnological modification

Introduction

There has been a growing interest in developing innovative modes of inquiry in social science research that engages with arts and design (Lupton, 2021; Lury and Wakeford, 2012; Marres et al., 2018). Identifying four main strands of collaboration between science and technology studies (STS) and design research, Salter et al. (2017) propose that these fields may draw upon each other in order to investigate the consolidation of scientific facts and technological artefacts, enlarge methodological repertoires, engage different publics with science and technology, and conduct interventions and political engagements with sociomaterial worlds. In this article, we focus on the second strand, that of enlarging methodological repertoires at the intersection of STS and design research. We aim to contribute to recent methodological development in the interdisciplinary arena of speculative research. Through case studies on the biotechnological modification of the living – human and more-than-human lives in co-constitutive relations with science and technology – we explore what it means to conduct and combine social science and design research in a speculative mode while remaining attentive to the methodological issues that this mode generates.

Speculation denotes in this article philosophically driven knowledge production in collaboration with research participants on science, technology and futures. We discuss examples of speculative ‘research events’ (Michael, 2016) in relation to Isabelle Stengers’ (2005, 2010, 2011a, 2011b, 2011c) conceptual work on the multiplicity of knowing. Stengers draws from A. N. Whitehead’s speculative philosophy so as ‘to be able to think about the creative power of the sciences’, but also ‘about their catastrophic indifference to what they judge “non-scientific”’ (2011a: 11). For Whitehead, the knowledge we can have of nature is embodied and sensory. Consequently, speculation is founded in various forms of experience: ‘It belongs to speculative thought to fight against the impoverishment of experience’ (Stengers, 2011a: 26). The research events we bring together and reflect upon from a methodological perspective highlight different forms of knowledge production on biologies of the body and technologies to shape the human condition. These research events have attempted at the *suppression of hierarchy* (Stengers, 2011c: 24) in the experiential production of knowledge, to explore sociotechnical futures with study participants. Conducted in a speculative mode, the study cases have explored open-endedness and the value of ‘not-knowing’ (Stengers, 2005).

Design scholars emphasize that speculation does not constitute a unified method in design, but they call for more methodological rigour (Dunne and Raby, 2019; Malpass, 2017; Tonkinwise, 2014). Social scientists also maintain that speculation cannot be fitted into an analytical grid with a defined set of elements (Hendrickx, 2017), with the result that speculation does not constitute a single method (Halewood, 2017; Wilkie et al., 2017). Bringing these views together, we develop in this article the concept of ‘the gap’. This concept denotes a mutual orientation, a mode of conducting research, which shapes concrete relations and positioning in research engagements. While we are cautious not to overdefine it, the gap attempts to capture the openness and uncertainty immanent in speculative research. The gap of speculative action is contingent and situated. It is constituted in and through research events that, as our case studies illustrate, call for an awareness of and a willingness to recognize the unsettling situations – such as the suppression of hierarchy – upon which speculative thinking is built. The concept of the gap, we propose, is a heuristic tool for analyzing the relations between participants and researchers in the constitution of speculative research practices.

Recent STS studies have investigated how speculative thinking might be applied in empirical research contexts from, for example, assisted reproduction to emergency provision and energy transition (e.g., Guggenheim et al., 2017; Meskus, 2021; Wilkie and Michael, 2018). In design research, speculative thinking has been used to explore and co-create visions and material objects that comment on, for instance, robotics, tissue engineering and electricity consumption (e.g., Auger, 2012; Dunne and Raby, 2013; Mazé, 2019). A unifying feature of speculative approaches has been an interest in futures as mediated, shaped and conditioned by science and technology – an interest with which we align ourselves as scholars of STS (Meskus) and design (Tikka).¹

Despite such shared enthusiasm for speculative modes of study, concrete methodological conditions of speculative research events remain under-explored.² There is a need for a more nuanced understanding of speculation *as it works*, as Guggenheim et al. (2017) propose. In an effort to make the processes of speculative research more visible, we ask the following: if speculation is expected to allow qualitative research to engage people in imagining and creating space for different kinds of present and future worlds, what are the implications for those involved? What kinds of elements of engagement might be pertinent when conducting speculative research? How can we gain a deeper understanding of speculative research by focusing on the way the approach carries with it its own conditions and constraints?

To answer these questions we draw from research experiences and observations from four study cases, in the following order: (1) a practice-led design engagement with bioscientists on the CRISPR-cas9 gene editing technology, conducted through an artist’s residency in a laboratory in Germany in 2018; (2) focus groups with elderly people that took place in 2020 in Finland about the biotechnological modification of ageing; (3) ethnographic interviews with European bioscience researchers on creating synthetic gametes in the laboratory, conducted in 2011–2016; and (4) a design collaboration with a reindeer herder living in the Finnish Arctic on the biotechnological modification of human and more-than-human nature, conducted in 2021. Cases 1 and 4 exemplify speculative design research, cases 2 and 3 speculative STS research.

We have brought the cases together to ensure that our findings could not be ascribed to the particularities of any individual case or the specific methodology of either author (cf. [Botero et al., 2020](#)). The first two cases illustrate what researchers ask from participants in the name of speculative openness, and how participants position themselves in speculative encounters. The two latter cases highlight how participants, in turn, invite researchers to reposition themselves in study processes and require researchers to become experientially involved in working in the gap of speculation.

Speculation in design and STS research

Speculative design is a conceptual field of design that often explores science and technology and their possible societal implications through ‘making’. While systematic methodological development in this field remains in its early stages, speculative design tactics include the use of counterfactual histories, ‘what if’ scenarios, unreality, ambiguity, and provocation to craft artefacts and, through them, to generate debates on sociotechnical futures ([Malpass, 2017](#)). Critical futures studies scholars also use scenario-building to explore possible, probable and alternative futures ([Ahlqvist and Rhisiart, 2015](#); [Inayatullah, 2013](#)). Speculative design shares the aim of contesting hegemonic thinking by creating alternative futures. However, in speculative design, these futures are explored through materiality and making. Often this includes an iterative process of making or co-creating physical props through engagement with different publics and participants. For instance, [Haines \(2021\)](#) has speculated on reproductive futures by creating hyperrealistic sculptures of physically transformed newborns, ‘designer babies’, to explore how better to survive the climate crisis ([Haines, 2021](#)). Speculative design artefacts might be objects of everyday culture but designed *for* alternative realities and futures. [Liu \(2021\)](#), for example, has designed pregnancy menswear to explore the possibilities of non-female and transgender pregnancies. Importantly, design research that builds on speculation is not trying to predict the future but uses design to open up different kinds of possibilities for discussion and debate ([Dunne and Raby, 2013, 2019](#); [Escobar, 2017](#)).

Speculative social research, meanwhile, aims to reclaim the notion of speculation from actuarial and economics-based analytical frameworks, and revitalize its use in studying the imaginary, the heterogeneous and even the impossible in social science ([Savransky et al., 2017](#)). Currently, speculation represents both one of the structuring principles of neoliberal capitalism and the imaginative force that must be deployed against it ([Beech et al., 2017](#)). Drawing from the process ontology of speculative philosophy, social research has sought to develop new approaches to the study of sociotechnical developments and of the ecological crisis and related futures ([Parisi, 2012](#); [Wilkie et al., 2017](#)). Like speculative design, this area of study does not provide a unified toolkit for conducting research in a speculative mode. To enable creativity in knowledge production and engagement with study participants, social studies that mobilize speculative thinking have probed into creating speculative devices such as pistol art ([Schillmeier and Lee Schultz, 2017](#)), software research robots ([Wilkie et al., 2015](#)), and sandbox-based play ([Guggenheim et al., 2017](#)). Here, too, the aim has been to render complex existing and

emerging technologies and forms of knowledge open for personal and collective consideration and valuation.

Like several previous studies at the intersection of social science and design research, we also engage with the speculative philosophy and process ontology of Whitehead, interpreted and developed further by Stengers (e.g., [Michael, 2012, 2016](#); [Rousell, 2022](#); [Wilkie et al., 2015, 2017](#)). Stengers' work on the intertwinement of experience and knowing, and multiple forms of knowing including the risks and promises of not-knowing, allow us to analytically unpack research events conducted in the speculative mode. The speculative mode has been elaborated particularly in relation to the conceptual figure of the 'idiot' that Stengers borrowed from [Deleuze \(1997\)](#) to denote a character who resists the consensus in a given situation, slows others down by not knowing, and in so doing questions the meaning of knowing ([Stengers, 2005](#)). In this article, we draw attention to the related concept of 'interstice'. Taking up [Whitehead's \(1985\)](#) notion of the interstice as something the idiot represents or embodies, Stengers discusses a kind of gap where knowledge production can encounter and address 'the unknown constituted by [...] multiple, diverse worlds' (2005: 995). Furthermore, she contends that because questioning the basis of knowledge engenders 'fright', interstices *tend to close rapidly* (2005: 996). This idea resonates with our experiences of conducting research in a speculative mode. We propose resisting the closing of the interstices – and the fear of messiness in research engagements – in order to consider how researchers, designers and participants relate to each other in speculative knowledge production.

A foundational element of working in the gap is that people are invited to orientate towards the uncertainties and not-knowing entailed, for example, by uncertain technoscientific futures (see also [Bryant and Knight, 2019](#)). Here, we follow the observation that interstices show how 'life is in the empty spaces' ([Debaise, 2013: 102](#)), a Whiteheadian emphasis of the in-between character of life. Temporality becomes likewise important in creating the speculative gap, since the term interstice connotes an interval between two moments. The interstices of time have often been regarded as mere instances of 'emptiness' separating cause from effect, or action from reaction ([Debaise, 2013](#)). In this article, we show that by an acceptance and appreciation of not-knowing, a speculative approach gives explicit value to what is thought of as emptiness, hesitation and temporal disjuncture in practices of knowing. Methodologically, this means that participants and researchers are explicitly and repeatedly repositioned in the relations of research engagement.

Creating 'the gap' for speculation

Scholars working with anticipatory public engagement methodology, scenario-building and speculative tactics have noted that it is actually very difficult to imagine alternatives to the predominant future scenarios. Without explicit attention to the social and cultural contexts of engagement, participants are likely to develop responses using definitions and narratives that are predefined by scientific and policy elites ([Guggenheim et al., 2017](#); [Macnaghten, 2021](#); [Milojević and Inayatullah, 2015](#)). Scientist participants in particular tend to assume that what is expected from them are performances of expertise and

knowledgeability regarding the scientific and technical questions explored. Yet speculative research engagements often invite participants to ‘suppress hierarchies’ of knowing, as [Stengers \(2011c\)](#) has described her experiences of collaborative speculative thinking in the context of teaching. These research events may also purposefully aim to ‘de-throne the fact-value distinction from which it has been assumed that procedure must flow from the presentation of a matter ‘factually’ before ‘value-laden’ opinions are invited’ ([Bell, 2017: 191](#)). Participants may, however, struggle to step out of their everyday frames of reference. We illustrate this observation with our first case study from design research.

In 2018, one of us (Tikka) spent 3 months in a biomedical research centre laboratory in Germany as artist in residence. Organized by an art and science agency, the residency was part of a larger EU project concerning public dialogues on genome editing ([Orion, 2021](#)). During the residency Tikka, a designer and non-scientist, collaborated with several bioscientists from the research centre. Some of them created standardized protocols for induced pluripotent stem (iPS) cells, while others concentrated on analyzing gene regulation. The topic of collaboration was the way biomedical technologies might be used in the future to modify human longevity through manipulating cellular time and the biological hallmarks of ageing. The process included, first, discussions and brainstorming with the scientists and, later, ‘making’, using materials available at the wet lab. The aim was to incorporate speculation as part of the scientific experimentation on genetic reprogramming at a moment when, globally, stem cell reprogramming and genome engineering were under close political, regulatory and ethical scrutiny (e.g., [Meskus, 2018](#)).

Using laboratory materials such as cell culture devices and cell colonies enabled moving the co-speculation with the scientists beyond merely using words and into the realms of making. Together with lab scientists, Tikka used the protocol of cellular reprogramming to reactivate one of the so-called Yamanaka factors or pluripotency genes in human cells using the novel dCAS9 system, a form of CRISPR genome editing technology. Materials and protocols of the everyday lab setting were deployed to co-speculate how ageing could be reversed on a molecular scale through genetic engineering. Drawing on this experimental experience, Tikka designed a semi-speculative device, an inhaler illustrating a future consumer product offered to halt the ageing process ([Figure 1](#)). The inhaler represented what would be needed, in theory, to halt ageing, its glass vials consisting of the components used in the laboratory experiment to manipulate cellular ageing. To bring in the broader societal and affective context, she placed the inhaler into a triptych of 11 photographs. This artwork presented a couple living in a speculative future where the device could be purchased for daily use, with some choosing to remain looking youthful and others deciding to age ‘naturally’.

Getting bioscientists to embrace speculative uncertainty and fabulation proved challenging. When collaborations took place within the institutionalized setting of the research centre laboratory, scientists were not as ‘free’ to speculate as the artist, being representatives of the scientific institution and thus attached to the scientific ‘facts’ of the present. They resisted venturing into thought experiments on bioscientific futures that were not yet scientifically proven. This is not unexpected. Studies on participatory research in scenario workshops have noted that scientists often feel uncomfortable about



Figure 1. A speculative rejuvenation device for daily use. Photo credit: Zuzanna Kaluzna.

leaving their accepted role and agreeing to an inherently subjective work mode of shared discussion (Oreszczyn and Carr, 2008).

The opportunity that speculative design provides here is that it need not operate solely within the epistemic ideas and established facts of bioscience. Taking Tikka's speculative lab experiment as an example, instead of focusing on the 'known' functions of cellular reprogramming, scientists can be invited to explore the 'unknown' areas of the protocol and consider imagined implications, not-yet-realized 'facts' and treatments-to-be emerging from their research. The issue here is, we propose, the challenge of enabling study participants to dwell in the spatial-temporal gap of not-knowing. Simultaneously, we have to acknowledge that investment in scientific expertise in institutionalized settings constrains participants' capacity and willingness to venture into that gap of uncertainty and speculative imagination.

Two critical points follow. Firstly, while speculative thinking advocates for undermining the 'hierarchical imposition of an order' (Bell, 2017), a 'non-hierarchical' approach is nevertheless a researcher-led choice, which positions study participants in a particular way. We explore this issue further in the next section. Secondly, the suppression of hierarchy does not imply an attempt to homogenize knowledge, or to postulate that all knowledge is the same. Speculation entails specific constraints (Halewood, 2017; Hendrickx, 2017). Stengers (2011c: 76) writes that 'between the most concrete experience and the various abstractions, there is no hierarchy for Whitehead', yet 'the artist's perception is not more authentic, it is different'. Speculative engagements may explore, for instance, state-of-the-art biology or ecology in an experimental, fabulative and creative manner. This does not imply that scientific facts, as they stand, are questioned, nor that they are necessarily reinforced. Rather, here, the premise of speculative philosophy is clear: knowing involves a relationship between thought and experience. Experiential speculative engagement between different participants aims to ask in a different way what matters in science and what might become possible in the future.

Shifting positions in research engagements

To investigate public issues associated with new science and technology and to enhance democratic governance, focus groups have been proven a useful method (Macnaghten, 2021). In addition to the content of their discussions, the interactive learning processes of the participants in focus groups have also been proposed as an important object of analysis (Wibeck et al., 2007). Drawing from these insights, but deploying the method in speculative research events, we conducted focus groups with elderly people in a large city in Finland about the possibilities of modifying ageing. Four focus groups with a total of 25 participants born in the 1940s were organized in March 2020. They took place just before the COVID-19 pandemic spread into Northern Europe and citizens aged 70 and over became the central targets of protection through social distancing. The majority of the participants had either an upper secondary education or a university degree. Their occupations ranged from teachers and other educators, and social and health care workers to positions in industry and business. The engagements involved unpacking and envisioning how biotechnological modifications of bodies and lives could take place, and attuning to

participants' feelings, ideas and experiences of the personal and societal implications of such developments (Hautamäki and Meskus, 2022).

In the call for participation, we attempted to pave the way towards entering the gap of speculative action. We explained that the workshops concerned collective discussion on ageing and futures, and what the participants thought about such issues as eliminating disease, extending longevity and the use of biomedical innovations like genetic engineering and stem cell-based regenerative medicine. The call highlighted that the working method was going to be informal and dialogic. It also stated that there were no right or wrong answers to the issues discussed, and that participants' personal views and life experiences were sufficient knowledge to address these issues. We wanted to explore how emerging biotechnologies and the reconfiguring of biological facts regarding life course, ageing, and intergenerational relations could be approached speculatively with citizens who were not 'experts' in the science topics yet 'experts' in another matter: living with an ageing body in an 'ageing society'. During the loosely scripted three-hour research events, we showed vignettes of media and other texts, as well as news pictures about scientific findings, to generate 'what if' questions and prompt discussion.

As with other participatory research, speculative research events are, in our experience, prone to incite questions about how the group involved is formed. The creative gap amenable for thought experimentation often involves researchers inviting people to participate as representatives of some community, public or audience. Yet, participants may be puzzled about who the 'we' are who are being asked to share experiences and views. Critics within design debates have questioned this aspect of speculative approaches. It has been argued that despite the best intentions of representing a plurality of views, there exists a lack of ethnic and cultural diversity in the 'we' who speculate on futures (Tonkinwise, 2014; Ward, 2021). Allowing that 'this kind of work needs to resonate with people if they are to fully engage with it', Dunne and Raby (2019), for instance, have started working more closely with social and political sciences. The aim is to try to overcome limitations in design research by taking better account of the cultural, social and political contexts of speculative work (Ward, 2021).

Several participants of the focus groups on ageing and biotechnologies asked who they were to imagine and act as representatives of the future. In one group, participants questioned from the outset that they were being defined as belonging to a certain age cohort, an expression included in the warm-up question, 'In your view, what is the most important role of your age group in society?' A former social work supervisor stated that 'I don't like this kind of categorizing, making an age cohort into kind of a team' (Gr1/2020). In another group, the first question from the participants after we presented the aims of the study was: 'Have we been selected in some way or is this based on random sampling?' (Gr3/2020). Moreover, participants pondered on socio-economic and other differences in the ability to speculate about high-tech issues. One retired teacher stated that 'We're here speaking amongst a bunch of people that have seen and read all kinds of stuff'. Before we had even begun discussing any speculative scientific and technological visions, this participant declared that people in his local, small-town supermarket checkout queue would consider a discussion like this as 'plain utopia': 'They would [...] say this is complete rubbish' (Gr1/2020).

These critical approaches indicate that the premise of openness in speculative research is both its condition and its risk. We are reminded by [Hendrickx \(2017\)](#) that speculation requires keeping in touch with ‘the empirical’ or ‘what is given in an experience or a situation’. Yet this empirical is not taken for granted but forms part of the question. With speculative openness, our participants took part in asking the question of what is given when agreeing to work in the gap. Furthermore, scholars of speculative research have emphasized that collaboration might not turn out as planned or expected through the ‘failures’ or ‘misbehaviour’ of participants. In line with the philosophical underpinnings of speculative research, what could be considered failures or misbehaviour are perhaps better understood as events that underscore emergent possibilities of empirical engagement ([Coleman, 2017](#); [Michael, 2012, 2016](#)).

Like in other participatory studies, *taking turns* in speculative work is part of forming the ‘we’ of a research situation (cf., [Morgan, 2019](#); [Wibeck et al., 2007](#)). It involves the repositioning of researchers and the researched, and the reshaping of knowledge hierarchies in the gap. The audiotapes of the groups show how, for instance, taking turns in thinking about technoscientific futures prompted our participants to keep pulling us researchers into the collective thought experiment. The elderly participants turned questions back on us, made comparisons, and pointed at glitches in our framings of the issues. Striving for a ‘minimum of input’ ([Morgan, 2019](#)) as a methodological guideline for focus groups was not a suitable approach here as the positions shifted. To moderate the discussion required straddling our own experience and expertise, and lack thereof, in the biotechnology issues discussed. A plurality of experiences and ideas was encouraged, and researchers became increasingly engaged in their production.

So far, our case studies have pointed to challenges in creating and allowing for a speculative research event to organize and unfold. Such an event is not a methodological free fall. It is constrained and conditioned by relations between researchers, participants and material surroundings and artefacts that are reworked during the process. Through the next two case studies, we elaborate further methodological issues that arise when working in the gap of speculation. In collaborative research engagements, researchers’ and designers’ own techno-preferences, emotions and ethical biases can be at stake for the collaboration to ‘succeed’.

Mutual invoking of affect

Working with different kinds of futures is not in any way specific to speculative methodology. Participatory methods typically address futures when engaging groups of people in scenario-building about technical developments such as nanotechnologies ([Felt et al., 2014](#)), GM crops ([Oreszczyn and Carr, 2008](#)) or urban sustainability ([Guimarães Pereira and Funtowicz, 2013](#)). In envisioning futures, participants’ imagination, feelings, hopes and fears are invoked and harnessed. This is the case also in speculative research events, which makes affective involvement an important methodological question. Being affected as part of the study processes concerns both research participants and researchers themselves, as [Blackman \(2015\)](#) observes of explorative methods. Affect is disclosed in atmospheres, gut feelings and bodily felt reactions and intensities during research, while it

is practised and modulated through various research aims and objects (Blackman, 2015). Posing speculative questions, the researcher or designer cannot but involve themselves in a situation in order to co-speculate (Dunne and Raby, 2013; Hendrickx, 2017). Immersing oneself in co-speculation as a researcher entails getting experientially involved in the gap. This might then ‘shake’ the researcher’s understanding of their own position in the process. As a researcher, one participates in the collaborative relations with perspectives and expectations that necessarily change through the speculative engagements.

Over multiple occasions during ethnographic fieldwork conducted between 2011 and 2016, one of us (Meskus) spoke with research scientists working in university laboratories in Finland, Sweden, the UK and Italy about emerging possibilities of modifying biological mechanisms of disease with the help of stem cell technologies. Below is a vignette from one of her encounters with stem cell scientists, which required the researcher to reposition herself and become affectively involved in speculation. The stem cell researcher invites, even demands, the researcher to work with her own experiences and ethical stakes:

R: I would certainly not get involved in anything that has to do [...] with reproductive modification.

I: Why do you feel so?

R: So, producing a living person.

I: Why, why not?

R: So, would *you* want to be the first [genetically modified] person in the world? ((gives a laugh))

I: That’s what I am asking you...

R: I am asking *you*!

I: Okay ((gives a laugh but does not continue))

R: Would *you* want to be the world’s first chimeric person? *I* would not want to be, and I don’t want to be involved in making one (17/2011).

Through the returned questions, the bioscientist invites the social scientist to be affected and to think about the future forms of genetic modification he is proposing. It has been claimed that speculative approaches in social science and design research are based on ‘a lure for feelings’ (Debaise and Stengers, 2017, see also Parisi, 2012). Methodological implications of working in the speculative gap concern how participants and researchers take turns in collectively invoking responses to different futures. Indeed, invoking affect is a methodological issue for researchers to be aware of and to deploy responsibly and respectfully (Bussu et al., 2020).

Within the same study, a head of research laboratory and university hospital physician we call Laura, offered in passing another prospect of reproductive futures. In her office located between the IVF clinic and the stem cell laboratory of a university hospital, Laura

noted that, through cellular reprogramming, scientists might be able to turn human skin cells first into stem cells and then into sperm and egg cells. Such modification of human reproduction, Laura said, could become part of ‘future fertility treatments’ (I3/2011).

The audiotape sequence of this phase in the interview includes several bemused brief laughs by the interviewed laboratory head while she offers her visions of possible ‘ethically concerning’ futures. These are accompanied by Meskus struggling to grasp the technical complexities and societal implications of such an imaginary of stem cell-based human reproduction. Referring to reprogrammed cell lines, Laura snorts that ‘these cells are problematic, but they are not talked about, as people don’t know about them yet’. Meanwhile Meskus tries to handle her ignorance by ‘idiotic’ questions that *slow the situation down* (Stengers, 2005). She asks, ‘So it’s so that ((pause)) hold on ((pause)) you take a skin cell from me...? ((silence))’ and ‘So what are the chances in succeeding...? ((silence))’ (I3/2011). After a short conversation on the possibilities of making human egg and sperm cells in the laboratory and the need for public discussion on such a prospect, the interview sequence ends with Meskus returning to the everyday aspects of stem cell research and letting the scene, or the ‘weak signal’ (Ward, 2021: 193), of a not-yet-existing biotechnological practice go.

In this example, the study participant again invokes affective orientation towards uncertain, as-yet-unrealized biomedical developments. She invites the researcher to encounter the not-known of biotechnology and reproductive futures, which the researcher is unprepared to grasp. Speculative thinking demands being open to ‘the unknown affecting *our* questions’ (Stengers, 2011a: 355, original emphasis). Following Stengers (2005, 2011a), Bell (2017: 188) writes that ‘speculation [...] is not the ruminative practice that takes place in contemplative comfort, but that which follows an interruption and a consequent re-orientation.’ Furthermore, as Michael (2012, 2016) and Wilkie et al. (2015) have shown in their work, ‘idiotic’ utterances and acts indicate that there might be ‘something more important’ (Stengers, 2005) going on in the research event, offering the possibility of redefining the ‘what’ and ‘how’ of the study.

The brief instance at the beginning of fieldwork reported above became a cue for including a speculative element in the study, which led to multiple conversations on the prospect of creating gametes in the laboratory (Meskus, 2021). The encounter with the bioscientist reconfigured the researcher’s understanding of what was important in the study. The conclusion from such experiences of speculative research is that ‘entering’ the gap of uncertainty is neither straightforward nor innocent. It involves rethinking present conditions of knowledge and sharing the experience of not-knowing in the relations of the study.

Co-speculation and time

To round off our discussion on the methodological risks and promises of speculative research, we introduce here a design experiment ongoing amidst humans and reindeers in the Finnish Arctic. As in the previous case examples, the broad subject matter of this speculative engagement is the biotechnological modification of the living. The point is to illustrate how participants invite researchers to reposition themselves in the study

processes and, again, this repositioning involves the difficulty researchers encounter in grasping futures. This case provides another example of how disrupting anthropocentric imaginaries of the world and creating other kinds of futures does not leave the researcher unaffected.

Speculative design often focuses on a linear acceleration of existing bioscientific research into the future by bringing it into the everyday lives of humans (Malpass, 2017). As part of her ongoing PhD study, Tikka has initiated a 2-year collaboration with a reindeer herder and his artist-researcher partner in the Finnish Arctic to investigate possible future relations between humans and more-than-humans in the region. Tikka's collaboration is aimed at imagining what alternative futures, not linear to the present, could look like from the perspective of nomadic herding. The original ideas and aims of the study have kept changing, because 'achieving' novel visions of eco-social futures has required the researcher to agree to venture into the gap of co-speculation from a participant-led perspective.

The co-speculation has been conducted through online dialogues and in-person visits to the home village of the collaboration partner, whom we call Toivo. Today in Finland, herders live mostly in stationary housing and use all-terrain vehicles (ATVs), snowmobiles and GPS tracking to follow the reindeer. The collaboration began with an examination of Toivo's experiences of the way modernization and technologization are affecting nomadic-based reindeer herding culture and how this will play out in the future.

Questioning mutual understandings of a situation and those who take part in it is an inbuilt risk in speculation. This is what takes place in the situational creation of the gap. 'Posing speculative questions does not leave the situation unaffected, and one cannot but involve oneself in a situation, become part of it in a way, in order to speculate' (Hendrickx, 2017). From this may arise hesitation and lingering in practices of knowing. Yet such lingering is the essence of speculation, as it may take the research into new directions. This happened in Tikka's collaboration with Toivo. Entering the gap meant to become affected by each other through listening and learning. Further, not-knowing demanded temporal reorientation. This meant bringing forward shared histories of human and reindeer life in migration as a starting point for imagining alternative futures. In Toivo's contemporary technologized semi-nomadic practice, the past is strongly present as traces of the ancient nomadic herding practice.

Following Stengers, Puig De la Bellacasa (2017) maintains that speculative thinking needs to attend to the co-constitutive relations between humans and more-than-humans when discussing present and future technoscientific worlds. There is, indeed, (also) in speculative research a rising interest in incorporating more-than-human perspectives into the realm of speculation. Rousell (2022) proposes, drawing on Whitehead, that speculation helps us see a novel togetherness of creaturely experience. Further, he emphasizes that 'there are no certainties that a pattern of creaturely experience that endures now will continue to endure in the future'. Working in the gap of speculative openness with the participant, the participant has also in this case encouraged the researcher to think differently about knowledge production, especially as it comes to the interconnected and disjunctured temporalities of humans' relations with more-than-humans.

Through learning about human-reindeer relations from Toivo, it became clear that thinking about human futures was not possible without thinking ‘with’ the reindeer and their past. In Toivo’s world, different understandings of time are present simultaneously, arising from the embodied knowledge of moving in the arctic environment. [Figure 2](#) illustrates this movement by Toivo. He emphasized that in the nomadic way of life, it was crucial for the human to adapt more to the nature and the movement of the reindeer than vice versa.

Consequently, Tikka has ended up co-creating with Toivo a story about trans-generational epigenetic inheritance of interspecies memories. The story involves speculation on biomedical harnessing of epigenetic and genetic pathways connected to reindeer migration, in order to know how to survive. The two co-speculators are working on an installation that illustrates a future where epigenetic modification is used as a technique to ‘remember’ and to re-establish lost connections to the environment ([Tikka, 2022](#)). Epigenetic activation of an ancient reindeer’s memories functions as a key to human survival in a world after an ecological collapse. As a collaborator, Toivo has brought new questions into the gap of speculative action. His experiential knowledge has repositioned the researcher as well as the timeline of the project. The future is approached through attempting first to understand and appreciate the past.

Our experience is that speculative approaches require patience. Regarding futures, it is only too easy to construct ‘an abstract future, from which everything subject to our disapproval has been swept aside’ ([Stengers, 2010](#): 10). In empirical use, speculative studies on multiple futures attempt to resist the temptation to rush for a judgement that recognizes and anticipates possibilities, thus shutting them out rather than creating them. This is the great promise of speculative encounters, but it demands an experiential involvement on the part of the collaborators that takes time and humility to develop. These

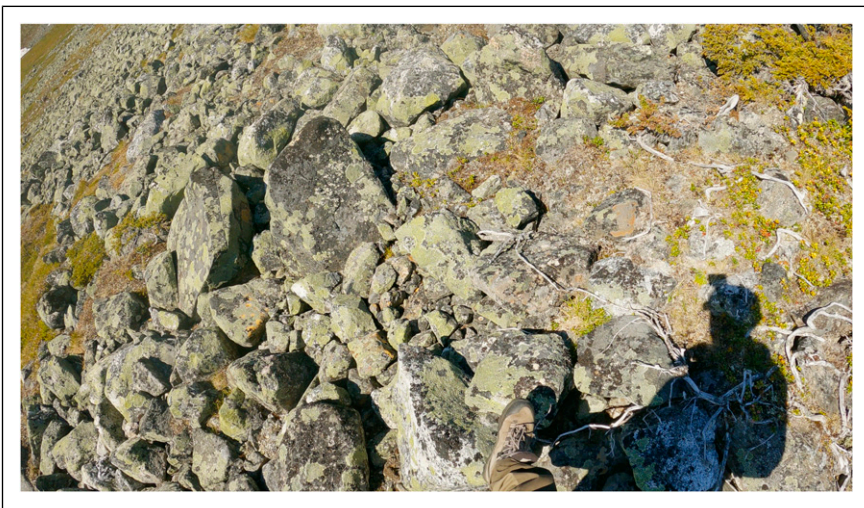


Figure 2. Screenshot of the film material of Toivo’s story. Picture credit: Toivo.

we often lack for various reasons. There is a danger that, in haste, the gap of mutually appreciative speculative engagement might close too early or fail to actualize before new questions are asked and knowing can be shared at more depth.

Conclusions

This article has sought to make the processes of speculative research more visible by drawing on our individual and joint study cases on the future of biotechnological modification of human life. We hope to contribute to critical methodological understanding about ‘how speculation works’ (Guggenheim et al., 2017) when it is brought into empirical research contexts in and at the intersections of social science and design research. The methodological observations discussed and theorized are meant to extend, not exhaust, ongoing scholarly discussions on speculation as a form of thinking and a mode of conducting research. Our observations are therefore not intended to be turned into methodological rules or normative statements. However, we believe that taking into account what is accomplished by working in the gap of speculative action helps to question ideas that speculative approaches are merely playful or, worse still, somehow ‘free’ of methodological content and constraints in their open-endedness.

The concept of the gap has been used as a heuristic tool for analyzing the mutual constitution of participants and researchers in speculative research processes. From a methodological perspective, the gap refers to the uncertainties and hesitations endemic to speculative approaches. These hesitations are not considered failures but are, rather, the very essence of such research engagements. In these ‘interstices’ we may address ‘the unknown’, as Stengers (2005) proposes. Relations between researchers and participants, as well as material surroundings and artefacts, are reworked in the process. They are key to making sense of speculative knowledge production, since creating the gap amenable for speculation entails shifting positions in research engagements.

The first two cases illustrated how the suppressing of hierarchy and reshuffling of expertise in the name of speculative collaboration is both challenging and constrained. A ‘non-hierarchical’ approach is a researcher-led choice that positions participants in certain ways that they might resist or struggle to embrace. Moreover, working in the gap does not leave researchers unaffected. In the two latter cases, we gave examples of how research participants invite and demand that researchers reposition themselves. This means that researchers become experientially more involved in working in the gap of speculation. They are affectively lured into reconsidering the aims and conditions of the encounters and the collaboration. This might involve, as in our case, rethinking the core topics of research engagement (the scope of technological developments and ethical issues that were included in the study) and what direction the speculative envisioning takes (futures could be envisioned only after extensive immersion in past experiences). Uncertainty and hesitation, questioning and repositioning, are simultaneously the means and the risks of speculative research.

Let us consider, following Whitehead, that science is an *adventure* that ‘enables us to characterize what we are dealing with and what situates us’. Every adventure calls forth the question ‘What does it make matter?’ (Stengers, 2011c: 18–19). When we take this

idea to encompass speculative research itself, the boldly adventurous character of speculation becomes clear: it attempts to characterize what we are dealing with and what matters in the present, and from there, what might become possible in the future. To encourage patience, Stengers (2011c: 26) reminds us that ‘speculative adventurisation does not produce miracles’. The adventure is constrained as it is always in a risky relation to its environment, which has the power to complicate the adventure. For us, this means that further methodological ponderings emerge concerning the gap of speculative action. What happens if speculative openness, hesitation and not-knowing become more normalized and spread into different fields of research? How might relations of expertise and knowing become different? Can we invoke new ways to approach ‘us’ as the inhabitants of ‘the future’? We invite others to add to this discussion and share their experiences of where and how speculative action takes place.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Academy of Finland under Grant 286114 (Meskus); and the Academy of Finland under Grant 325457, the Kone Foundation under Grant 201902038 and Art4med project Grant 1.1.2020 (Tikka).

ORCID iD

Mianna Meskus  <https://orcid.org/0000-0002-8562-2524>

Notes

1. Participatory research on science, technology and futures is conducted with various methods and theoretical orientations that also affect the field of futures studies. As we aim to contribute to STS and design research scholarship interested specifically in speculative gestures, the elaboration of the similarities and differences between futures studies and speculative research approaches is beyond the scope of this article. We wish to acknowledge however that salient methodological discussion is ongoing in futures studies (e.g., Ahlqvist and Rhisiart, 2015; Guimarães Pereira and Funtowicz, 2013; Mazê, 2019; Milojević, 2014; Milojević and Inayatullah, 2015), and the connection of this to speculative research could be explored further.
2. It must be noted that in parallel with this emerging scholarship, speculative thinking has become a topic of interest in methodological discussions in the field of educational research. Informed by Gilles Deleuze’s and Felix Guattari’s as well as Whitehead’s and Stengers’ philosophical thinking, these discussions have explored ontological thought and qualitative research methodologies under the concept of ‘post-qualitative’ research, which critiques methodocentrism and conventional understandings of what will count as ‘data’, and our relation to those data (e.g., MacLure, 2013, 2021; Mazzei, 2021; Rousell, 2022; Springgay and Truman, 2017). Just as in

social science and design research, key issues of speculative methodology here concern the limits of our research practices.

References

- Ahlqvist T and Rhisiart M (2015) Emerging pathways for critical futures research: changing contexts and impacts of social theory. *Futures* 71: 91–104.
- Auger JH (2012) *Why Robot? Speculative Design, the Domestication of Technology and the Considered Future*. PhD Thesis. London, UK: Royal College of Art. Available at: <https://researchonline.rca.ac.uk/1660/1/Why-Robots-Print.pdf> (accessed 21 September 2021).
- Beech D, Hultqvist A and Pihet V (2017) Introduction to Speculation. *Parse* 7. Available at: <https://parsejournal.com/article/introduction-to-speculation/> (accessed 13 December 2021).
- Bell V (2017) On Isabelle Stengers' 'cosmopolitics': a speculative adventure. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London and New York: Routledge, 187–197.
- Blackman L (2015) Researching affect and embodied hauntologies: exploring an analytics of experimentation. In: Timm Knudsen B and Stage C (eds) *Affective Methodologies: Developing Cultural Research Strategies for the Study of Affect*. Basingstoke, UK: Palgrave Macmillan, 25–44.
- Botero A, Hyysalo S, Kohtala C, et al. (2020) Getting participatory design done: from methods and choices to translation work across constituent domains. *International Journal of Design* 14(2): 17–34.
- Bryant R and Knight DM (2019) *The Anthropology of the Future*. Cambridge, UK: Cambridge University Press.
- Bussu S, Lalani M, Pattison S, et al. (2020) Engaging with care: ethical issues in participatory research. *Qualitative Research* 21(5): 667–685. DOI: [10.1177/1468794120904883](https://doi.org/10.1177/1468794120904883)
- Coleman R (2017) Developing speculative methods to explore speculative shipping. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London, UK: Routledge, 130–144.
- Debaise D (2013) A philosophy of interstices: thinking subjects and societies from Whitehead's philosophy. *Subjectivity* 6(1): 101–111.
- Debaise D and Stengers I (2017) The Insistence of possibles: towards a speculative pragmatism. *Parse* 7: 12–19. Available at: <https://parsejournal.com/article/the-insistence-of-possibles%E2%80%A8-towards-a-speculative-pragmatism/> (accessed 13 December 2021).
- Deleuze G (1997) *Différence et Répétition*. London, UK: Athlone Press.
- Dunne A and Raby F (2013) *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge, UK: The MIT Press.
- Dunne A and Raby F (2019) Designers need to recognise their limitations and work with them. *James Auger in Conversation with Anthony Dunne and Fiona Raby, Pioneers of Critical Design*. SpeculativeEdu. Available at: <https://speculativeedu.eu/interview-dunne-raby/> (accessed 25 August 2021).
- Escobar A (2017) *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. Durham, UK: Duke University Press.

- Felt U, Schumann S, Schwarz CG, et al. (2014) Technology of imagination: a card-based public engagement method for debating emerging technologies. *Qualitative Research* 14(2): 233–251.
- Guggenheim M, Kräftner B and Kröll J (2017) Creating idiotic speculators: disaster cosmopolitics in the sandbox. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London: Routledge, 145–162.
- Guimarães Pereira Â and Funtowicz S (2013) VISIONS for Venice in 2050: Aleph, story telling and unsolved paradoxes. *Futures* 47: 69–78.
- Halewood M (2017) Situated speculation as a constraint on thought. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London and New York: Routledge, 52–63.
- Haines A (2021) Transfigurations. Available at: <https://www.agihaines.com/transfigurations> (accessed 27 August 2021).
- Hautamäki L and Meskus M (2022) Living temporality: speculative engagements with elderly people on bioscience and the body. Article manuscript.
- Hendrickx K. (2017) Speculation. In: de Bloois J, De Cauwer S and Masschelein A (eds) *50 Key Terms in Contemporary Cultural Theory*. Antwerp, Belgium: Pelckmans Pro, 280–285.
- Inayatullah S (2013) Futures studies: theories and methods. In: Al-Fodhan N (ed) *There's a Future: Visions for a Better World*. Madrid, Spain: BBVA, 36–66.
- Liu A (2021) Untitled (pregnancy menswear). Available at: <https://ani-liu.com/pregnancy-menswear> (accessed 8 December 2021).
- Lupton D (2021) 'Things that matter': poetic inquiry and more-than-human health literacy. *Qualitative Research in Sport, Exercise and Health* 13(2): 267–282.
- Lury C and Wakeford N (eds) (2012) *Inventive Methods: The Happening of the Social*. Abingdon, UK: Routledge.
- MacLure M (2013) Researching without representation? Language and materiality in post-qualitative methodology. *International Journal of Qualitative Studies in Education* 26(6): 658–667.
- MacLure M (2021) Inquiry as divination. *Qualitative Inquiry* 27(5): 502–511.
- Macnaghten P (2021) Towards an anticipatory public engagement methodology: deliberative experiments in the assembly of possible worlds using focus groups. *Qualitative Research* 21(1): 3–19.
- Malpass M (2017) *Critical Design in Context: History, Theory, and Practices*. London, UK: Bloomsbury Visual Arts.
- Marres N, Guggenheim M and Wilkie A (eds), (2018) *Inventing the Social*. Manchester, UK: Mattering Press.
- Mazé R (2019) Politics of designing visions of the future. *Journal of Futures Studies* 23(3): 23–38.
- Mazzei LA (2021) Speculative inquiry: thinking with Whitehead. *Qualitative Inquiry* 27(5): 554–566.
- Meskus M (2018) *Craft in Biomedical Research: The iPS Cell Technology and the Future of Stem Cell Science*. Basingstoke & New York: Palgrave Macmillan.
- Meskus M (2021) Speculative feminism and the shifting frontiers of bioscience: envisioning reproductive futures with synthetic gametes through the ethnographic method. *Feminist Theory*. doi: [10.1177/14647001211030174](https://doi.org/10.1177/14647001211030174)

- Michael M (2012) 'What are we busy doing?': engaging the idiot. *Science, Technology, & Human Values* 37(5): 528–554.
- Michael M (2016) Notes toward a speculative methodology of everyday life. *Qualitative Research* 16(6): 646–660.
- Milojević I (2014) Creating alternative selves: the use of futures discourse in narrative therapy. *Journal of Futures Studies* 18(3): 27–40.
- Milojević I and Inayatullah S (2015) Narrative foresight. *Futures* 73: 151–162.
- Morgan D (2019) *Basic and Advanced Focus Groups*. Los Angeles, CA: SAGE Publications.
- Oreszczyn S and Carr S (2008) Improving the link between policy research and practice: using a scenario workshop as a qualitative research tool in the case of genetically modified crops. *Qualitative Research* 8(4): 473–497.
- Orion (2021) Using art as a way to level the playing field when discussing science. Available at: <https://www.orion-openscience.eu/publications/inspiring-stories/202011/using-art-way-level-playing-field-when-discussing-science> (accessed 17 September 2021).
- Parisi L (2012) Speculation: a method for the unattainable. In: Lury C and Wakeford N (eds) *Inventive Methods: The Happening of the Social*. Abingdon, UK: Routledge, 232–244.
- Puig de la Bellacasa M (2017) *Matters of Care: Speculative Ethics in More than Human Worlds*. Minneapolis, MN: University of Minnesota Press.
- Rousell D (2022) Accidental creatures: Whitehead's creativity and the clashing intensities of more-than-human life. *Qualitative Inquiry* 28(5): 427–434. DOI: [10.1177/10778004211065811](https://doi.org/10.1177/10778004211065811)
- Salter C, Burri RV and Dumit J (2017) Art, design, and performance. In: Hackett EJ, Amsterdamska O, Lynch M, et al. (eds) *The Handbook of Science and Technology Studies*. 3rd edition. Cambridge, UK: The MIT Press, 139–167.
- Savransky M, Wilkie A and Rosengarten M (2017) The lure of possible futures: on speculative research. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London, UK: Routledge, 1–17.
- Schillmeier M and Lee Schultz Y (2017) 2Sweet2Kill: speculative research and contributory action. In: Wilkie A, Savransky M and Rosengarten M (eds) *Speculative Research: The Lure of Possible Futures*. London, UK: Routledge, 163–179.
- Springgay S and Truman SE (2017) On the need for methods beyond proceduralism: speculative middles, (in)tensions, and response-ability in research. *Qualitative Inquiry* 24(3): 203–214.
- Stengers I (2005) The cosmopolitical proposal. In: Latour B and Weibel P (eds) *Making Things Public: Atmospheres of Democracy*. Cambridge, MA: MIT Press, 994–1003.
- Stengers I (2010) *Cosmopolitics I. Posthumanities* 9. Trans. Robert Bononno. Minneapolis, MN: University of Minnesota Press.
- Stengers I (2011a) *Thinking With Whitehead: A Free and Wild Creation of Concepts*. Trans. Michael Chase. Cambridge and London: Harvard University Press.
- Stengers I (2011b) *Cosmopolitics II. Posthumanities* 10. Trans. Robert Bononno. Minneapolis, MN: University of Minnesota Press.
- Stengers I (2011c) Wondering about materialism. In: Bryant L, Srnicek N and Harman G (eds) *The Speculative Turn: Continental Materialism and Realism*. Melbourne, Australia: re.press, 368–380.
- Tikka E (2022) Mnemonia. Available at: <https://www.emiliatikka.com/mnemonia> (accessed 30 September 2022).

- Tonkinwise C (2014) How we intend to future: review of Anthony Dunne and Fiona Raby, speculative everything: design, fiction, and social dreaming. *Design Philosophy Papers* 12(2): 169–187.
- Whitehead AN (1985) *Process and Reality: An Essay in Cosmology*. Corrected Edition. New York, NY: The Free Press.
- Wibeck V, Abrandt Dahlgren M and Öberg G (2007) Learning in focus groups: an analytical dimension for enhancing focus group research. *Qualitative Research* 7(2): 249–267.
- Ward M (2021) A practice of hope, a method of action. In: Mitrović I, Auger J, Hanna J, et al. (eds) *Beyond Speculative Design: Past – Present – Future*. Split, Croatia: University of Split, 166–200.
- Wilkie A and Michael M (2018) Designing and doing: enacting energy-and-community. In: Marres N, Guggenheim M and Wilkie A (eds) *Inventing the Social*. Manchester, UK: Mattering Press, 125–147.
- Wilkie A, Michael M and Plummer-Fernandez M (2015) Speculative method and Twitter: bots, energy and three conceptual characters. *The Sociological Review* 63(1): 79–101.
- Wilkie A, Savransky M and Rosengarten M (eds) (2017) *Speculative Research: The Lure of Possible Futures*. London, UK: Routledge.

Author biographies

Mianna Meskus is Associate Professor of sociology at the Faculty of Social Sciences at Tampere University. Her research is situated at the intersection of sociology and feminist science and technology studies, with specific focus on genetics, reproductive medicine and stem cell science. Meskus has published two monographs, *Craft in Biomedical Research: The iPS Cell Technology and the Future of Stem Cell Science* (Palgrave, 2018) and *Elämän tie: Tutkimus lääketieteellisestä teknologiasta, vanhemmuudesta ja perimän hallinnasta* [Science of Life: A Study on Medical Technology, Parenthood and the Government of Heredity] (Vastapaino, 2009), as well as articles in journals such as *BioSocieties*, *New Genetics and Society*, *Science as Culture*, *European Journal of Women's Studies* and *Feminist Theory*.

Emilia Tikka is Doctoral Candidate at the Department of Design, School of Arts, Design and Architecture, at Aalto University. Her PhD research explores re-designing human-nature-technology relations with a focus on synthetic biology and genome-editing technologies. The PhD research aims to re-frame speculative design as an inclusive approach, introducing plural voices in technoscientific discourses and practices. Next to conducting her PhD at Aalto, she is a member of Meskus's research team at Tampere University and Artist in Residence in the EU project Art4med at the Finnish Bioart Society (2021–2022). Her former affiliations include: Visiting Scholar at Humboldt-Universität zu Berlin and Artist in Residence at the laboratories of Max-Delbrück-Centre for Molecular Medicine in Berlin. Tikka has given several invited talks e.g., in the Global Primer Conference of Speculative Futures, USA, International Congress of Arctic Social Sciences (ICASS X), Russia, and Material Trajectories, Designing with Care Conference, Germany. Her art and design works have been exhibited internationally in museums and galleries.