Figures-in-the-making:
Figurations of AI and gender in science, popular culture, and everyday life

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Submitted in total fulfilment of the requirements of the degree Doctor of Philosophy

The School of Culture and Communication

The University of Melbourne

October, 2019

Abstract

Artificial intelligence is often considered the science of making intelligent machines. Unavoidable are the ways in which gender informs and shapes what constitutes intelligence, yet rarely is gender explicitly addressed as a topic of research. At best, gender is reduced to an empirical question of counting gendered bodies. Indeed, by studies of gender, what many actually mean is a study of women—their presence or exclusion, their representation, or the ways in which their lives are affected by systems and technologies. Even in studies of AI that foreground feminist readings of science and technology, gender is a taken for granted relation —the stable backdrop against which AI is enacted rather than something which is itself under revision. Gender, in this context, is conceptualised as a predetermined, preformed category; already made rather than something that is constituted through the practice of history or technology making itself.

This thesis considers how, in the making of artificial intelligence, gender too is being made. Drawing on methods and theory from feminist science and technology studies, cultural studies, film and media studies, and queer and gender studies, it examines how AI and gender are co-constituted across different sites in technoscientific culture. It develops the concept of "figuration" as a critical methodology and applies this to a number of case studies that span across sites of science, popular culture, and everyday life. The case studies addressed include: Alan Turing and the Turing test, the Dartmouth Summer Research Project on Artificial Intelligence, the 2008 film *WALL-E*, the 2014 film *Ex Machina*, Apple's digital personal assistant Siri, and finally, Amazon's digital domestic assistant Alexa.

The main argument of the thesis is that consistently, across technoscientific culture, gender both figures, and is figured by, AI. On the one hand, gender fundamentally constitutes how AI figures are made intelligible as subjects and objects. Gender is what mediates expectations and makes the role of an AI clear to a user, consumer, or audience. Conversely, as technologies are figured by gender, gender itself becomes technologised. Gender is figured as an artifice, as a performative and imitative category that even a machine following the correct procedures can also enact. This thesis demonstrates how it is not only gendered bodies that are at stake in algorithmic and AI culture but gender itself as a socio-cultural system. In doing so, the thesis contributes to a broader narrative of gender's ongoing role in the conceptualisation and materialisation of technoscientific objects and figures.

Declaration

I certify that:

1. the thesis comprises only my original work towards the PhD except where indicated in the preface
2. due acknowledgement has been made in the text to all other material used
3. the thesis is fewer than 100,000 words in length, exclusive of bibliographies and appendices

Thao Phan

Preface

This research was generously supported by the Australian Government Research Training Program (formerly, Australian Postgraduate Award).

Adapted versions of chapter five of have been reproduced in the following publication: Phan, T. (2019) Amazon Echo and the Aesthetics of Whiteness. *Catalyst: Feminism, Theory, Technoscience*, 5(1), 1-38

Acknowledgements

I would first like to acknowledge and pay my gratitude to my supervisor, Professor Scott McQuire, who has been with this project from the beginning and who has seen it evolve over the course of many years. This research has benefitted immensely from his guidance and subtle nudges. I would also like to extend my thanks to my associate supervisors: Dr Nicholas Chare, who was on my supervisory committee at the very beginning of the candidature, and to Dr Gilbert Caluya, who provided me with support and confidence towards the end.

I would especially like to thank the research administration staff, especially Dr Gabrielle Grigg and Annemarie Levin. I say, with no exaggeration, that there would simply be no School of Culture and Communication without these two humans.

Over the course of my candidature, I have been lucky enough to be surrounded by the most brilliant and generous colleagues and friends. Jess Marian, Ben Nicoll, Chris O'Neill, Tom Sutherland, and Scott Wark have shared with me many, many lunches. Sarah Richardson, Erin Stapleton, and Jen Beckett have been my most staunch advocates. Maria Hach, Sally Olds, Joe Latham, and Cameo Dalley have been exemplary officemates, cubby buddies, and car pool pals. These people have enriched my life and helped drag this tired body across the finish line.

Thank you to my mentors, Tim Neale and Emma Kowal, for taking me under your wings and making me feel like I had a home in academia. Your support has changed my life.

A special thanks to my family. My mum, dad, sister, and especially, bà ngoại. Like many children of migrants, my achievements are a testament to their hard work and sacrifice.

To Dough the cat for a being a model of calm during moments of stress.

And of course, Kieran, who was there before, will be there after, and provided me with everything I needed in between. This would not have been possible without you.

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Chapter one

Introduction

In her influential book *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (1999), N. Katherine Hayles opens with a provocative account of what is considered the first formal "test" for determining machine intelligence:

> You are alone in the room, except for two computer terminals flickering in the dim light. You use the terminals to communicate with two entities in another room, whom you cannot see. Relying solely on their responses to your questions, you must decide which is the man, which is the woman. Or, in another version of the famous "imitation game" proposed by Alan Turing in his classic 1950 paper "Computing Machinery and Intelligence," you use the responses to decide which is the human, which is the machine.
>
> (p. xi)

In this passage, Hayles subtly brings to attention one of the most frequently overlooked aspects of what is now referred to as the Turing test: the foundational role of gender. She reminds the reader of how, from the very beginning of modern computing, human-machine difference was constructed in the image of sexual difference. Despite the widespread recognition of the Turing test as one of the defining moments in the history of AI, this crucial connection often escapes common accounts of this event. Indeed, in most mainstream readings, gender is often reduced to an additive category—something inserted after the fact rather than something that might have been there from the very beginning. Gender, in this context, is conceptualised as a predetermined, preformed category, already made rather than something that is constituted through the practice of history or technology making itself. By reminding us of the role of gender in what she calls the "primal scene of humans meeting their evolutionary successors, intelligent machines" (p. xi), Hayles challenges the reader to consider how gender and sexual difference might fundamentally, and also *mutually*, inform the ways in which we conceptualise the research fields, cultural figures, and technical objects we call "artificial intelligence" (hereafter AI).

This thesis begins with the seemingly basic assumption that there is a relationship between the way we conceptualise social systems, such as gender, and the way we conceptualise technological phenomena, such as AI. This relationship is not determining, in

the sense that one precedes and acts upon the other, but rather is mutually constitutive such that each *constitutes the conditions of the other's intelligibility* and each is *constituted by those very conditions*[1]. It is in this unique entanglement that I suggest technological phenomena are given meaning, value and a sense of history or futurity. As science and technology scholars have long argued, technological phenomena are more than just technical objects. Beyond just lines of code, systems or hardware, these phenomena also embody a rich array of anxieties, beliefs, desires and investments in the kinds of worlds we humans envision for ourselves (and for others). In this sense, technologies can be understood not just as objects but as figures, that is, as things that are symbolic and that contain within them the capacity to represent their own genealogy of knowledge, power and practice.

Figures have occupied a prominent role in feminist studies of science and technology. Donna Haraway—whose famous kinship of feminist figures include the cyborg (1985/2004a), the modest-witness (1997), cat's cradle (1994), and most recently, the cthulucene (2016)—has returned again and again to the great potentiality of figures to animate her critical practice. For Haraway (2004b), "every being that matters is a congeries of its formative histories" (p. 2). To read beings as figures is to unfold those histories into lineages that stretch across space and time. Figures help to situate lines of inheritance in the here and now and to articulate connections and accountability. Thinking of technological systems and objects as figures opens a conversation into the evolving cultural life of technology. It allows us to see them not as discrete products of a linear and rational process, but as complex and porous phenomena with legacies that are informed by and carry beyond an object's lifespan.

The aim of this thesis is to consider how AI can be thought of as a figure and to analyse the role of gender in its figuration. Looking across a range of cultural sites, I ask *how can gender figure, and be figured by, AI? How are figures produced differently in different material-semiotic contexts? And finally, how can figuration be understood as a critical feminist practice?* This thesis places under interrogation the idea that gender or AI are fixed or stable objects. Rather, in the tradition of feminist scholars such as Judith Butler (1993/2011), Donna Haraway (1997), and Karen Barad (2007), I approach both these phenomena as the effect of iterative

[1] This framework builds on the work of Barad (2007) and her analysis of the relation between objects and agencies of observation. She writes, "theoretical concepts are defined by the circumstances required for their measurements. That is, concepts are specific material arrangements" (p. 196). In this case, the concept of gender is figured by the specific material arrangements of technology, and vice-versa. Gender is not a static object or tool that is merely applied to study technology, but is rather an arrangement that changes through its figurative relationship.

and citational practices[2], material-semiotic actors that question their own immediate presence and final determination[3], momentary materialisations of ever-changing intra-actions[4].

Figures-in-the-making

The questions that guide this thesis raise a complex array of issues that elude easily disciplined approaches to research. Like feminist theory, this study is guided not by disciplinary commitments, but by core interests and problems that demand a wide scope of literacy. I am influenced foremost by feminist social studies of science and technology (STS), but also by media and communication studies, screen and cultural studies, queer and gender studies, critical race studies, information studies, as well as social and historical studies of science and technology more broadly. Such an interdisciplinary mix is necessary in order to interrogate the unwieldy host of figures that have been, and continue to be, produced everyday.

The title of this thesis, *figures-in-the-making*, is itself a refiguration of terms. The phrase "in the making" was famously used by Bruno Latour to describe his empirical method for studying the production of scientific knowledge. In *Science in Action* (1988), Latour argues that science and technology is too often obscured behind a black-box that conceals the great complexity of actors and networks that function to present situated propositions as objective matters of fact. He states, "We study science *in action* and not readymade science or technology; to do so, we either arrive before the facts and machines are blackboxed or we follow the controversies that reopen them" (p. 258, original italics). The objective is to observe science as it is *in the making*, in progress, in order to trace the myriad of investments and agonistic power struggles that underpin claims produced through the scientific process. For Latour, one must "shadow scientists while they are engaged in their work of doing science" (p. 145). Whether this is following them into the field or into the lab, "[sneaking] into the few places where the papers are written" (p. 15), such a practice is necessary in order to disrupt the trope of the heroic scientist who independently discovers the world and instead give due

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[2] See Butler's writing on performativity in Gender Trouble (1990) and Bodies That Matter (1993/2011). She states, "performativity must be understood not as a singular or deliberate 'act,' but rather, as the reiterative and citational practice by which discourse produces the effects that it names" (p. xii). Here, materiality is considered explicitly as the effect of power.

[3] See Haraway's Situated Knowledges (1988). She describes the material-semiotic actor as "intended to portray the object of knowledge as an active, meaning-generating part of apparatus of bodily production without ever implying the immediate presence of such objects or, what is the same thing, their final or unique determination of what can count as objective knowledge at a particular historical juncture" (p. 595)

[4] A term introduced by Karen Barad (2007) to describe the nature of matter. For Barad, matter is "not a thing, but a doing, a congealing of agency…Matter refers to the materiality and materialisation of phenomena, not to an assumed, inherent, fixed property of abstract, independently existing objects" (p. 2010). Unlike, interaction, intra-action does not assume the prior existence of distinct entities.

recognition to the various actors (human or otherwise) that contribute to the fundamentally social practice that is the construction of scientific knowledge.

My use of "in the making", however, does not derive directly from Latour but comes instead via Haraway. In her seminal book *Modest_Witness@Second_Millenium.FemaleMan ©_Meets_Oncomouse™* (1997, hereafter *Modest_Witness*), she introduces the phrase "gender-in-the-making" to critique reductive readings of gender in narratives of scientific action. She argues that social studies of science scholars, including Latour, rarely consider gender beyond a functionalist category. She states that, at best, gender is treated as "merely a question of reconstituted 'generic' men and women, beings resulting from either biological or social sexual difference and playing out roles, but otherwise of no interest" (p. 26). Critiquing classic texts in STS such as Latour's *Science in Action*, Haraway asks how apparatuses for generating scientific knowledge are "*instrumental* in both sustaining old and crafting new 'gendered' ways of life" (p. 28, original italics). Understanding gender, in this formulation, is not about following pre-formed beings and examining either their presence or absence at the scene of scientific action, but rather, treating gender as something that is also in-the-making while science is being made.

In this thesis, I follow Haraway's approach to gender-in-the-making and adopt/adapt her hyphenated phrase to conceptualise my own critical terminology. I consider how figures, in this case AI and gender, are mutually constituted; together in-the-making. Joined by hyphens, the phrase "figures-in-the-making" visually illustrates the concept to which it refers. The word figure alone is too easily interpreted as referring to a pre-established, single object. By adding "in-the-making," I switch the emphasise from a figure as a discrete object to figuration as contingent process. Unlike Latour, who specifies a time and a place for studying science in action—in the lab, before science is made—I contend that when it comes to figures like gender, there is no single site of action or pre-final moment. Gender is always a dynamic relation; it is constantly constituted through performative action and so can only ever be examined in-the-making.

To consider AI as a figure-in-the-making as well shifts the analytic register again. How might AI, like gender, also be constantly under construction, iteratively constituted? How might this change where we consider the site of scientific action to be? Unlike Latour's description of science in the making, technological figures are not predominantly made in the lab per se but are rather made across multiple sites—certainly, yes, in scientific discourse, but also in popular culture, commercial media and other sites in everyday life. Following figures-in-the-making means extending analysis to these diverse imaginaries and actors as equally

legitimate sites of action. The challenge of this thesis is holding these figurations together in all their multiplicity and in all their contradictions.

This research comes at the beginning of new intersections between gendered and digital living; what might be called "binary life." The expansion of digital infrastructure, the growth in computational power, and the push to incorporate these new technologies into existing institutions (from public to private) and into every sphere of human activity (cultural, economic, political, and social) has meant that the binary language of zeroes and ones now inescapably governs the terms of daily life. Simultaneously, the historic domination of the concept of binary gender is now under increasing scrutiny. Queer and trans theorists and activists have lead the way in terms of researching and modelling forms of life that are not governed by rigid, dualistic gender precepts. They have also questioned the logic and ethics of living under binary gender and its patriarchal companion, compulsory heterosexuality.

This vastly altered landscape in which humans reconfigure the terms of gender at the same time that machines adopt them marks an exciting moment in the undoing of nature/culture in which the artifice of this distinction becomes legible to a greater public. The opportunity to question and intervene in figurations of AI and gender presents itself at every turn. The questions that we must now contend with are: how can we best practice response-ability in binary life? Which figures reinscribe damaging social orders and which might just challenge them? Emerging out of an interrogation of the initial set of questions I introduced above, these new questions orient this thesis around a feminist ethics that uses figures-in-the-making, as methodology, to ask how AI and gender might be figured better and differently.

Chapter overview

Each of the six case study chapters in this thesis are centred on a specific figuration of AI and gender. Each illustrates a unique moment in the history of this co-figuration and, while every chapter contains its own focus and approach, together they contribute to a broader narrative of gender's ongoing role in the conceptualisation and materialisation of AI as objects and as figures. As I have stated, it is not the case that either gender or AI precedes and acts upon the other but rather that each *constitutes the conditions of the other's intelligibility* and each is *constituted by those very conditions.* The task for each chapter is to provide concrete illustrations of this point and, while this is certainly not an exhaustive list, it nevertheless aims to map the great diversity of discourses, practices, events, objects and media through which figurations of AI and gender occur.

This thesis focuses on three domains: scientific history, popular culture, and everyday life. In exploring these different dimensions of AI, I do not examine AI researchers' attitudes

towards gender, nor do I look at prominent issues, such as the representation of women in AI research fields. My focus is not on top-down questions of gender—such as how cultures within organisations influence or determine figurations for users—but instead on how figurations emerge and are negotiated in cultural life. I also wish to avoid the conflation between the study of gender and the study of women. While women and women's lives are certainly implicated within the discussion that will be explored here, my aim is not to provide an account of real women per se, but instead to trace the complicated relation between AI and gender as it appears across different cultural sites.

Chapters two and three of this thesis provide the theoretical and methodological framework for the study. Chapter two, *The AI Question in Feminist Technoscience*, traces the feminist lineages that inform this thesis. By mapping the history of ideas, stories, and thinkers that prefigure the question of AI and gender, I hope to situate this thesis within an existing narrative of feminist encounters with technology. This chapter also functions as a literature review on feminist approaches to the study of AI and gender and outlines their significance to my own theoretical approach. Chapter three, *Figuration: A methodology*, discusses figuration as the critical methodology for this study. It discusses figuration in the works of feminist science and technology scholars such as Donna Haraway, Claudia Castañeda, and Lucy Suchman. It also draws in arguments for figuration from disciplines such as film studies and cultural studies in order to define the formal framework of analysis for the case studies that follow.

The first two case study chapters examine the figuration of AI and gender in scientific domains. Chapter four, *Imitating Alan Turing*, takes the historic figure of Alan Turing and the Turing Test as its sites of analysis. Through a close reading of Turing's 1950 article, "Computing Machinery and Intelligence", I examine the role of gender in his original conceptualisation of the imitation game. Here, I argue that despite modelling human-machine difference on gender and sexual difference, Turing elides this point to make an artificial distinction between the "intellectual" and the "physical," a division that subsequently relegates gender to an irrelevant aspect of conceptualising intelligent machines. His insistence on being "discrete"—on keeping these aspects neatly separated—was also reflective of the way he lived his own life: partitioning the "intellectual" aspects of his personality from the "physical." I argue that this distinction was ultimately untenable, both in Turing's own life and the AI figurations which he articulated, and that rigid discourses of gender have contributed to rigid interpretations of artificially intelligent machines.

Chapter five, *Making Minds at Dartmouth*, analyses material surrounding the 1956 Dartmouth Summer Research Project, also known as the formal "birthplace" of AI research. This includes original proposals, personal accounts, and secondary descriptions from

significant figures in AI history, such as John McCarthy, Allen Newell, Claude Shannon, and Marvin Minsky. The chapter interrogates the aggressive and competitive cultures that shaped early AI and focuses on the dominance of symbolic AI as a research paradigm that fetishises a universal subject for modelling intelligent machines.

The thesis then moves from scientific domains to domains of popular culture. Chapter six, *Animating WALL-E,* is the first of two chapters that examines AI figurations on film. Focusing on the 2008 Disney Pixar film *WALL-E*, I consider how gender is used in film to bestow subjectivity on AI characters. I argue that the authentic performance of personhood is, in many cases, contingent on the perceived authentic performance of gender. *WALL-E* is in many ways an ideal case study because it features characters that are literally brought to life through the power of computer animation. I argue that *WALL-E*'s animism is attributable not just to the technical skill of the animators and their ability to simulate believable movements and textures, but equally to their ability to simulate characters with specific drives and desires. In short, within this computer-animated narrative of artificially intelligent machines, it is gender and sexuality that served as an animating catalyst.

Chapter seven, the second chapter on film, examines the 2015 film *Ex Machina* directed by Alex Garland. Where in the preceding chapter I discussed how AI technologies are gendered in film, in this accompanying chapter I explore how gender is conversely technologised. Examining *Ex Machina*'s narrative, the VFX post-production process and its marketing material, I argue that this text epitomises contemporary figurations of gender as a variable within an algorithmic system. Gender is systematised, codified and reduced to a programmed set of instructions that can be used by machines to manipulate and deceive. It is no longer understood as an index of nature, but as a sign of the creeping artifices of algorithmic culture.

In the final two case study chapters, I turn to AI in everyday life. Chapter eight, *Siri's Gendered Labour*, examines Apple's digital personal assistant, Siri. I analyse Siri's gendered figuration and aestheticisation in commercials, demonstration videos and critical user reviews. Here, I draw on the work of Helen Hester (2016) to argue that Siri is predominantly figured as an assistant to accompany the twenty-first century hyper-employed post-Fordist worker. This assistant automates feminised labour and, in doing so, separates it from the historic context of working women. It is my contention that Apple's consistent claims to create, invent and revolutionise mobile technology too easily extends into claims to create and invent reproductive labour itself. Such a conflation of terms amounts not only to an erasure of the feminised dimensions of contemporary waged labour, but an erasure of the historic dimensions of reproductive labour altogether.

In chapter nine, *Amazon Echo and Figures of Servitude*, the final case study chapter, I turn to the Amazon Echo and the digital assistant Alexa. Looking at user reviews, commercials and user-generated parody videos on YouTube, I argue that the Echo is figured on an idealised vision of domestic service. This vision romanticises the relations of servitude in a way that denies the pain and historical context of that relation. It decontextualises and dehistoricises the terms of domestic service. It also significantly misrepresents the direction of power between the user and the device in such a way that makes contending with issues like surveillance and digital labour increasingly difficult.

Finally, my conclusion brings these disperse case studies together. I discuss the trajectory of AI and gender's co-figuration across these different discursive domains: from gender's early absence in scientific discourse, to its symbolic manipulation in popular culture, and its strategic deployment in everyday life. I reflect on the relationship between the case study materials and the kinds of readings that were produced, and make a case for "figures-in-the-making" as a critical framework that has utility beyond just the study of AI and gender.

My hope is to contribute to the growing body of scholarship in feminist technoscience that questions how objects and knowledge produced by technoscience are critically entangled with complex material-discursive practices and the effects of such knowledge on differently gendered, raced, classed, and abled bodies. Such questions of knowing and doing and their relation to being and ethics is what fundamentally compels enquiry within this field and what too underpins this research. The questions raised here are inherently political insofar as they are designed not just to dissect and analyse but to help imagine and advocate for what Haraway (1988) calls "better accounts of the world" (p. 579).

Chapter two

The AI question in feminist technoscience

In *The Science Question in Feminism* (1986), Sandra Harding traces the progression of feminist criticisms of science from what she calls a "reformist to a revolutionary position" (p. 9). She argues that while early feminist critiques began by examining "the woman question in science"—the situation regarding the status and equity (or lack thereof) of women in science—these gradually evolved into a deeper criticism mobilised around "the science question in feminism"—a fundamental questioning of the possibility of ethical engagement with a science which is not just informed by, but essentially structured on, exclusionary and oppressive principles (p. 9). Where the former positioned discriminatory practices such as sexism or racism as susceptible social biases that could be overcome through a more stringent adherence to "good" scientific practice, the latter saw such biases as constitutive of scientific practice itself such that the issue was not overcoming "bad" science with "good" science, but radically rethinking the epistemological and methodological basis of science as a whole (p. 25). Drawing on Harding's incisive analysis, I seek to trace the progression and character of feminist engagements within the specific science of AI. Where her study considered the newly burgeoning field of encounter, here I follow the influence of this now-established field in framing contemporary feminist dialogues on gender and technology.

Significant changes and developments to both science and feminism since the publication of Harding's analysis have, however, complicated the terms of reference such that it has become increasingly difficult to read either science or feminism as discrete or separate fields. The collapse in distinction between science, technology, industry and the military, coupled with the tight enmeshment between sociocultural and technological processes at the end of the twentieth and beginning of the twenty-first century has undermined the possibility of such a separation. Feminist science scholars concerned with the dissolution of these borders sought to mimic this collapse in language, flagging the new relation of science, technology,

and society with the term "technoscience"[5] (see Haraway, 1997, p. 50; Weber, 2013, p. 406). Addressing feminism in this context unavoidably means considering its relation to technoscience. Of interest to this thesis are the ways in which the topic of AI is situated in this relation. Refracted through the prism of these changes, "the science question in feminism" is here transposed to "the AI question in feminist technoscience."

In this chapter, I chart the history of tensions that have so far informed feminist engagements with AI. Situated within a longer lineage of feminist STS, "the AI question in feminist technoscience" is prefigured by a number of significant movements and debates within this area. Part one examines the development of dominant narratives regarding science and technology within feminist discourse. Beginning with an analysis of early feminist critiques of science, I outline the gendered symbolism of science and technology with masculinity and masculine cultures. I examine the ways in which these arguments have extended into discussions about specific technologies, such as computers and network culture, and also map the radical shift in discourse during the 1980s and 1990s towards rethinking the oppositional dialectic between science and feminism. I then look at the coming of age of feminist technoscience in the early 2000s and its connection to recent feminist movements, such as Cyberfeminism, New Materialism, and Xenofeminism.

In part two of this chapter, I consider how these critical debates have subsequently informed contemporary approaches to feminist studies of AI. Here, I provide a critical review of approaches and methods to research and identify a number of key influential works. The literature under examination range from ethnographic studies of Artificial Life, to analyses of archival material and canonical works of AI scientists. Unlike traditional critiques of AI which are usually undertaken by practitioners from within the AI field itself—such as cognitive science, philosophy of mind, engineering and computer science— researchers in feminist studies of AI often hail from very different disciplinary backgrounds—including history, anthropology, media and communication studies, cultural studies, English and literature, and women and gender studies. These disciplinary affiliations substantially shape not only the questions that are posed but the theoretical and methodological approaches used. The scholarly research emerging from these disciplines is grounded in data that foregrounds human experience, reveals hierarchies of power and social organisation, and is illustrative of

[5] I follow Donna Haraway's definition of technoscience which is influenced by Bruno Latour. She states: "This condensed signifier mimes the implosion of science and technology into each other in the past two hundred years around the world. I want to use technoscience to designate dense nodes of human and nonhuman actors that are brought into alliance by the material, social, and semiotic technologies through which what will count as nature and as matters of fact get constituted for—and by—many millions of people" (Haraway, 1997, p. 50). Other definitions that are also used in feminist science and technology studies extend on the philosophy of Bachelard and Heidegger and deploy technoscience as a term to recognise the technologisation of science (as instrumental rationality) and the primacy of techno-mediated knowledge practices as the dominant scientific mode (see Sofia, 1993).

dominant ideology and culture—for instance: ethnography, archival research, textual analysis, as well as discourse and narrative analysis. With this in mind, the discussion in this chapter is centred on three specific aims: 1) to ground my research within an existing and ongoing conversation within feminist studies of science and technology, 2) to flag my own ethical investments and sensibilities as a feminist researcher, and finally, 3) to frame my methodological approach to the study of AI, which will be examined at length in the chapter that follows.

Part I: Science, technology and feminism

To define feminist STS as a singular "field" is a misleading characterisation. Hammond and Subramaniam (2003) have described feminist science studies as emerging not from a single project or discipline but instead through a broad set of concerns regarding women, gender and science. They argue that this open framing has inevitably led to an internal incoherence that, on the one hand, has produced a diverse and interdisciplinary body of scholarship that covers an impressive range of research methods, approaches and foci, and on the other, led to a fragmentation that makes it impossible to define a canon or core as many scholars draw from such divergent fields that to articulate a single set of resources would necessarily be a reductive process. To attempt to write this history is, then, from the beginning a troubled enterprise as it seeks to impose a coherent narrative on an area of research that is defined by its incoherence. Any attempt to narrativise or classify feminist STS as a "field" risks imposing an institutional classificatory system that inevitably creates boundaries around what is *internal* or *external*, *central* or *peripheral*, *legitimate* or *illegitimate*. As Annemarie Mol has incisively argued:

> why would we want to delineate and even mark a field, and, worse, why with boundaries? A lot of good work in STS helps to show that there are always leaks and, more importantly, interferences. That what happens in one site, informs and helps to shape what happens elsewhere.
>
> (cited in Bauchspies and de la Bellacasa, 2009, p. 341)[6]

This section, then, is not intended as a comprehensive or authoritative account of feminist technoscience, but rather, as a primer to the approaches and ideas that have shaped the

[6] It should be acknowledged, however, that it is only through the reflective work of feminist science scholars and their efforts in curating edited collections of significant works that my "not" narrative is made possible (see Keller and Longino, 1996; Kirkup et al, 2000; Nelson, 1996; Rothschild, 1983; Wyer et al, 2013). Of particular note are the essays written by Banu Subramaniam that reflect on her experience in feminist science studies and work that has been significant for her intellectual development (see Subramaniam, 2003, 2009; Bauchspies and de la Bellacasa, 2009).

questions, concerns and sensibilities of this thesis. To also clarify: I use the terms feminist science studies, feminist STS, and feminist technoscience interchangeably throughout this chapter. This is first because, as Hammond and Subramaniam (2003) have noted, internal inconsistency has meant that many scholars lack a common language and disciplinary identity, such that they rarely rally around or deploy a single, coherent set of terms. And secondly, because the language of scholarship is still in motion and so to give one term primacy over another implies a certain fixity that simply isn't there. This multiplicity of terms reflects the diverse trajectories of writers whose work I draw on (and who also use these terms inconsistently and interchangeably). Like them, I resist the impulse to establish a universal common language for feminist science studies and, like them, I invest in a politics of indeterminacy that stands against the call for a more orderly world (see Barad, 2012, p. 218).

From women *in* science to gender *and* science

As Harding (1986) observes, dominant political and institutional culture is a scientific culture, where "scientific rationality has permeated not only the modes of thinking and acting of our public institutions but even the ways we think about the most intimate details of our private lives" (p. 16). The recognition of the power and prestige of scientific discourse was a critical entry point for early feminist critiques on the underrepresentation of women and women's interests in scientific culture. Although the project of writing histories of women in science is certainly not new,[7] the feminist critique of the scientific institution is a specifically mid to late twentieth century phenomenon.

Londa Schiebinger (1989) has argued that prior to the 1970s, discussions of women, gender and science were largely ignored in the study of scientific history. Only with the increase in numbers of women in the professions of both science and history did interest in women's experiences increase. Biographies, historical analyses, and work on the status of women in science were vital in bringing to light the many contributions of women and provided insight into the circumstances of exclusion itself. The works of historians such as Keller (1983a, 1983b), Rossiter (1982, 1995, 2012), Schiebinger (1989, 1993), Stepan (1986) and Tuana (1993) were invaluable in this regard as they provided evidence and accounts of the ways in which modern science was not only developed on the foundational belief of the

[7] The European women's movement of the 1880s-1920s established journals and conferences on the subject of women and science, and encyclopaedias were collecting the names of women who were learned in arts and science to demonstrate the breadth of their accomplishments as early the fourteenth century (Schiebinger, 1989, p. 3)

biological inferiority of women (and racialised others)[8] but was also culturally and institutionally structured to ensure their continued absence.

Firsthand accounts from women working in the sciences articulated everyday concerns which tied personal experiences in the classroom, hallways, and laboratory to larger patterns in scientific culture.[9] Indeed, the recognition of *science as a culture* was a crucial insight that led many researchers, particularly in anthropology, to study disciplines such as physics and biology ethnographically[10] if only, ironically, to find that these disciplines defined themselves as being "cultures of no culture" (Traweek, 1992, p. 162). The conversation quickly developed from the recognition of equity barriers and the interrogation of tactics of exclusion to criticisms of the value-laden-ness of knowledge produced in these closed communities. Drawing on mainstream feminist movements, the voice of feminist science studies expanded from a focus on women *in* science to a more abstracted interrogation of gender *and* science. Science (broadly defined) was criticised as an inherently masculine culture. Radical feminist politics found plenty of fodder within scientific discourse and institutions which resulted in calls to reject scientific ideologies on the grounds that it justified and naturalised relationships of dominance and subordination. Activist and neurophysiologist Ruth Bleier (1983) forcefully argued:

> Science is *not* the neutral, dispassionate, value-free pursuit of Truth…scientists are not objective, disinterested, or culturally disengaged from the questions they ask of nature or the methods they use to frame their answers…Science is the male intellect: the active, knowing subject; its relationship to nature—the passive object of knowledge, the untamed—is one of manipulation, control, and domination; it is the relationship of man to woman, of culture to nature.
>
> (pp. 193-196)

This association between science and masculinity became a primary point of interrogation for feminist science scholars who argued that this mythology was one of the largest contributors to the underrepresentation of women in STEM (science, technology, engineering, mathematics) fields. Commenting on the decline in women's participation in these industries, Evelyn Fox Keller (1983b) argued that despite the introduction of affirmative

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[8] See, in particular, the work of Nancy Leys Stepan (1986). Stepan has analysed the application of Darwin's theory of sexual selection to explain the perceived lack of intellectual capacities of both women and "lower races" and argued that broader societal classifications of inferiority and difference lead to a science based on a prejudiced conflation of the two. The belief that similar intellectual deficiencies would also similarly manifest physically led to the systematic measurement and study of the shape of the skull.

[9] see Keller (1977/2001), Subramaniam (2000)

[10] see Traweek (1992), Knorr Cetina (1999)

action plans and specialised funding, "the single most powerful inhibitor [to women's participation] was the widespread belief in the intrinsic masculinity of scientific thought" (p. 130). For Keller, assumptions such as "science is impersonal, women are personal" and "science is hard and tough-minded; women are soft and sentimental" are upheld and circulated, not only by scientific institutions, but equally by contemporary feminists who, in seeking refuge from masculine science, turned to affinities between women and nature (p. 113).

This view was exemplified most markedly in movements such as ecofeminism. Seeking a union between feminists and the ecology movement, ecofeminism promoted the connection between women, femininity, and nature as a remedy to male-dominated, masculine culture. The underlying assumption was that science, being the domain of men, was imbued with masculine agency and thus valued within its numbers an inherent desire for the control and domination of nature. Misogynous attitudes towards women were here reified in the violent exploitation of the earth. As ecofeminist Ynestra King (1983), argued, "the hatred of women and the hatred of nature are intimately connected and mutually reinforcing" (p. 118). This view mobilised literary metaphors between women and the earth, such as "mother-nature" and the "virgin landscape." Whereas these metaphors once served a moral and normative function to constrain against the improper use of the earth's resources, during the sixteenth and seventeenth centuries the same metaphors were exploited to legitimise industrial activities. The earth was described as having "secrets" to hide from man, which if found, were to the benefit of human prosperity. As a result, the scientific language employed was rife with metaphors of rape and torture.

In her comparative analysis of pre-industrial and industrial analogies of the earth, Carolyn Merchant (1983) examines the language of Sir Francis Bacon as an example of such rhetoric:

> In the seventeenth century, Francis Bacon carried the new ethic a step further through metaphors that compared miners and smiths to scientists and technologists penetrating nature and shaping her on the anvil. Bacon's new man of science must not think that the "inquisition of nature is in any part interdicted or forbidden." Nature must be "bound into service" and made a "slave," put "in constraint" and "moulded" by the mechanical arts. The "searchers and spies of nature" are to discover her "plots and secrets".
>
> (pp. 113-114)

As Merchant demonstrates, such a view was necessary to allow for the processes of commercialisation and industrialisation which, by their nature, alter the earth. Moral restraints that framed overuse in terms of greed, avarice and lust were overturned by the perceived benefits of industrial activities. Consequently, Western culture ceased to view the

earth as organism to be nurtured and instead approached nature as a body to be shaped into submission (Wajcman, 2004, p. 21). Many ecofeminists took such anecdotes as evidence of mistreatment, and the earth as maternal female body become popular iconography for rallies against exploitation, destruction and instrumentalisation of not just nature, but also animals and people for the purposes of capitalist wealth.

Gender symbolism and technology as "applied science"

This polarisation and essentialisation of the nature of science in terms of cultured symbol systems can be understood as what Harding (1986) has called "gender symbolism" or "gender totemism" (p. 177). Taking cues from Simone de Beauvoir, Harding defines gender as a fundamental analytic category through which people derive meaning and assign value to phenomenon. In the practice of gender symbolism, dualistic gender metaphors are assigned to various perceived dichotomies that, she argues, often have very little to do with sexual differences; "[a]s far back in history as we can see we have organised our social and natural worlds in terms of gender meanings within which historically specific racial, class and cultural institutions and meanings have been constructed" (p. 17). With their moral and political implications, gendered dualisms are often appealed to in the organisation of social activity, such as the division of labour. The domination of certain genders in fields, such as men in science and women in caring roles, has subsequently been misconstrued as the result of biology and individual gender identities. However, at best, these are only "imperfectly correlated with either the 'reality' of the perception of sex difference" (p. 18). As Harding suggests, it would be a mistake to assume that gender differences in individuals, in human activities, and in symbolic systems are at all morally, politically or biologically symmetrical.

The mainstream gendered symbolisation of scientific activity as inherently masculine has also been extended into feminist readings of technology more broadly. Read as "applied science," technology was criticised as being encoded with gendered meanings that shaped its design and use. Feminist science scholar Joan Rothschild (1983) has argued that "technology is part of our culture; and, of course, our culture, which is male dominated, has developed technology that reinforces male supremacy" (p. vii). In her analysis of women and the domestic sphere, Rothschild has argued that technologies such as the microwave, refrigerator and vacuum cleaner have had a controlling and devaluing effect on women's household labour. She disputes liberatory claims that these technologies have "freed" women from the burdens of domestic life and argues instead that by underpinning the continued existence of a nuclear family structure, domestic technologies sanctioned the asymmetric and gendered division of labour.

Although gendered tasks predate the industrial period, it is only with the rise of industrial capitalism that the home and workplace became explicitly separated. The quickly evolving means of production and social relations of production, resulted in the re-categorisation of labour tasks between those which contributed to industrial processes and the production of capital, and those that serviced the domestic household. Men and women were stratified between these two categories of activity and consequently "men's labour" migrated outside of the home while "women's labour" became increasingly defined within it. As labour performed outside the domestic domain produced material wages, men's labour was therefore considered valuable whilst women's labour was a taken-for-granted activity.[11] Rothschild argues that women's unpaid domestic labour became essential in the capitalist social and political order as it enabled the everyday (male) worker to more freely invest their labour power in the market (p. 80). Though this was to the benefit of capitalist production practices, the consequence was that women were often confined to dependent relationships with their working partners. Subsequently, with the expansion of consumer culture, it was not long until the category of "Mrs. Consumer" was created and the deluge of technological products that reinforced such an identity appeared on the shelves of every neighbourhood. Domestic appliances, because they were designed within an economy that reinforces the domestic roles of women, are material manifestations of the gendered power relations that have so far disempowered women.

Computers and "hard mastery"

Within this context, it is unsurprising that technologies like digital computers have also been understood as coextensive with gendered mythologies of science. With histories tied to military funding and STEM industries, computers and computational cultures have developed in line with these gendered institutions. In her 1984 book *The Second Self: Computers and the Human Spirit*, psychologist and social scientist Sherry Turkle examines the link between computers and psychosocial development. She argues that computers, like all technology, alters our relationship with the world affecting "the way we think, especially the way we think about ourselves" (Turkle, 1984, p. 13). Through interviews with children, people who are "addicted" to videogames, hackers, hobbyists, and AI researchers, she provides an analysis of the ways these different groups express themselves and develop their personalities and style in relation to computers. She argues that computers have become culturally associated with what she calls masculine "hard mastery" of skills, as opposed to feminine "soft mastery" (pp. 104-105). She discusses how the masculine hard mastery has come to typify the

[11] These points have been the touchstone for critical movements such as Marxist Feminism and Socialist Feminism

field of computing and how developments in gender psychology have ideologically enforced this position by presenting male characteristics as akin to machines:

> Hard mastery is the imposition of will over the machine through the implementation of a plan. A program is the instrument of premeditated control. Getting the program to work is more like getting 'to say one's piece' than allowing ideas to emerge in the give-and-take of conversation…[T]he goal is always getting the program to realize the plan. Soft mastery is more interactive…the mastery of the artist: try this, wait for a response, try something else, let the overall shape emerge from interaction with the medium. It is more like a conversation than a monologue.
>
> (pp. 104–105)

"Hard" in this sense also conforms to perceived images of scientists as disciplined thinkers reasoning to arrive at a powerful understanding of nature's way. Men too are supposed to be tough-minded, exceptionally rational, unswayed by emotion while women supposedly outdo them in intuitive skills. As Paul Edwards (1990) neatly asserts in his analysis of gendered metaphors of computing, in Western ideology "computers, scientists, and men are hard; children, nurses and women are soft" (p. 104).

Like Turkle, Edwards (1996) has analysed the cultural connection between masculinity, Western rationalist epistemologies that posit a dualism between mind and body, and metaphors of computing. He argues that analogies between minds and computers are so embedded that it is almost natural to refer to thinking as *computing*, the brain as a *calculating machine*, and memory as *looking up stored data* (p. 161). By aligning computers within a longer tradition of Western rationalist thought, such metaphors have helped to legitimate computing as a science. It is unsurprising then, states Edwards, that computers are read as the literal embodiment of the split between thought and its objects (1990, p. 108). The consequence of these metaphors is a bolstering of the mythology of masculine culture in science, this time reified in the claims to the disposition of men's minds with the structure of computers and the nature of thinking.

While criticisms of the association between masculinity and technological cultures had been instrumental in explaining the pervasiveness of gendered symbolism and its cultural effects, in some instances, these arguments reproduced the oppositional dialectic with which they claimed to critique. Writing prior to both Edwards and Turkle, self-described radical lesbian feminist Mary Daly in her seminal book *Gyn/Ecology: The Metaethics of Radical Feminism* (1978) extended perhaps one of the most emblematic feminist cultural criticisms of the masculine myth of science and technology. In a chapter titled "Deadly deception: mystification through myth," Daly argued that "phallocracy" constructs women on the outside

of institutional myths of authority, religious myths of the sacred, and even cultural myths concerning "reality" itself (pp. 43-52). "Phallotechnic progress" enables this estrangement by reducing women to "hollow holograms" (p. 57). Computer-aided space travel, total therapy, cloning, "transsexualism[sic]" reproductive technologies are, for Daly, tools for "male-mother miming"—an unnatural "mechanical masculinist" process that seeks "the elimination of female self-centering reality" (p. 52). She reads this state of "robititude" as a negative condition because it replaces "real," "natural" women with "feminine non-women conceived by male mothers" (p. 52). For Daly, all technology (including speculative technologies such as AI, cloning, cyborgs etc) are classified as phallocentric, and feminists should instead turn to "gynocentric" figures, such as "the goddess," through which to construct their own cultural myths.

However, this reading of men, women and technology has subsequently been criticised as reductive and problematically reproducing *a priori* within the terms of the argument a woman/man, nature/culture dialectic. Jack Halberstam (1991) has argued that by seeking to preserve women's "essential naturalness," Daly effectively regenders female nature and male science. He writes, "[t]o predicate a critique of patriarchy… on the basis of a true and authentic self, who jealously guards her boundaries (physical and spiritual) and her goddess-given right to birth children, is merely to tell the story that patriarchy has told all along about women" (p. 454). This is, indeed, a difficult bind to avoid in cultural feminism. By arguing that culture, not nature, produces the gendered subject, one replaces a discourse of essentialism with an essential non-essentialism, the effect of which is just as determinative. Seeking new strategies for critique, poststructural feminists such as Halberstam have explored the possibility of writing a new dialectical ontology. Essential to this movement is the work of American feminist scholar, Donna Haraway. Haraway, and specifically her essay "A Manifesto for Cyborgs: Science, Technology and Socialist Feminism in the 1980s" (1985/2004a, hereafter Manifesto) served as a primary pivot point from thinking science and/or feminism to thinking feminist technoscience.

A manifesto for feminist technoscience

The term "technoscience" has been deployed in feminist scholarship to describe the changing conceptualisation of science and technology within this matrix of relations. Where feminist approaches in the 1970s and 1980s investigated the political and social conditions of science, taking for granted the separation of science from society, new approaches focused instead on the dissolution of these borders and the epistemological implications for understanding key concepts such as nature, culture, subjectivity, objectivity, self and other. This change in theory also accompanied changes in scientific practice by which mergers between science, industry,

the state, academy, and military had become intensified. The understanding of science as a social practice, the powerful role of communication technologies in mediating culture and the subject, and developments in fields of AI, ALife, biotechnologies and neurosciences, meant that on a more practical level, approaching science and technology as separate from the self was no longer a tenable practice. The implication for feminist studies of science and technology was a radical shift in how feminists positioned themselves in relation to critique. As feminist STS scholar Jutta Weber (2013) has argued, feminist technoscience seeks to "develop approaches which go beyond either the euphoric affirmation of science and technology or their abstract negation" (p. 554).

To say that the ideas put forward in the Manifesto have been influential would be an understatement. Unsatisfied with the term "ground-breaking," Zoë Sofoulis (2002) describes it as something "more like the seismic centre of an earthquake" whose rumbles are still being felt well into the twenty-first century (p. 84). The Manifesto not only inaugurated the cyborg as a key figure for understanding contemporary human-machine relations, it also introduced into feminist vernaculars a dialectic of engagement with science and technology that moved beyond problematic dualistic or oppositional modes.

First published in the *Socialist Review* in 1985, the Manifesto opens with a discussion of the cyborg as a metaphor for the flattening of difference between previously ontologically discrete categories: humans and animals, organisms and machines, mind and body, nature and culture. For Haraway, cyborgs symbolise "*pleasure* in the confusion of boundaries" and the late twentieth century abounds with such "cyborgian" images of transgression and hybridity (p. 8). She states:

> Contemporary science fiction is full of cyborgs — creatures simultaneously animal and machine, who populate worlds ambiguously natural and crafted. Modern medicine is also full of cyborgs, of couplings between organism and machine, each conceived as coded devices, in an intimacy and with a power that was not generated in the history of sexuality. Cyborg "sex" restores some of the lovely replicative baroque of ferns and invertebrates (such nice organic prophylactics against heterosexism). Cyborg replication is uncoupled from organic reproduction. Modern production seems like a dream of cyborg colonization of work, a dream that makes the nightmare of Taylorism seem idyllic. And modern war is a cyborg orgy, coded by C3I, command-control-communication-intelligence, an $84 billion item in 1984's U.S. defence budget.
>
> (1985/2004a, p. 8)

Using these examples amongst others, she illustrates the resonance of the cyborg as a figure for the late twentieth century, and historicises its emergence as an effect of what she

calls the proliferation of "totalising theory" (p. 23). She examines cybernetics, the post-World War II paradigm that brings together information and biological sciences, as a language of totalisation. Cybernetics articulates all organisms (humans, animals, and machines) as analogous information processing systems, governed by principles of communication and control. As such, it "[translates] the world into a problem of coding," creating ontological boundaries that are defined only by the differential permeability of information (p. 23). Within this paradigm, information becomes a universalising force, the effect of which is a rearrangement of social relations of science and technology from "comfortable old hierarchies of domination" into what she calls "the informatics of domination" (p. 20). As bodies are governed informatically—in relation to information—structures of power (corporate, military and state) become inextricably tied to information technologies and biotechnologies.

She examines feminist movements, and specifically the rhetoric of radical feminist scholar Catherine McKinnon, as another example of late twentieth century totalising theory. Critiquing McKinnon's conceptualisation of female consciousness as a product of men's desire, Haraway argues that McKinnon's theory is "totalizing in the extreme" insofar as it denies any kind of difference or source of political consciousness aside from sexual difference (p. 18). Although she sympathises with the call for feminist collective action, she argues for the limits of identification as a means to construct political unity:

> [G]ender, race and class cannot provide the basis for belief in "essential" unity. There is nothing about being "female" that naturally binds women. There is not even such a state as "being" female, itself a highly complex category constructed in contested sexual scientific discourses and other social practices. Gender, race, or class consciousness is an achievement forced on us by the terrible historical experience of the contradictory social realities of patriarchy, colonialism, and capitalism.
>
> (p. 14)

She argues that the insistence on identification as a means of raising political consciousness either erases polyvocality or infinitely fractures it, both of which result in the policing of experience and identity, and both of which effectively reproduce the oppressive logic of Western patriarchy. Haraway observes that radical feminism critiques the erasure of women's experience under patriarchy by means that are, hypocritically, themselves predicated on the erasure of experience of other forms of oppression:

> None of 'us' have any longer the symbolic or material capability of dictating the shape of reality to any of 'them'. Or at least 'we' cannot claim innocence from practicing such dominations. White women, including socialist feminists, discovered (i.e., were forced kicking and screaming to notice) the non-innocence of the category 'woman'.

(p. 16)

As figures, cyborgs represent the questioning of ontological boundaries, as they are part organism and part machine. They are the materialisation of cybernetic sociotechnical relations, a figure which exists only through the erasure of difference. Recognising cyborgs as the iconography of regimes of totalisation, Haraway co-opts them as ironic figures through which to explore the potentiality of feminist resistance within this space. She intentionally subverts the terms of masculine symbolism and the mythology of masculine science:

> From one perspective, a cyborg world is about the final imposition of a grid of control on the planet, about the final abstraction embodied in a Star War apocalypse waged in the name of defense, about the final appropriation of women's bodies in a masculinist orgy of war. From another perspective, a cyborg world might be about lived social and bodily realities in which people are not afraid of their joint kinship with animals and machines, not afraid of permanently partial identities and contradictory standpoints.
>
> (p. 13)

The self which is produced through reflections of the other and which insists on its own autonomy or "innocent wholeness" is revealed by cyborg worlds to be illusory. Cyborg ontologies resist dualistic dialectics and thus also resist the reproduction of oppressive logics which enable domination, appropriation or incorporation of self over other. In rewriting cyborgs as a feminist myth, Haraway creates what she calls a "world-changing fiction": a narrative which advocates for alternative forms of knowing and doing, what in later works she describes as a feminist ethical imperative to create "better accounts of the world" (1985/2004a, p. 7; 1988, p. 579).

In closing the Manifesto, Haraway reiterates her critique of universalising and totalising theory while also advocating for the acceptance of responsibility of the social relations of science. For feminists, this means firstly, "refusing an anti-science metaphysics" and secondly, "embracing the skilful task of reconstructing the boundaries of daily life, in partial connection with others, in communication with all our parts" (1985/2004a, p. 39). Feminist technoscience is, then, a term which implies an acknowledgement of the inseparability of feminist scholarship from epistemologies and cultures of science, rather than critique from a safe or innocent position outside of it. As she states in later works, the word *technoscience* itself visually mimics this complicated project of entanglement and connection, intentionally non-hyphenated in order to serve as a "visual onomatopoeia" of the implosion of categories within cyborg worlds (1997, pp. 4, 50-52).

New feminist ground

The influence of Haraway's scholarship in shaping contemporary feminist discourse regarding science and technology cannot be overstated. I end this section with a brief discussion of three feminist movements influenced by Haraway's approach: Cyberfeminism, New Materialism, and Xenofeminism. While these movements are not mutually exclusive, and do not represent the only forms of contemporary feminist scholarship in this space, they are significant because they continue to reflect on and reorient feminist dialogues with science and technology, and in the tradition of Harding, continue to question the relationship between science and the social.

Drawing direct inspiration from Haraway's work, Cyberfeminism emerged as a movement during the early 1990s. Judy Wajcman (2004) has framed Cyberfeminism as "a reaction to the pessimism of the 1980s feminist approaches that stressed the inherently masculine nature of technoscience," and as such, many Cyberfeminist works centre on feminine empowerment, pleasure, liberation, and emphasise women's subjectivity and agency within cybercultural structures and technologies (p. 63). Sofoulis (2002) has stressed the activist dimensions of Cyberfeminism, arguing that Cyberfeminists seek to explore the "theoretical and artistic potential of technologies and metaphors of the information age for women…Cyberfeminists make the connection between the cyberpunk slogan 'information wants to be free' and the feminist liberatory dimensions of Haraway's cyborg myth" (p. 98).

Both Sofoulis and Wajcman credit the popular circulation of the term with Australian feminist art collective VNS Matrix (1991-2001) and UK philosopher and cultural theorist Sadie Plant. The VNS Matrix's visual essay *A Cyberfeminist Manifesto for the 21st Century* was a seminal text for the movement, not only giving it a name but setting the tone for this discourse. Composed using digital graphics, the cyberfeminist manifesto featured horned women embedded in a molecular network shooting arrows from their eyes to connect a naked female body to a bubble of text which declared "the clitoris is a direct line to the matrix" and that the VNS matrix were "the virus of the new world disorder…terminators of the moral code…the future cunt" (Starrs et al, 2002, p. 206). As part of their self-narrated origin story they stated their aims as "on a mission to hijack the toys from technocowboys and remap cyberculture with a feminist bent" (VNS Matrix, 2016). They spread their message using guerrilla graffiti tactics, through online forums, and through exhibitions of original artistic works. One example was the unveiling of a prototype video game titled "All New Gen," a game which required users to inhabit a space called the Contested Zone—"a terrain of propaganda subversion and transgression"— to fight against Big Daddy Mainframe to

achieve the goal of "data liberation" (VNS Matrix, 2016). This intentionally hyperbolic strategy to reclaim and rewrite the relationship between women and technology using the tools of the information age was exemplary of the creativity and sardonic attitude of many cyberfeminist scholars.

Sadie Plant (1995, 1996, 2000) explored similar themes in her work examining the relation between women and machines. Drawing on Freudian and Irigarayan frameworks, she spun complex metaphors between cyberspace and femininity. In her seminal book *Zeros + Ones: Digital Women + the New Technoculture* (1997), Plant traced a history of computing which polemically inverted the terms of patriarchal claims over technology. The "one" of *Zeros + Ones* was the individuated self of Western philosophy; "To the ancient Greeks, one was everything and anything, first and last, best and good, universal, unified. It was the symbol of existence, identity and being…To be anything at all was to be one" (p. 54). The one symbolised the position of man in histories of technology against which women were measured and found to be "zero"; "absence, nonbeing and nothingness" (p. 55). Reading this relation through the binary language of computing—a language defined by sequences of zeros and ones—Plant displaced the phallic and singular order of one with the radical and feminine potential of zero. Using psychoanalytic metaphors of weaving, hysteria, the veil and the womb, she reread the history of computing to foreground the role of femininity and female figures. As she famously states:

> The matrix weaves itself in a future which has no place for historical man: he was merely its tool, and his agency was itself always a figment of its loop. At the peak of his triumph, the culmination of his machinic erections, man confronts the system he built for his own protection and finds it is female and dangerous.
>
> (p. 62)

Like Cyberfeminism, the tradition of New Materialism has sought new pathways in cultural theory to rethink the epistemological role of dualisms in shaping understandings of gender and technology. Where cyberfeminism reversed the dialectic—aligning women with technology—New Materialism examined the primacy of dualisms as they are produced in action. In their genealogy of New Materialism, Rick Dolphijn and Iris van der Tuin (2012) write that it is for this reason that New Materialist philosophy takes "a profound interest in the morphology of change and gives special attention to matter (materiality, processes of materialization) as it has been so much neglected by dualist thought" (p. 93). This "turn" to matter was accompanied by renewed engagements with materialist philosophy. Locating themselves within the same tradition as Benedict Spinoza, Simone de Beauvoir, Henri

Bergson, Alfred North Whitehead, and Brian Massumi among others, New Materialist philosophy insists on the semiotic-material nature of knowing and being, that is, an understanding of discourse and matter that is inextricably intertwined, redefining objects and identities as the result of contingent materialisation (Coole and Frost, 2010, p. 29; Dolphijn and van der Tuin, 2012, p. 94). It is here that New Materialism resonates with feminist philosophy. Authors such as Karen Barad (2007) and Rosi Braidotti (2002, 2013) have interrogated systems of difference (including sexual difference) by critically reassessing the nature of categorisation through alternative narratives of materialisation. Barad, for instance, engages with quantum theory in order to challenge an individualist metaphysics. As a trained theoretical physicist, Barad takes insights from quantum theory, and in particular the work of Niels Bohr, to argue that phenomena in the universe do not exist through any *a priori* categories of distinction, rather they are produced in and through material-discursive apparatuses in a process she calls "intra-action"—"the mutual constitution of objects and agencies of observation with phenomena (in contrast to 'interaction,' which assumes the prior existence of distinct entities" (Barad, 2007, p. 197). In this way, matter is "substance in its intra-active becoming—not a thing, but a doing, a congealing of agency. Matter is a stabilising and destabilising process of iterative intra-activity" (p. 210).

Braidotti (2013), by comparison, establishes her position through an engagement with the continental philosophical tradition of Spinoza, Deleuze and Guattari, Irigaray and Kristeva. Positioning herself as a feminist anti-humanist, Braidotti explores the radical potential of the posthuman as figure which rejects the self-aggrandising, universalising and anthropocentric epistemologies of Humanism. For Braidotti, the end of the humanist subject affords the unique opportunity to imagine alternative subjectivities no longer grounded in dualistic ontological structures. Both Barad and Braidotti situate their philosophies within materialities that are both human and non-human, and which take account of systems that are environmental, technological, political and economic. In this way, their philosophies intersect with question of ethics and living and being *with* the world with a sense of intimate connection that is profoundly different to previous systems of relations. As Diana Coole and Samantha Frost (2010) stress, it is this ethical sense of engagement with systems, objects, and beings beyond the human which motivates the New Materialist drive to rethink boundaries and categorisation:

> From our understanding of the boundary between life and death and our everyday work practices to the way we feed ourselves and recreate or procreate, we are finding our environment materially and conceptually reconstituted in ways that pose profound and unprecedented normative questions. In addressing them, we unavoidably find ourselves having to think in new ways about the nature of matter and the matter of

> nature; about the elements of life, the resilience of the place, and the distinctiveness of the human.
>
> (p. 6)

Finally, the most recent of these three movements is Xenofeminism. Much like cyberfeminism and Haraway's cyborg ontology, Xenofeminism also entered public consciousness through the means of a manifesto. Circulated online in 2015, the multimedia "essay" was compiled by international feminist collective Laboria Cuboniks. Titled *Xenofeminism: A politics of Alienation* (hereafter XFM), it advocated for a revitalising feminist and queer politics established on the unifying potential of the common experience of alienation. It states:

> We are all alienated – but have we ever been otherwise? It is through, and not despite, our alienated condition that we can free ourselves from the muck of immediacy. Freedom is not a given–and it's certainly not given by anything 'natural'. The construction of freedom involves not less but more alienation; alienation is the labour of freedom's construction. Anyone who's been deemed 'unnatural' in the face of reigning biological norms, anyone who's experienced injustices wrought in the name of natural order, will realize that the glorification of 'nature' has nothing to offer us—the queer and trans among us, the differently-abled, as well as those who have suffered discrimination due to pregnancy or duties connected to child-rearing. XF is vehemently anti-naturalist.
>
> (Laboria Cuboniks, 2015, 0x01 section)

The XFM can be considered as enacting Haraway's call for a politics of affinity rather than a politics of identity. By recognising the common condition of alienation under an unprecedented exploitative order of capitalism, the XFM argues that an increase in this condition will inevitably lead to the reformation of the current (unstable and unjust) world order. Influenced by the Left Accelerationist movement, and particularly the works of Nick Srnicek and Alex Williams, Xenofeminism proposes a seizing of control of the tools of alienation, including information technologies (which have functioned as ideological infrastructure) but also reproductive technologies, medical technologies, biotechnologies, AI technologies, environmental technologies, technologies of the home, technologies of work, and even gender and race as technologies of identity and marginalisation. They also explicitly reclaim rationalism as a means to also reclaim science in service of an emancipatory feminist politics; "To claim that reason or rationality is 'by nature' a patriarchal enterprise is to concede defeat. It is true that the canonical 'history of thought' is dominated by men, and it is male hands we see throttling existing institutions of science and technology. But this is precisely why feminism must be a rationalism—because of this miserable imbalance, and not despite

it." (Laboria Cuboniks, 2015, 0x04 section). In this way, Xenofeminism takes the politics of feminist technoscience to its furthest ends, not only rethinking ontological categorisation but reconstructing boundaries to align with a queer, technologically literate, anti-capitalist, anti-humanist feminist agenda.

Part II: Feminist studies of AI

I turn now to consider how these critical debates have informed contemporary feminist approaches to AI. While critiques of AI, its ethics and social implications, have always circulated alongside the science itself, researchers engaged in this discourse have historically come from within traditional AI fields, such as cognitive science, computer science, and philosophy of mind. Very few, if any, of these studies have foregrounded gender or feminist approaches within their critiques. Only in the last few decades has there been sustained engagement between feminist scholarship and what Lucy Suchman (2007a) has called "the sciences of the artificial." A phrase borrowed from AI researcher Herbert Simon, the sciences of the artificial cover AI and its parallel and subfields, such as robotics, human-computer interaction, artificial life (ALife), software agents, and ubiquitous computing. Suchman has argued that feminist approaches to the sciences of the artificial have been primarily organised around a number of central concerns, namely, "changing conceptions of the sociomaterial grounds of agency and lived experience, of bodies and persons, of resemblance and difference, and of relations across the human/machine boundary" (p. 139). In the remaining sections of this chapter, I consider how these concerns have developed in relation to broader critical debates in feminist technoscience. I also examine the different methods, theoretical approaches and modes of analysis employed by feminist scholars in their engagements with AI and the sciences of the artificial.

Gendered epistemologies and the form/matter split

As in feminist science studies more broadly, many feminist scholars have employed historical analyses to identify ongoing patterns of structural exclusion within AI fields. These studies have built on the work of historians who have focused on the omission of women's labour and women's narratives from mainstream histories of technology.[12] Again, women's physical exclusion has been understood as symptomatic of the symbolisation of these fields as masculine, and concomitantly the products of their research as epistemologically reifying masculinity. As a science concerned with making intelligent machines, AI has been of

[12] For histories of the role of women in computing, see: Ensmenger (2003), Hicks (2017), Fritz (1996), Isaacson (2014), Light (1999), Lupton (1996), and Perry and Greber (1990). Also influential were histories of women and the telephone switchboard, see: Lipartito (1994), Maddox (1977) and Rakow (1988).

particular interest to feminist researchers seeking to question the politics of knowledge and the gendered history of capital 'R' Reason.

One of the most comprehensive and exemplary studies of AI in this vein is Alison Adam's *Artificial Knowing: Gender and the Thinking Machine* (1998). In this study, Adam provides an incisive critique of gendered epistemologies in the construction of AI cultures and artefacts. Her analysis of symbolic AI and early paradigms of research draw attention to the ways in which, in the very first instance, AI was a science constructed on gendered patterns of rationality. She argues that the types of knowledge represented in early formal models of cognitive science implicitly produced a split between the rational and the irrational. While rationality has been defined within the Western intellectual traditional as a product of pure mind, separable from the body, irrationality came to represent the realm of exclusion—as those traits which escape intelligibility within narrowly defined epistemologies.

Adam examines a range of AI projects, from very early 1950s AI programs, such as Allen Newell, Herbert Simon and J.C Shaw's Logic Theorist, to 1990s robotics projects, including Rodney Brooks' learning "robot baby" Cog. She argues that, in almost every instance, in searching for intelligent behaviour, researchers would solipsistically look inwards for inspiration, regarding themselves as "the gold standards for such subjects" (p. 5). She notes that from the 1950s and still to today, AI research and development remains a male-dominated field, the result of which is that AI models are embedded with a tacit norm of masculinity and detrimental because they fail to represent what she refers to as "women's way of knowing." She states:

> this kind of problem was the natural choice of workers in the field; an example of what is taken to be the highest form of reasoning, something that people find highly abstract and difficult, a masculine standard drawn from their own lives, which was then to form the subject matter of the first significant AI program.
>
> (p. 30)

For Adam, the danger is that in refining paradigms for research, certain epistemologies are never presented as just a choice or as chosen, but are instead put forward as the objectively *natural choice*—the unquestionable "truth" of intelligence. In this way, Adam's analysis aligns with early feminist critiques of science and technology that work to expose the gendered bias at the heart of science. She finds that, like many projects within the scientific tradition, what constitutes "intelligence" for AI practitioners and the conditions by which intelligence is constructed, unsurprisingly, reflects the masculine status quo.

In a similar analysis, Annemarie Jonson interrogates the metaphysics of ALife projects through the tradition of continental philosophy. In *Still Platonic After All These Years: Artificial Life and Form/Matter Dualism* (1999), Jonson takes to task the position of ALife expert Christopher Langton in his claims regarding the promise of ALife projects. Langton states:

> The dynamic processes that constitute life—in whatever material bases they occur—must share certain universal features—features that allow us to recognise life by its dynamic form alone, without reference to its matter…Life is a property of the organisation of matter, rather than a property of the matter which is so organised… Life is a property of form, not matter, result of the organisation of matter rather than something that inheres in the matter itself.
>
> (cited in Jonson, 1999, p. 47)

Using feminist theory and philosophy to deconstruct Langton's claim, Jonson argues that this reductionist view reproduces the form/matter split as the primary precept of life. She analyses examples of ALife software, such as the computer simulation Tierra which hosts small programs that compete "*in silico*" in ways that are said to mimic evolutionary and ecological dynamics. These programs exist in an informational universe, which for Langton, is defined by its immaterial "logic" rather than material "substance." The result, Jonson argues, is that "digitally encoded information is ontologised as life's disincarnate essence and origin… On these theorists' locutions, matter is epistemologically as well as ontologically extraneous to life, and may be unproblematically jettisoned from purview" (p. 49). Identifying this elision as "commonplace in the history of metaphysics," she then problematises it using the work of feminist scholars Evelyn Fox Keller, Susan Oyama and Vicky Kirby and through the deconstructionist theory of Jacques Derrida (pp. 49-54). By situating the philosophical problem of ALife within a history of ideas and counter-ideas, Jonson challenges the foundations on which the philosophy of ALife is premised.[13]

Risking an encounter

While these contributions have been invaluable to the tracing and naming of reductive and exclusionary principles at the heart of AI and the sciences of the artificial, many feminist scholars have argued for modes of engagement that do more than critique from the outside. In the same ways in which Halberstam and Haraway sought to create new epistemologies that pushed beyond the abstract negation of science and technology, feminist scholars engaging with the sciences of the artificial have similarly sought new strategies for critiquing

[13] See also Edwards (1990), Golumbia (2003) and Sofia (1993).

binaries, such as form/matter, natural/artificial or masculine/feminine, without reproducing them.

One of the most thorough and ambitious examples is Sarah Kember's *Cyberfeminism and Artificial Life* (2003). Influenced by Haraway's ironic engagements with technoscience, Kember traces the development of ALife as both a discipline and a cultural discourse through a revised interpretation of Cyberfeminism. Cyberfeminism, she argues, must do more to engage in dialogue with the sciences of the artificial. In her words, there must be an element of "risk":

> What feminism risks, in a dialogue with ALife, is not complicity—complicity as illustrated in Sadie Plant's work bypasses dialogue and is tacit, given—but the complacency of a secure, well-rehearsed oppositional stance. Feminism risks its anti-biologism (and technophobia) by entering a more dynamic relationship based on contest and consent, on centrifugal and centripetal forces.
>
> (p. 176)

She demonstrates this risk by engaging with the history, actors, artefacts, and ideas of ALife, reading closely its ties to informational and biological sciences. For Kember, there is a need for feminists to relinquish long-standing conceptual figurations that reproduce oppositions between essentialism and constructivism, ontology and epistemology, nature and culture. Too often, she argues, feminists produce straw-readings of science that do not see it on its own terms. The challenge for feminists is to recognise the plurality of positions within the sciences and to extend to these cultures the same generosity that they expect in their own practice.

Kember's study is driven by a practical desire to model engagements in Cyberfeminism and emerging biocultures that move discourse beyond the damaging rhetoric of the science wars, arguing that these attitudes are stifling, reductive, and unnecessarily adversarial. Importantly, they do not best serve the communities they seek to represent. For Kember, cyberfeminism in its parodic critiques of essentialism and sustained engagements with technology, is in a unique position to intervene in the production of posthuman understandings of life. This requires not only an ontological or epistemological shift on behalf of feminist and science researchers, but a recognition of the ethical imperative to do such work. As she states, "the choice is between making a difference and making no difference in the construction of ideas and artefacts which constitute life-as-we-know-it and life-as-it-could-be" (p. ix).

Elizabeth A. Wilson advances a similar ethic in her book *Affect and Artificial Intelligence* (2010). She draws on Latour to argue for a mode of critique that "trades in multiplication

rather than subtraction and scorn" (p. xii). Critique, she argues, should aim to re-orient rather than debunk; to be empathic rather than paranoid.[14] To this effect, Wilson's aim is to re-orient dominant cultural critiques of AI by providing a "prehistory" of affect and emotion in studies of artificial cognition. Drawing on psychological and biographical data, she maps various affective relations across different AI sites. She analyses chess-playing as an affective as well as cognitive game, chatbots as instances of "co-assembled human-machine affectivity" and the affective relations between key researchers in the field in order to insert into a so far "asexual" narrative "strong libidinal relations between men" (p. 123). Unlike Adam who reads the history of AI as one that has prioritised reason over other forms of knowledge, such as affect and emotion, Wilson argues that reason and emotion need not be read as radically opposed concepts. In this AI historiography, she demonstrates the ways in which affect has always already been present in a field that claims to concern itself exclusively with the masculine pursuit of mind and cognition and not the feminine realm of body and emotion.

Wilson's ambition to provide a revised history of AI expands analyses within feminist STS to include psychological and biographical data—corpuses that she contends are too often dismissed for being too individualistic and insubstantial. Her utilisation of affect theory as a means to enact an anti-Cartesianism is driven by a similar impulse to Haraway, Barad, and New Materialist philosophy. Though they draw on different strategies—Wilson's use of affect and psychology, Barad's use of materiality and quantum physics—there is nevertheless an analogous drive to produce readings of AI that are not strictly critical or oppositional to feminist sensibilities. Like Kember, Wilson's aspiration is to demarcate a history of AI that does more to intervene in how AI futures are imagined, and as she states: "An analysis of the ways in which thinking and feeling were miscegenated in the early ears of AI will be useful for how we position ourselves to imagine the future embodiments of affects and cognition in artificial systems" (p. 6).

Histories, narratives, cultures

Alongside these critical feminist histories are cultural and anthropological studies that, along with deconstruction and critique, seek to investigate the broader cultural conditions which have led to the formalisation of AI and the sciences of the artificial as distinct research fields. In *Silicon Second Nature* (1998), STS scholar Stefan Helmreich provides a classical anthropological account of Artificial Life covering the field, scientific actors, and the digital organisms produced. His ethnography of the Santa Fe Institute for the Sciences of

[14] Wilson draws on Eve Kosofsky Sedgwick's discussion of contemporary critical and cultural analysis. Sedgwick (1997) argues that paranoid inquiry has become coextensive with critical theoretical inquiry. It is seen as *the* mode of analysis rather than just simply *a* mode of analysis.

Complexity provides a first-hand account of how computer programs have come to be considered life-forms in twentieth century U.S and European culture. While Helmreich's study does not focus specifically on gender, gender nevertheless forms a critical aspect in understanding the scientific cultures of ALife scientists. His discussion ranges from the gendered creation myths of a masculine God that "sparks the formless matter of earth with a kind of divine seed" that unconsciously circulate in ALife discourse, to the gendered figurations of computational work in terms of masculine "hard mastery" to feminine "intuition" as well as the gendered demographic of Alife researchers themselves (pp. 35, 71, 115). Helmreich's study provides a narrative for the emergence of a science committed to "synthetic vitality" and the cultural and ideological commitments that make such a narrative possible.

Similarly, Paul Edwards (1996) in *The Closed Word: Computers and the Politics of Discourse in Cold War America* examined AI through his historical account of the role of computers during the Cold War. Like Helmreich, Edwards is an STS scholar and as such emphasises the history of technology through social, political, and cultural contingencies rather than through master tropes of progress or revolution, in his words, "technological change as technological choice" (p. xiii). He moves away from narratives of computer history that explain the story from a single site, such as the laboratory, or from the perspective of actors within the field. Instead, he examines the influence of ideologies, popular culture, interpersonal relationships, funding bodies, government policies, and contemporary politics to craft a more complex story of the role of computers in Cold War culture.

Like Helmreich, Edwards' analysis is not centred explicitly around gender but gender nevertheless figures significantly within his discussion: in the masculine desire for mastery and control embedded in the arms race discourse, in the universalist assumptions of cybernetics and psychological behaviourism, and the heteronormative cyborg subjectivities modelled in films such as *Terminator 2*. By extending his political social analysis to popular culture, Edward's is able to demonstrate the pervasiveness of "closed world" rhetoric and its manifestation historically, theoretically, and mythologically. He argues that fictional narratives, like scientific theories or political discourse, "do not merely describe, but actually demonstrate, *what it's like* to inhabit specific forms of subjectivity, particularly versions of the self" (p. 304, original italics). Fiction thus constitutes an important semiotic resource, a vital site for tracking large-scale discourse as it moves between interacting institutions. Edwards' approach to fiction and popular culture as an equally legitimate site for the analysis of AI narratives and figurations has been instrumental in guiding the collection of my own case studies, but also in shifting dominant conceptualisations of studies of science and technology to alternative sites outside of the lab.

This cross-disciplinary approach to case study materials is demonstrated most elegantly in N. Katherine Hayles' *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999). In this influential work, Hayles traces three critical narratives that prefigure the emergence of the sciences of the artificial: 1) how information lost its body, 2) how the cyborg was created as a technological artefact and cultural icon in the years following World War II, and 3) how a historically specific construction called "the human" is giving way to a different construction called "the posthuman" (p. 2). Hayles discusses these narratives in relation to three waves in cybernetics, arranging her analysis so that each section is composed of 1) a discussion scientific theory, 2) a historical chapter grounded in specific applications of theory, and 3) literary texts which are contemporaneous with these theories and technologies. Hayles, who is primarily a literary scholar, incorporates popular cultural texts in order to demonstrate the wide circulation of scientific narratives through the body politic.

Coextensive with new movements in feminist technoscience, Hayles' approach is exemplary of an analytic strategy that seeks to account for material-semiotic entanglements, and the inclusion of literary analysis within her argument serves to ground her study within embodied narratives of scientific development. This method is designed to eschew abstraction and the teleology of disembodiment (a strategy which has particular significance in relation to AI) and to foreground the circuit between science, culture and the imagination. Reading literary texts alongside scientific theories represents an effort to perform specificity and embodiment:

> In articulating the connections that run through these discursive realms, I want to entangle abstract form and material particularity such that the reader will find it increasingly difficult to maintain the perception that they are separate and discrete entities. If, for cultural and historical reasons, I cannot start from a holistic perspective, I hope to mix things up enough so that the emphasis falls no on the separation of matter and information but on their inextricably complex compounding and entwinings. For this project, the literal texts with their fashioning of embodied particularities are crucial.
>
> (p. 23)

The application of methods that encourage material-semiotic readings of histories, actors, events and narratives in AI is a key strategy that drives the methodological approach of this thesis. In particular, the adoption of case studies that span across sites of science and culture help to foreground the contingency of AI figurations on broader cultural formations, rather than as a discourse that emerges *ex nihilo*, and to emphasise the role of mediation and circulation to the formation of discourse and narrative.

Materialising the human-machine boundary

The final approach that I discuss in this chapter is found in the work of Lucy Suchman. Suchman articulates some of the critical potential of applying feminist modes of analysis to the sciences of the artificial. As an interlocutor with feminist technoscience scholars such as Haraway and Barad, Suchman's work looks beyond revisionist histories, to instead provide situated studies that analyse boundary action and materialisation as they are enacted. In *Human-Machine Reconfigurations* (2007b), an expanded second edition of her 1987 book *Plans and Situated Actions*, Suchman explores relations of sameness and difference in configurations of non-human agency. By calling to attention the materially contingent conditions by which difference is produced between humans and nonhuman machines in regards to capacity for action, she shifts the conversation from a discussion of difference per se to a discussion of "which differences matter, here?"[15] (p. 2). To this effect, she formulates as her guiding questions: "how and when the categories of human or machine become relevant, how relations of sameness or difference between them are enacted on particular occasions, and with what discursive and material consequences" (Suchman 2007b, p. 2).

By examining the socially, historically, and political situated nature of human-machine configurations, Suchman calls for a recognition of the response-ability for (in reference to the work of Barad and Haraway) "inevitable cuts through which bounded sociomaterial entities are made" (p. 7). Drawing on an array of artefacts situated at the human-machine interface, from photocopiers (the subject of her original text), to expert help systems, computer graphics and animation software agents, wearable computers, and interactive digital art projects, she illustrates how and under what circumstances intelligibility for non-human agency emerges from material processes.

As an anthropologist, her research methods draw on ethnographic principles, which include participant observation, lengthy embedded site visits, and interviews, as well as auto-ethnographic writing. For instance, in early case studies, she videotaped encounters between Xerox photocopiers, a prototype interactive interface, and would-be users, documenting the struggles and failures of interaction and communication between these actors. She attributed these failures to "deep asymmetries between person and machine" (p. 11). Drawing on findings from sociological studies of face-to-face human conversation, Suchman argued that human conversation was not structured on the exchange model that formal, mathematical theories were predicated on. Rather, human communication entailed dynamic, mutual intelligibility facilitated by "an extraordinarily rich array of interactional competencies, strongly situated in the circumstances at hand (the bounds and relevance of which are, in turn,

[15] A phrase borrowed from Sara Ahmed (1998).

being constituted through that same interaction)" (p. 10). Where humans have a range of sensory apparatus to collect information about their interlocutors, by contrast, machines can only access a very limited sample of information about users. Mutual understanding (in human terms) was, thus, skewed towards a presence that was not available to the machine.

In contrast to this example, Suchman later discusses her interactions with the artistic installation *Prosthetic Head* by performance artist Stelarc. Unlike the photocopier, interactions between the user (in this case Suchman) and a three-dimensional digital representation of Stelarc's head was defined by a "liveliness" that she attributes to the rich assemblage of artefacts that make up the exhibition: pressure-sensitive pads for a user to step onto, the large display the fills the users field of vision, the programming language and database used by the head, and the people present at the scene of action (which in Suchman's case also included the human Stelarc who helped to facilitate the conversation). Her interactions with the prosthetic head modelled a different mode of human-machine interaction than the photocopier insofar as it was assembled to encourage collaborative performance rather than predetermined action.

Suchman consistently deploys the terms of figuration to describe the materialised relations between humans and machines. This language allows her to articulate the contingency of assumed categories of sameness and difference, such as those between human and machine, but also to express a sense of hope and agency that the terms of difference may still yet be revised. Figuration for Suchman, as it is for me, is a means to acknowledge responsibility and to advocate for ethical action. The commitment to reconstruct boundaries, rather than rally against them, in this sense resonates with contemporary sensibilities in feminist technoscience seeking to reassess entanglements with matter and to rethink ontological categorisations such that they offer critical potential for queer, anti-racist and anti-sexist projects.

New questions for feminist technoscience

What can be said about the AI question in feminist technoscience? As I've discussed in this chapter, feminist technoscience is best characterised, not as a coherent, unified field per se, but as a set of shared sensibilities and an attentiveness to common issues. These include structural exclusions in scientific fields, biases in the creation of scientific knowledge and technological artefacts, a concern for the welfare of people (especially marginalised groups) living in technoscientific culture, and a desire to reform symbolic and physical systems so that they may best serve the community. The tactics and strategies deployed to address these issues, however, have differed greatly. For many of the researchers discussed in this chapter, the focus has been on reflecting and developing modes of critique. These critiques were aimed at

institutions, actors, discourse, and in some cases, each other. Yet this critique has been necessary to secure the healthy plurality and a non-adversarial recognition of difference advocated by scholars like Kember and Suchman.

In this context, feminist technoscience has found in AI and the sciences of the artificial the opportunity to develop new methods, vernaculars, and modes of inquiry. AI complicates key assumptions and divisions in theories of human subjectivity—such as agency, personhood, subject/object, nature/culture, self/other—and as such provides fertile ground for feminist provocation. As the AI question because more pertinent, not just in feminist technoscience but in everyday life, it introduces into the body politic concerns for ethical and philosophical issues that feminist scholars have long proffered. Feminist scholarship has, then, become an ideal resource for the study of AI. But it is not just the case that feminist theory or philosophy is merely a tool that can be used to interrogate and refashion AI culture. AI, conversely, provides exciting new provocations and challenges that push feminist theory into unfamiliar territory. This mutual exchange forms the platform on which I develop my own approach and analysis.

Chapter three

Figuration: A methodology

> Methods for studying science and technology, like their research objects, are both already made and always in the making
> (Suchman, 2012, p. 48)

The terms *figure* and *figuration* have become staples within the vernacular of feminist technoscience. They are adaptable phrases, often deployed to signal a particular analytic orientation or ethical-political commitment to the normative values of feminist science studies—what Barad calls an "ethico-onto-epistem-ology" (Barad, 2007, p. 185). But what does it mean to describe something as a figure or as being figured? Though these terms, and their many variations—including *pre*figuration, *con*figuration and *re*figuration—circulate widely as part of academic discourse, rarely do proponents of figures for feminist thinking pause to reflect on: what, exactly, is a figure? What is figuration as a process? And what makes figuration amenable as a specifically feminist method?

In this chapter, I discuss figuration as the primary critical methodology for this thesis. The aim is to: 1) delineate a framework for the study of figures, 2) make a case for the utility of this framework for analysing AI and gender, and 3) explore the significance of figuration to feminist technoscience more broadly. Figuration asks us to consider what a figure represents, how this representation came to be, and how else it might be figured. As I will elaborate in the following sections, figuration as a method requires the tracing of material histories and the naming of specificities and differences. Although this chapter draws mainly on resources from feminist technoscience, it is also influenced by literature in critical theory, media studies, film studies, as well as cultural studies.

The ambiguity around figuration is in part due to the mutability of figures themselves. Figures can be literal or speculative; they can be hopeful points of entry or can embody oppressive world orders. Figures can also shift and change not only *over* time and space, but also *in* time and space. It is my contention that despite these ambiguities, there are three fundamental aspects which make both figures and figuration useful tools for analysis. Firstly, that regardless of form, figures always represent more than themselves and, as such, can be

read as embodying broader social and cultural ideologies, anxieties, and beliefs. Secondly, figuration relates to the tracing of form such that the naming of specificity, difference, and material and semiotic histories within and between figurations is essential to understanding their function. Figures, in this sense, are distinct from concepts such as myths or eternal archetypes insofar as they stand against readings that are ahistorical or apolitical. Finally, while figures are representational (representing more than themselves), figuration as a process questions the traditional representational relation. While representation often assumes a linear sequence where an object, event, person or thing *precedes* its representation, figuration displaces this relation, providing an inverted model by which it is the process of representation that *produces* the object.

The case studies in the chapters that follow demonstrate just some of the possible figurations of AI and gender in technoscientific culture. The sites I have chosen are organised by domain and case study materials: chapters four and five address imaginaries in science, analysing biographies, archive materials, publications, and interview transcripts of AI researchers considered foundational to the field; chapters six and seven address imaginaries in popular culture, analysing diegetic narratives, production and post-production techniques, and marketing materials of Hollywood films that feature AI characters; and finally, chapters eight and nine address imaginaries in everyday life, analysing advertisements, customer reviews, and parody videos of AI digital assistants. By organising these cases into sections I do not mean to suggest that these are discrete or separate sites. On the contrary, they are thoroughly imbricated, part of the same circuit of circulation and semiotic exchange. Instead, what I hope to emphasise is how these different materials *materialise analysis*. While the primary aim is to provide comparative case studies to illustrate the pervasiveness of the mutual figurations between AI and gender across different discursive domains, I also wish to demonstrate how the specificity of the materials themselves intra-act with the apparatus that is said to measure them (see Barad, 2007, p. 148).

Significantly, as the epigraph above suggests, figuration reminds the researcher that they too are inside the phenomena they critique. The very work of articulating a research method is itself an act of figuration—an attempt to give fixity to a shifting material-semiotic process. In Barad's words, the research method—as a measuring instrument—produces the objects it claims to observe. Figuration is thus tied to responsibility, an "ethical obligation to intra-act responsibly in the world's becoming, to contest and rework what matters and what is excluded from mattering" (p. 178).

Figures and representation

In linguistic terms, a figure is an aspect of language in line with allegory, metaphor and trope. The word *figurative* refers to the use of words beyond their literal meaning. Like metaphor, which creates "understanding and experience of one kind of thing in terms of another" (Lakoff and Johnson, 1980, p. 5), figurative language generates meaning through flows of deferral and connection. It is the process of connecting figures to material, historical and cultural contexts in unexpected and creative ways which opens new worlds of thinking and being. For this reason, Donna Haraway (1997, p. 11) has referred to figures as "condensed maps of contestable worlds" embodying "universes of knowledge, power and practice," to which I would add ideology, culture and belief. Figures, for Haraway, are world-making, "worlding" forth new patterns of experience (see Haraway, 1988; 2004; 2016; Spivak, 1985). In this sense, figures represent more than themselves—they are representational without being mimetic.

By deferring the literal, figures dismiss any distinction between florid or poetic language and neutral or scientific language. As Lakoff and Johnson (1980, p. 3) argue, figurative language goes beyond embellishment or rhetorical flourish and functions as an intrinsic aspect of discourse itself, scientific or otherwise. For Haraway, it is this observation that gives figures a specific utility within critical studies of science and technology. Swerving from the literal contradicts models of scientific performativity that are predicated on the presumption of a "neutral" (that is, non-figurative) use of language. Figures decline objectivism in favour of culturally-situated rhetorical systems, a strategy that underscores the constitutive relation of culture to language and thus exposes the conceit, especially in science, of discourse which claims to be neutral, self-evident, or merely descriptive.

Figures are also propositional. If they can be said to be world-making then they can be used to make better worlds. Being representational without being mimetic means they have unique utility as speculative tools. Indeed, it is this aspect of figures that has made them attractive for feminist critique. To communicate the transformative and critical potential of figures, Haraway (1997, pp. 191-192) adopts bell hooks' concept of "yearning." For hooks, yearning is an expression of collective desire, part of the radical potential of postmodern critique. As she states,

> Yearning is the word that best describes a common psychological state shared by many of us, cutting across boundaries of race, class, gender and sexual practice. Specifically in relation to the post-modernist deconstruction of "master" narratives, the yearning that wells in the hearts and minds of those whom such narratives have silenced is the longing for critical voice.
>
> (hooks 1990, p. 29)

In this respect, figures can be understood as the materialisation of yearning—a proposition for an alternative narrative to live by. Figures should "incite our lust for barely possible worlds"—anti-racist, anti-colonial, pro-feminist worlds—and "serve as a base for solidarity and coalition" (hooks in Haraway 1997, p. 128).

This approach to figures as a feminist method is also supported by scholars such as Kember and Suchman. In her discussion of movements such as cyberfeminism, Kember (2003, p. 51) argues that cyberfeminists have the unique opportunity to intervene in critical moments in the (re)production of what counts as nature and what counts as culture within popular discussions of science and technology. There is a need to interrupt the circulation of damaging narratives and to take responsibility for what is figured and how. Similarly, Suchman (2012, p. 49) argues that considering technological objects as figures opens the possibility for reading alternate material-semiotic futures by which they can be reenacted and un/remade. Figuration, she argues, "[draws] our analytic attention to the ways in which technologies materialise cultural imaginaries, just as imaginaries narrate the significance of technical artefacts" (p. 48). It is in this sense that figures can be considered to be political and pragmatic, with implications for social action. While figures are the product of worlds, they also work to materialise them. The challenge of feminist technoscience is to reimagine and reassess: which technoscientific figures do we offer to the world? Which figures should we allow to world?

Figuration and the tracing of form

As a method, figuration can be understood as a means to account for the ways in which figures come to be. While figures may appear stable, they are only ever temporary stabilisations. It is their persistent reproduction over time that gives the impression of stability or of an essential character, but all figures have histories which demonstrate their changeability and all have the possibility of being figured differently.

One of the few authors to discuss the process and significance of figuration as a methodology is interdisciplinary scholar Claudia Castañeda. In her book *Figurations: Child, Bodies, Worlds* (2002), Castañeda uses figuration as a methodological tool to describe how the figure of the child appears across a range of cultural sites. She argues that the child is persistently figured as an entity in the making, conceptualised according to its *potentiality* rather than its *actuality* (p. 1). She states that it is in this "unique capacity, in its potentiality, that the child's availability—and so too its value as a cultural resource—lies" (p. 1). Using figuration as a methodology, she is able to demonstrate how the child is consistently figured as mutable and incomplete in different sites within historical and contemporary discourse—nineteenth- and twentieth-century writing in developmental cognitive science, policy and

reporting on transnational adoption and child-organ stealing, and in poststructuralist and feminist theory. Like Haraway, Castañeda also reads the significance of figures in their capacity for world-making. She argues that the strength of figuration is that it provides a means to produce accountability, "[making] it possible to describe in detail the process by which a concept or entity is given particular form—how it is figured—in ways that speak to the making of worlds" (p. 3).

By tracing the ways in which normative views of the child circulate and are embedded in different textual and social sites, Castañeda makes a case for the pervasiveness of figures across genre, media, time and space. Like Castañeda, my aim is also to demonstrate the persistence of figures across different domains in technoscientific culture. These domains are more than just backdrops against which figuration takes place, instead constituting the conditions and resources by which figures are produced and reproduced.

As a descriptive tool, figuration asks us to explicitly name social, cultural and material conditions. Tracing the form of figures as they manifest in and through semiotic-material space brings the contingencies which shape how we conceptualise objects, ideas, people and events to attention. This is significant, as figures are not only subject to these conditions but also have an agential quality, actively making worlds as they are made by them. In this way, figures compel us to consider the effects of dominant forms and practices; in Barad's (2007) words, "which practices we enact matter—in both senses of the word" (p. 91).

As a method, figuration stands against historically dominant approaches in science that seek to discover the universal or essential truth of phenomena. Where the scientific method is invested in ideals such as objectivity and replicability, figuration proposes an approach to the study of science and technology that expressly rejects the idea of objective or replicable accounts of phenomena. Figuration calls for an attentiveness to the intra-active encounters and narratives which materialise figures in particular ways and, importantly, places an emphasis on their non-essentiality and mutability (Barad, 2007; Suchman, 2012). This method undermines claims to describe objects "just as they are" or "without bias" and stresses the unique assemblage of semiotic-material relations in every instance of figuration. Of significance to this thesis are the ways in which gender intersects with the figuration process. In recognising that figures are not eternal, but situated and constituted through socio-material relations (such as gender), it is possible to conceptualise the connection between figures and their social milieu and to imagine alternate figurations of both.

Displacing linear representation

While figures are representational, because they represent more than themselves, figuration as a process questions the traditional representational relation. Figuration displaces a linear or temporal model of representation in which the original *precedes* the copy and instead proposes an alternate model in which it is the representation or the copy which *produces* the original. In his discussion of the etymology of the term "figural", Eric Auerbach (1984) traces it back to the Latin root *figura*. Mapping the movement of the term through the Hellenistic period and into the Middle Ages, Auerbach describes one of its earliest usages by the Epicurean poet Lucretius to refer to the "transition from the form to its imitation, from model to copy" (p. 16). He notes that in Christian theology the term is further used to describe ideas of prophecy and return:

> Figural prophecy implies the interpretation of one worldly event through another; the first signifies the second, the second fulfils the first. Both remain historical events; yet both, looked at in this way, have something provisional and incomplete about them; they point to one another and both point to something in the future something still to come, which will be the actual, real, and definitive event. This is true not only of Old Testament prefiguration, which points forward to the incarnation and the proclamation of the gospel, but also of these latter events, for they too are not the ultimate fulfilment, but themselves a promise of the end of time and the true kingdom of God.
>
> (p. 58)

Elaborating on Auerbach's definition, Lauren Bliss (2015) eloquently describes the figural system as "the *effect that produces the cause* rather than the cause that produces the effect…an inversion of the principle of aetiology where what is represented at once *produces and preserves* the original to which it refers" (pp. 12, 37, original italics). She illustrates using examples from the Christian texts: "The Fall of Adam prefigures the coming of Christ, and Christ fulfils the Fall of Adam. The Bible, in a Christian figural analysis, is the interpreter of itself under the all seeing eye of God. This is formed through the death and resurrection of Jesus Christ as the mystery of the 'Word made Flesh'" (p. 29). The figural structure thus displaces a causal or temporal link from one object, event, person or thing to another.

In her study on cinematic figuration, Bliss uses this principle of figuration to intervene into psychoanalytic film theory, arguing that it is possible to articulate a different relation of the body to cinema than that which dominates psychoanalytic film analysis by looking at films through the lens of figuration. By analysing films through figures such as the witch, the Virgin Mary, and the antipodean, Bliss illustrates how cinema reproduces the relation

between the lived body of the spectator and the fictitious body on the cinema screen in such a way that it appears immanent to the image itself. While this thesis does not engage with psychoanalytic readings of films or texts, I take Bliss' analysis of the figural as central to my own interpretation of figuration.

This understanding of the figural structure as representation, return,, and fulfilment that clarifies how boundaries, such as those between human/machine or man/woman, may appear as *the source* for representation when they are in fact *the effect*. Like Bliss, I argue that figuration produces—not through a linear, temporal relation, but through an enactment which gives the impression as if it always already was. Bliss describes this as "an at once 'concrete' reality that manifests itself as if it had already occurred" (p. 30). Figuration thus has an ideological function naturalising certain beliefs or actions as merely the natural state of affairs rather than one possible materialisation among many.

Figures-in-the-making in binary life

As discussed in the introduction, the phrase "figures-in-the-making" is a provocation in two parts. First, it challenges the idea of sanctioned sites of STS research. As part of his "first rule of method" for studying science, Latour (1988) famously states, "[w]e will enter facts and machines while they are in the making; we will carry with us no preconceptions of what constitutes knowledge; we will watch the closure of the black boxes and be careful to distinguish between two contradictory explanations of this closer, one uttered when it is finished, the other while it is being attempted" (pp. 13-14). The point of entry is always the laboratory—the place where scientists work. Latour criticises science studies scholars who do not follow this path and who engage only in discursive or semiotic analyses of scientific texts. I quote him here at length:

> For a layperson, studying science and technology would mean analysing the discourse of scientists, or counting citations, or doing various bibliometrics iconography, that is, extending literary criticism to technical literature. No matter how interesting and necessary these studies are, they are not sufficient if we want to follow scientists and engineers at work; after all, they do not draft, and read and write papers twenty-four hours a day. Scientists and engineers invariably argue that there is something behind the technical texts which is much more important that anything they write… Although it is a rare outcome, it is essential for us to visit the places where the papers are said to originate. This new step in our trip through technoscience is much more difficult, because, whilst the technical literature is accessible in libraries, archives, patent offices or corporate documentation centres, it is much less easy to sneak into the few places where the papers are written and to follow the construction of facts in

> their most intimate detail. We have no choice, however, if we want to apply our first rule of method: if the scientists we shadow go inside laboratories, then we too have to go there, no matter how difficult the journey.
>
> (p. 63)

Only by entering into the lab where science is made is it possible to observe science in action and thereby fully account for the array of actors and twists and turns of contingency that shape narratives of discovery. While this method has been instrumental in providing nuanced and detailed accounts of the work that constitutes science and in challenging the popularly understood claim that science produces knowledge impartially and apolitically, there is some dissonance when applied to the study of figures. If figures are iteratively constituted and enacted in every moment of discourse, then there is no single site of action or pre-final moment for critique. Latour's method assumes certain boundaries between making/made, before/after, in action/in finitude. If the laboratory, as Latour insists, is "the place where scientists *work*" (p. 64, original italics), then it is a much bigger, much more complicated and much more dispersed place than he had imagined.

Second, focusing on figures-in-the-making encourages the researcher to also consider other formations that are in-the-making while science is being made. In her critique of Latour, Haraway (1997, pp. 34 -45) takes issue with his dismissal of semiotic analysis and visual culture—tools used largely in feminist, postcolonial and multicultural oppositional theory. Science studies scholars too often overlook the racial formations, gendered formations, class formations, formations of sexuality, and formations of what counts as a fit or an able body. She argues that, perversely, the methodological mandate to go into the lab can often work to intensify the narratives of heroic scientific action this very method is designed to critique. She draws attention to the tropes of war that appear in Latour's own ethnographic narratives of science:

> The action in science-in-the-making is all trials and feats of strength, amassing of allies, forging of worlds in the strength and numbers of forced allies. All action is agonistic; the creative abstraction is both breathtaking and numbingly conventional. Trials of strength decide whether a representation holds or not. Period. To compete, one must either have a counter laboratory capable of winning in these high-stakes trials of force or give up dreams of making worlds.
>
> (p. 34)

These tropes become self-replicating as they are figured both by the analyst and the analysand. By undervaluing the role of semiotics and the skills required to examine them,

science-in-the-making overlooks other figures that are also in-the-making and, crucially, overlooks the pivotal relation between the semiotic and the material.

The study of AI and gender as intertwined figures-in-the-making comes at a critical time in binary life. The boundary between inside/outside of the lab is even more obscure than before. Naming AI as a figure asks us to consider the dynamic contingency of its figuration. What are the social, cultural and political conditions of its figuration? Which figures are circulated and which are not? How do they circulate? And with what effect? These questions become all the more urgent in the context of AI's growing role in public life. While AI has long circulated in the cultural imagination, it is only over the last few decades that AI systems and technologies have been deployed at a powerful scale and speed and in ways that profoundly affect the quality of life of individuals and communities.

Similarly, to name gender as a figure poses related questions about its conceptualisation as more than just an identity category. In the long tradition of feminist philosophy, figuration asks us to consider how gender has been made and re-made in relation to either nature or culture in different domains and at different t[16] It also alludes to gender's cultural figuration beyond biological markers of sex. In following Judith Butler's (1993/2011) description of gender's performativity, gender can be readily understood as a regulatory apparatus, something "constructed through relations of power, and specifically, normative constraints that not only produce but also regulate various bodily beings" (p. ix). In considering AI and gender's mutual figuration we can now ask: How might AI be one of those bodily beings? How might gender materialise and make intelligible non-human as well as human bodies? And how might the knowledge generated from these questions be used in service of those whose bodies are still subject to violence and governed by strict regulations of the terms of binary gender?

My approach continues work within STS that addresses scientific discourse outside of the traditional site of the lab. The term "imaginaries" is often used to describe these social and cultural sites. It is used to describe such diverse phenomena as globalisation (Appadurai, 1996), the nation (Anderson, 2006), Western modernity (Taylor, 2003), and social bodies and bodily difference (Gatens, 1995). Within social studies of science and technology, these terms have been applied to examine nuclear power (Jasanoff and Kim, 2009), genes and genetic technologies (Franklin, 2000; van Dijck, 1998), as well as the climate and climate change (Levy and Spicer, 2013; Neimanis et al, 2015; Yusoff and Gabrys, 2011). In these examples, the imaginary covers the sociocultural manifestations of objects of technoscience. For

[16] For example, see Evelyn Fox Keller's (1992) discussion of gender and the human genome project. Here, she discusses how projects such as the human genome project reconfigure the fixity of nature and recast culture as a rigid social category.

instance, in her discussion of the genetic imaginary, Sarah Franklin (2000) extends her analysis of the changing scientific discourse on genetics and genomic governmentality to examine popular films which incorporated this discourse. Looking at the 1993 blockbuster film *Jurassic Park* and its subsidiary products, such as toys and theme park rides, Franklin makes a point of stressing the significance of the imaginary for our understanding of how popular knowledge circulates and how public perceptions are formed around what she calls narratives of "life itself." Similarly, Neimanis et al (2015) have analysed artworks and abstract performances that respond to climate change as expressions of what they call the "climate imaginary" (p. 480). Present within climate imaginaries, they argue, is the desire to intervene into value regimes and redirect the public orientation towards climate change. As such, the imaginary forms a vital part of governance. It provides "normative and speculative visions for alternatives to the status quo" which are otherwise excluded from discourse on climate policy (p. 480).

While these studies themselves are exceptional and have significantly contributed to the case study selection of this thesis, the framework of the imaginary still tacitly reproduces a distinction between the study of "real" scientific practice and "imaginative" socio-cultural narratives of science. Figures-in-the-making is an attempt to collapse this distinction and challenge the hierarchy that exists between legitimate and illegitimate methods for studying science and technology. Figuration is a process that is not only conducted by scientists and technologists, but by an innumerable number of actors working across different cultural domains, from commercial organisations to Hollywood sceenwriters to people in their everyday lives. This conceptualisation also, necessarily, constructs the researcher or analyst as implicated within the practices and discourse in which they critique. It puts researchers "at risk" with the subjects and objects of their research. The following chapters are designed as illustrative case studies of AI and gender as figures-in-the-making. They offer readings of the different kinds of co-constitutive relations that are taking place in binary life and model a framework for new inquiries in feminist technoscience.

Chapter four

Imitating Alan Turing

In June 2012, on the 100th anniversary of Alan Turing's birthday, Google featured on its homepage an animated, interactive "doodle" composed of a key written in binary code, a scrolling role of tape, and an abstract set of instructions to match the numbers on the tape to the key.[17] A simulation of Turing's hypothetical a-machine (today known as the Turing Machine), the Google doodle was designed to showcase the life and work of one of AI's most celebrated intellectual figures (see Fig. 1). The doodle neatly captures many of Turing's key traits: his strengths in computational logic, his gift for code-breaking, and his love of games and play. But it also inadvertently functions as an effective cipher for decoding the role of Alan Turing in shaping contemporary figurations of AI and gender.

By its nature, the doodle is a representation: Google's interpretation of an icon significant to the history of modern computing. But unlike many Google doodles, this image represents an artefact that never actually existed. Proposed by Turing in a paper published in 1936, the original Turing Machine was a hypothetical device to help explain the unprovability of a complex mathematical problem—the *Entscheidungsproblem* (Turing, 1936). While Turing described the machine in writing, he made no efforts to sketch or visually depict the device in his paper. Consequently, the designers of the Google doodle were left with the challenge of translating this abstract conceptual model into something visual, literal and functioning. It was an unsurprisingly difficult process that required a great deal of experimentation and testing before the doodlers could find a reasonable working solution, a frustration documented in their explanation of the design:

> Much of it is abstract and hard to show, so we went through a lot of designs before finding one that seemed workable. Turing Machines are theoretical objects in formal logic, not physical things, so we had to walk a fine line between technical accuracy and accessibility. We struggled especially to find a good representation for programs, and

[17] The historical and textual data for this chapter are drawn from Andrew Hodges' detailed biography *Alan Turing: The Enigma* (2012) and website (https://www.turing.org.uk/book/); Elizabeth A. Wilson's *Affect and Artificial Intelligence* (2010); and The Turing Digital Archive, an online collection that contains nearly 3,000 images of letters, photographs, newspaper articles, and unpublished papers by or about Alan Turing. The images from the archive were scanned from the collection of Turing papers held in the Archive Centre at King's College, Cambridge (http://www.turingarchive.org/). The citations in this chapter reflect the archive coding "AMT."

> to choose puzzles of appropriate complexity; we did a lot of user testing and iteration, more than for any past doodle.[18]

The struggle to give form to a phenomenon composed only in the abstract is precisely the predicament that Turing himself introduced into dominant figurations of AI in scientific discourse. In this chapter, I return to what Hayles has called AI's "primal scene" to examine the role of gender—or rather, its erasure—in early figurations of machine intelligence. Drawing on key publications by Turing, digital materials from the Turing archive, and biographical material on Turing's life, I analyse Alan Turing and the Turing test as a significant site in the negotiation, and subsequent occlusion, of gender in dominant figurations of AI. It is my contention that Turing's approach to machine intelligence set a precedent in which questions of embodiment, gender, and difference are sidelined in order to articulate a vision of intelligence modelled on universalist principles. His attempts to separate the "intellectual" from the "physical," both in his conceptualisation of intelligent machinery and in his own life, was an artificial distinction that would ultimately prove untenable—a conceptual failure that for Turing resulted in personal catastrophe. The difficulties of negotiating gender and difference in a field that fetishises universal knowledge is a legacy that continues to haunt AI today. While contemporary feminist writers have subsequently found radical potential in their recuperative readings of the Turing test, I argue that such potential can only be observed retrospectively. Rigid interpretations of both gender and intelligence during the period of Turing's life meant that many of these arguments were literally unimaginable at that time. Much like the designers of the Google doodle, then, grappling with a legacy of abstraction is a part of the process of negotiating renewed figurations of AI within contemporary contexts.

Alan Turing: The Icon

Alan Turing occupies a canonical role in the history of AI. Trained as a mathematician, logician, cryptanalyst, and theoretical biologist, he is celebrated within the scientific community for his contributions to the development of early electronic computing, his theoretical inquiries into the nature of machine intelligence, and for his work during the Second World War as a codebreaker for the British Government Code and Cypher School (GC&CS). He is also one of the very few AI researchers to receive mainstream recognition. His life and work have been the subject of critically acclaimed biographies and his story has been adapted into a Broadway production, television docudrama, as well as a Hollywood

[18] An archived copy of the Google doodle with notes from the designers is available at https://www.google.com/doodles/alan-turings-100th-birthday

feature film.[19] His name is now synonymous with intellectual prestige and adorns a number of university labs, buildings, auditoriums, amphitheatres, walkways and other architectural sites as a testament to the contemporary value of Turing's name as a signifier of scientific excellence.

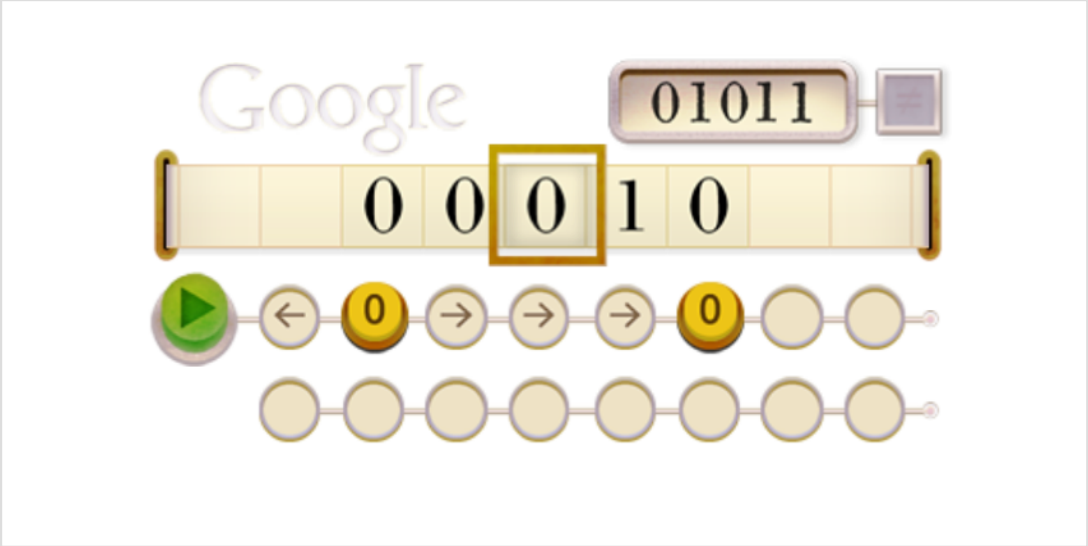

Fig. 1. *Alan Turing Anniversary Google doodle*. Screenshot by author. Source: https://www.google.com/doodles/alan-turings-100th-birthday

In addition to this legacy, Turing is now also remembered as a gay icon who lived and died under discriminatory legislation against homosexuality and homosexual acts. His conviction for "gross indecency" and forced acceptance of hormone therapy (also known as chemical castration) serve as a grim reminder of the inhumane and degrading treatment of thousands of homosexual men by the state. In many accounts of his life, however, his mistreatment is often written as merely coincidental to his scientific contributions. His Royal pardon in August 2014 was criticised as both 60 years too late and also a token gesture given the same affordance was not granted to some 50,000 other men also punished under the same conviction (BBC News, 2013).

However, the secretive nature of his wartime employment coupled with the shame associated with his conviction and subsequent suicide meant that many of his accomplishments could not be acknowledged until well after his death. It was not until the 1970s when restrictions surrounding the Official Secrets Act were loosened that Turing was openly affiliated with significant government projects, such as the Bombe (devices used to crack the German Enigma code) and the Colossus computer (Britain's first programmable

[19] For the biography see *Alan Turing: The Enigma* (2012) by Andrew Hodges. The broadway production, *Breaking the Code* (1986) by High Whitemore. Television docudrama see *Codebreaker* (2011). And for the feature film see *The Imitation Game* (2014) directed by Morten Tyldum.

electronic digital computer)[20]. Andrew Hodges (2012, pp. 533-535) has suggested that it was the confluence of a number of cultural currents, specifically the "coming of age" of computers and the brief renaissance of American liberalism reframing perspectives on the persecution of homosexuals, that helped create sympathetic ground for the public to appreciate narratives like Turing's. It is, then, with the benefit of a great deal of hindsight that a fuller picture of his life and contributions to modern computing can be really acknowledged.

Turing's publication record shows that he had been thinking both theoretically and practically about designing machines for computation from as early as the mid-1930s. During the Second World War, he was given the opportunity to put these ideas into practice, working with a team of engineers and cryptanalysts in the Hut 8 division of the GC&CS to crack the German naval encryption code Enigma.[21] After the war, he was employed at the National Physical Laboratory (NPL) working on the design for what is arguably the first stored-program computer, the Automatic Computing Machine (ACE), conspicuously leaving this position only three years later. In her examination of Turing's archive, Elizabeth Wilson (2010) has found key clues shedding light on his departure. In letters to the neurologist and cybernetician, W. Ross Ashby, Turing writes: "In working on the ACE I am more interested in the possibility of producing models of the action of the brain than in the practical applications of computing" (cited in Wilson, 2010, p. 32). Turing's antipathy to the "practical" and his interest instead in the philosophical questions of computing were supported by letters from the lab's director, Sir Charles Darwin:

> He wants to extend his work on the machine still further toward the biological side. I can best describe it by saying that hitherto the machine has been planned for work equivalent to that of the lower parts of the brain, and he wants to see how much a machine can do for the higher ones; for example, could a machine be made that could learn by experience? This will be theoretical work, and *better done away from here.*
>
> (cited in Wilson, 2010, p. 33, original italics)

Evidently, Turing concurred with this recommendation, leaving the NPL for a short sabbatical at King's College, Cambridge before taking a position in the Mathematics department at the University of Manchester. It was at this time that these early strands in his

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[20] Some papers written by Turing during his employment at the Government Code and Cypher School (GC&CS) were not released by the government until as late as 2012. See Vallance, C. (2012, April 19). GCHQ releases WWII Turing papers. BBC News. Retrieved from https://www.bbc.com/news/technology-17771962

[21] Despite popular belief, Turing did not himself 'crack' the Enigma code. This was done so by Polish cryptanalysts years earlier using their own decoding machine the 'Bomba Kryptologiczna' (Cryptological Bombe). However, Turing with the help of the Hut 8 team, notably Gordon Welchman, did develop an improved version that could more efficiently decode Enigma in reasonable time and under the constraint of regularly changing plugboards, which had proved a complication for the Polish (see Hodges 2012, pp. 175-277)

career—his predisposition toward logical problem-solving, his strong interest in exploring the potentials of electronic digital computing, and his philosophical interrogations of intelligent machinery—would come together to inform his most famous contribution to AI: the Turing test.

Can machines think?

The Turing test is commonly characterised as the first formal benchmark for evaluating intelligence in a machine. In his summary of the test, Stefan Helmreich (1998) writes:

> The 'Turing test' consisted of an imitation game in which an interrogator communicated simultaneously with a computer and a person over teletype. The interrogator was allowed to ask any range of questions he or she liked, all in an effort to see if the computer could respond in such a way as to be indistinguishable from a person. If the computer passed as a person, it could be considered intelligent.
>
> (p. 246)

This classic description of the test is the most commonly accepted version both in and outside of the AI field. It is this interpretation that has gained public notoriety, in large part thanks to high-profile events such as the Loebner Prize, an annual AI competition that offers a $100,000 award to any program that can, under the conditions of the Turing test, convince a panel of judges that it is a human.[22] But, as Helmreich himself points out, this interpretation omits key aspects of the original experiment that foreground the primary role of gender. If we return to the essay in which the test was first introduced, Turing's 1950 article "Computing Machinery and Intelligence," it is clear that gender and sexual difference constitute the original framework from which human-machine difference is then correlated.

The paper begins by asking "Can machines think?" Rather than answer directly, Turing instead proposes an experiment that explicitly uses as its analogue the assumed difference between men and women. Its design is based on a nineteenth century parlour game called "the imitation game", the rules of which Turing explains as follows:

> It is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of

[22] The Loebner prize has been running since 1991, with a small prize (currently $4,000) awarded each year to the most "human-like" AI. The grand prize of $100,000 is reserved for a program that can engage in convincing conversation for over 25 minutes and decipher and understand text, visual, and auditory input.

> the game he says either 'X is A and Y is B' or 'X is B and Y is A'. The interrogator is allowed to put questions to A and B thus:
>
> C: Will X please tell me the length of his or her hair?
>
> Now suppose X is actually A, then A must answer. It is A's object in the game to try and cause C to make the wrong identification. His answer might therefore be "My hair is shingled, and the longest strands are about nine inches long"… The object of the game for the third player (B) is to help the interrogator.
>
> (Turing, 1950, pp. 433-434)

Turing suggests that players communicate using typewritten text so that "tones of voice" and other bodily clues can be concealed from the interrogator. With these rules in mind, he poses a new question:

> What will happen when a machine takes the part of A in this game? Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman? These questions replace our original "Can machines think?"
>
> (p. 434)

The advantage of this strategy, he argues, is that it "draw[s] a fairly sharp line between the physical and the intellectual capacities of a man" (p. 434). As this statement suggests, for Turing the mechanical reproduction of "mind" is a wholly different project to the mechanical reproduction of "body." This position not only instantiates a dualistic approach to the question of intelligence, but also sets an agenda for AI research that separates it from the bodily concerns of parallel fields such as automata studies and cybernetics—fields more closely aligned with engineering and biology respectively. The distinction between the intellectual and the physical would be a recurring theme for Turing, both in his theoretical work and in his life (as this chapter will later discuss). In a BBC lecture given a year later, he again reiterates this position, making clear what the priority should be for creating intelligent machinery:

> I certainly hope and believe that no great efforts will be put into making machines with the most distinctly human, but non-intellectual characteristics, such as the shape of the body. It appears to me to be quite futile to make such attempts and their results

> would have something like the unpleasant quality of artificial flowers. Attempts to produce a thinking machine seem to me to be in a different category.[23]

What is the effect of this categorisation, in which mind is placed in a different class to body and thinking is reduced to the mimicry of planned linear procedures? One key issue is that, in the leap from imitation game to Turing test, the body (and accordingly gender) is bracketed out as a central concern in figurations of machine intelligence.

From imitation game to Turing test

In critiques of the Turing test and its legacy, feminist scholars have rightly argued that the effacement of embodied thinking is symptomatic of Turing's own classical approach to metaphysics and reason. In his exemplary critique, Paul Edwards (1996) has argued that the Turing test establishes a metaphorical structure that connects minds with computers. This structure reduces complex functions such as thinking and communication to simplified processes, such as information processing and symbol manipulation. He states:

> Turing did not require that the computer imitate a human voice or mimic facial expressions, gestures, theatrical displays, laughter, or any of the thousands of other ways humans communicate. What might be called intelligence of the body—dance, reflex, perception, the manipulation of objects in space as people solve problems, and so on—drops from view as irrelevant…The Turing test makes the linguistic capacities of the computer stand for the entire range of human thought and behaviour…[it] represent[s], in a sense, pure subjectivity, abstracted from the physical, experiential, and cultural contexts in which human relations with objects and others ordinarily take place.
>
> (p. 159)

Edwards draws parallels between Turing's dualism and that of Descartes. He argues that where the Cartesian concept of mind was structured on a "mind-as-mathematics" metaphor —in which mathematical proof provided the universal basis for understanding decision making and experience—Turing's concept of mind was structured on a "mind-as-computer" metaphor that similarly reduced the vast functions of thought to set programs and symbolic instructions. This model not only oversimplifies the complex and embodied processes that constitute actions like thinking or communication,[24] but tacitly reproduces the thinking

[23] AMT DB5. 'Can digital computers think?'. TS with AMS annotations of a talk broadcast on BBC Third Programme, 15 May 1951. http://www.turingarchive.org/viewer/?id=459&title=8

[24] See Peters (1999) and Suchman (2007b) for detailed studies of the history and complexity of theorising communication between humans and machines.

subject on historically gendered grounds. As Edwards contends, within the Western intellectual tradition, the ideal traits of rationality (linear logical progression, precise technical skill, being unswayed by emotion) are often conflated with the ideal traits of masculinity such that the rational subject is itself defined *ipso facto* in relation to the masculine subject. In this context, the Turing test is exemplary of the ways in which gendered forms of power and subjectivity are embedded within seemingly banal conceptual metaphors, an observation that allows Edwards to demonstrate the broader political dimensions of language and discourse.

Like Edwards, N. Katherine Hayles (1999) examines the Turing test as an extension of ideals developed in Enlightenment philosophy. For Hayles (1999), the real imitation of the test is in the way that it reproduces the pitfalls of liberal humanism:

> Identified with the rational mind, the liberal subject *possessed* a body but was not usually represented as *being* a body. Only because the body is not identified with the self is it possible to claim for the liberal subject its notorious universality, a claim that depends on erasing markers of bodily difference, including sex, race, and ethnicity.
>
> (pp. 4-5)

She argues that it is this deep-seated belief in the disembodied nature of the subject that allows for outlandish claims within computational culture, such as the ability to upload human consciousness onto a machine. The Turing test thus constitutes one key moment in a much longer story. But its significance lies also in the way that it reveals how gender can become an easily discarded conceptual framework.

Within AI discourse, gender is often understood as a contingent characteristic of the body. Gender is just one physical variable among many others. If the body can be thought of as a container for the thinking subject, as Hayles argues that it so often is, then gender is part of what personalises and augments it, changing how it may look and how it may function but otherwise not significantly affecting the contents within. When conceptual tests (such as the Turing test) then enact forms of bodily erasure by literally hiding the body away and presenting only the informational pattern that it produces, gender too is subject to erasure.

Despite forming the foundation upon which human-machine difference is theorised, the ease with which gender is discarded in mainstream interpretations of the Turing test speaks to the ongoing classification of gender as a superficial or negligible phenomenon, as well as to the poor status of (socially, politically and culturally) situated modes of being. Although the Turing test, and the disembodiment that it represents, has been heavily critiqued by researchers across the disciplines, it has proven itself to be a powerful master narrative that continues to influence AI figurations today. As Hayles (1999, p. xi) states "The Turing test was

to set the agenda for Artificial Intelligence for the next three decades. In the push to achieve machines that can think, researchers performed again and again the erasure of embodiment at the heart of the Turing test."

The arguments put forward by Edwards and Hayles can be situated within a long tradition of feminist scholarship that critiques the low status of the body and embodiment in Western abstract theory. In *Feminist Theory and the Body* (1999) Janet Price and Margit Shildrik summarise the main objections as follows:

> The status of the body within the dominant Western intellectual tradition has largely been one of absence or dismissal. Despite the necessary ubiquity of the body, and its apparent position as the secure grounding of all thought, the processes of theorising and theory itself have proceeded as though the body itself is of no account, and that the thinking subject is in effect disembodied, able to operate in terms of pure mind alone… At the risk of misleading simplification, it can be argued that the denial of corporeality and the corresponding elevation of mind or spirit marks a transhistorical desire to access the pure Intelligible as the highest form of being.
>
> (pp. 1-2)

As feminist theorists have long argued, the hierarchy between body and mind resonates with hierarchies of gender (see Grosz 1994; Irigaray 1985). In the reproduction of the mind/body split, the feminine is consistently associated with the more devalued term. Philosophers such as Elizabeth Spelman (1999) have traced the pre-Cartesian antecedents of this relation, making the connection between dismissive attitudes towards the body and dismissive attitudes towards women.

In her reading of Plato, Spelman (1999) contends that his philosophy can be characterised as both psychophilic and somatophobic. In a crude summary of his position, she states: "Our bodies are not essential to our identity; in their most benign aspect, our bodies are incidental appendages; in their most malignant aspect, they are obstacles to the smooth functioning of our souls" (p. 39). It is only through the soul that virtuousness, knowledge and goodness can be achieved, but it is the body "with its deceptive senses" that "tempts us away from the virtuous life" (p. 34). She analyses Plato's derision of the body and bodily desire and his consistent use of women and women's lives to illustrate the behaviours that he sees as corrupting the virtuous soul:

> To have more concern for your body than your soul is to act just like a woman; hence, the most popular penalty for a soldier who surrenders to save his body, when he

> should be willing to die out of the courage of his soul, is for the soldier to be turned into a woman.
>
> (p. 37)

As Spelman further explains, Plato argues that souls go through many different life forms, and unless a man lived righteously he would, in his next incarnation, "pass into a woman."

Again, the fetishisation of the pure and virtuous soul that is free from the distractions of the body maps neatly onto the structure of the Turing test and reflects Turing's own views on the recreation of physical and bodily characteristics as pointless and excessive. In this way, the Turing test aligns the science of AI with an intellectual tradition that has historically framed gender and the gendered body as a constitutive other. I would like to stress here that it is not that gender is simply not present—as the above reading of "Computing Machinery and Intelligence" demonstrates—but that *gender is erased*. This erasure is symptomatic of the desire to see intelligence and identity in terms of a purely informational pattern, one which can be enacted equally by both a human and a machine. In order to do this, however, gender and the body must first be proven to be redundant.

In the context of the Turing test, this erasure manifests in a denial of the significance of gender to the structure of the test. For instance, Hodges (2012) describes gender as "a red herring" in Turing's paper. He states "The whole point of this game was that successful imitation of a woman's responses by a man would *not* prove anything. Gender depended on facts which were *not* reducible to sequences of symbols. In contrast he wished to argue that such an imitation principle did apply to 'thinking' or 'intelligence'" (p. 415, original italics). Here, Hodges discredits the role of gender on the grounds that gender (unlike intelligence) cannot be separated from the body (a contention that I discuss in more detail later in this chapter). In other examples, gender is dismissed on more misogynistic grounds. For example, mathematician and Research Director at the French National Centre for Scientific Research (CNRS), Giussepe Longo (2018) argues that the gendered structure of the Turing test is flawed because one cannot pretend to be both a woman and a thinking subject:

> I must admit that I am not particularly interested in the psychological considerations that you adduce to convince the reader of the plausibility of the game of imitation and the possibility of tricking the reader: you do not go much beyond banalities such as 'Do you have long hair? Can you write a poem?'...'Add 34957 to 70764' (pause about 30 seconds and then give an answer) '105621'. That's wrong: the machine has to imitate a woman and, as we well know, women, in mathematics…
>
> (p. 7, ellipsis in the original text)

Longo's contempt for women in mathematics presumably extends to women and their position in intellectual life more broadly. This attitude illustrates the kind of sexism that can, and has, proliferated in an intellectual tradition that lays claim to a false universal subjecthood for intelligence. That women are marked by gender in ways that men are not becomes a convenient excuse to justify their exclusion. The derision of the body here easily extends to a derision of gender and ultimately women. As Wilson (1996)has succinctly argued, "Turing's test presents cognition not as a neutral term in a politically and historically innocent philosophy, but as a the privileged term in a philosophy that names the (female) body inferior and non-psychological" (p. 586). Insofar as it draws on this problematic philosophy, the Turing test instantiates an understanding of AI that is figured on gender's erasure.

On being "discrete"

The dualistic themes apparent in the Turing test also figure in broader aspects of Turing's work, his life, as well as his legacy. In particular, discrete separation is a persistent frame that also functions to describe the trajectory (and eventual failure) of gender's erasure within early AI figurations in scientific discourse. Returning to "Computing Machinery and Intelligence," this manifests in the language used by Turing to describe the type of machine he imagines can participate in the imitation game: digital computers. He describes a digital computer using the analogy of an automated human computer:

> The human computer is supposed to be following fixed rules; he has no authority to deviate from them in any detail. We may suppose that these rules are supplied in a book, which is altered whenever he is put on to a new job. He has also an unlimited supply of paper on which he does his calculations.
>
> (Turing, 1950, p. 436)

If given the appropriate rules and instructions, a digital computer can "mimic the actions of a human computer very closely" (p. 438). This kind of digital computer Turing referred to as a "discrete state machine"—"machines which move by sudden jumps or clicks from one quite definite state to another. These states are sufficiently different for the possibility of confusion between them to be ignored" (p. 439). Digital computers can be considered as discrete state machines because the rules provided describe specific, definite states which the machine must occupy in order to function. These specific instructions prompt the machine to occupy a different state that is distinct from the last. Unlike a light switch which has only two states—on or off—a digital computer is capable of a very large number of states. The Manchester machine (one of the earliest stored-program computers), for instance, is capable of occupying 2^165,000 states.

The unique property of digital computers is that they can be programmed to mimic any discrete state machine. The strength in this, Turing says, is that one need not design a new machine to do various computing processes. This kind of machine he calls a *universal* machine. It is one that can occupy any number of discrete states, and it is this kind of machine that he imagines as succeeding in the imitation game.

The subtle shift from "discrete state" to "universal" to describe digital computing here implicitly reflects certain normative views of gender. Gender is itself also said to be discrete: one is *either* a man or a woman. By claiming that one type can universally occupy either state, Turing flattens sexual difference, and in doing so, suggests the possibility of a universal subject. It is, arguably, no coincidence that key principles of digital computing described by Turing also reflect key principles of gender. As this thesis contends, gender forms a fundamental aspect of how AI is figured and, as this example illustrates, this includes instances of difference and erasure. As with the universal subject, the subject modelled by Turing in the Turing test also represent a false universalism. When read carefully, the terms of the original imitation game state that is it only the male player who can play the role of the deceiver, only he is able to occupy different states. The female player on the other hand is always restricted to her definite state, always in the position to earnestly prove her identity to the interrogator. Despite claims of transcendent subjecthood free from the constraints of the gendered body, in practice it is the male subject who becomes the standard for universality, and universalism is written in his image.

The logic of "discrete states" also figures prominently in interpretations of Turing's life. Hodges (2012) has compellingly argued that the discrete state machine reflects Turing's approach to work and relationships. As a mathematician, Turing was concerned with the symbolic world. The tradition of formalist mathematics, which informed his approach, treated all problems as if they were a puzzle. Hermetically sealed, they did not ask for connection to the world but rather sought to build worlds within themselves. His fascination with the symbolic and abstract naturally led him to excel in cryptanalysis. This was a profession that was both qualitatively and structurally identical to formalist mathematics.

Working for the government decoding top secret messages required both discretion and discreteness. At Bletchley Park, he was hidden away in a remote location outside of London safe from the physical conflict taking place on further shores. For Turing, the war was like a game of chess in which he controlled the pieces but never suffered the effects of a loss. Hodges contends that "to portray cryptanalysis as a purely symbolic activity was very much a Hut 8 view of the war, sheltered from the politics and military activity, trying to work in a self-contained way without interference from the outside" (2012, p. 422). He argues that the model of the mind proposed in the Turing test mimicked Turing's work as the "Brain of

Britain" during WWII. Turing brushed aside questions associated with a physically embodied mind connected to the social and political world, choosing instead to treat the problem of intelligence as a question of logical problem solving. As Hodges incisively states "the discrete state machine, communicating by teleprinter alone, was like an ideal for his own life, in which he would be left alone in a room of his own, to deal with the outside world solely by rational argument" (p. 425).

The secretive nature of the work itself also explicitly called for discretion to ensure military-grade security. Codebreakers were bound by the Official Secrets Act which prevented them from sharing knowledge about their work with colleagues or loved ones. For Turing this meant a formal mandate to separate his professional work from his personal life. It was not until the 1970s when security protocols on WWII information was loosened could the labour of those at Bletchley Park be publicly acknowledged and the discrepancies between public and private record reconciled.

Fig. 2. *Alan Turing in the 1930s*. Retrieved: https://commons.wikimedia.org/wiki/File:Alan_Turing_portr%C3%A9.jpg

But, as his life illustrates, this ideal could not be maintained. Although he believed that life could be organised into simple, discrete states, no separation was ever tenable. In January of 1952, Turing arrived home to find his house had been burgled. He had earlier that month begun a relationship with a younger man named Arnold Murray. Murray confessed to knowing the culprit and with this information Turing filed a report to the police. Over the course of the investigation, Turing's sexual relationship with Murray was revealed and both he and Murray were subsequently charged with "gross indecency." To this he pleaded guilty and

was given the choice between imprisonment or probation with "organo-therapic treatment"—injections of synthetic oestrogen administered over the course of a year designed to decrease his libido, and more specifically, curtail what was perceived as the "homosexual drive" (Hodges, 2012, p. 469). He chose the latter.

Alongside the many consequences of his so-called "treatment", impotency and gynecomastia (enlargement of breast tissue in men) being the most extreme, Turing also lost access to Bletchley Park and his cryptanalytic work. Overcome with paranoia over Soviet espionage, American authorities had only two years earlier issued a Senate subcommittee to enquire into "the extent of the employment of homosexuals and other sex perverts in Government" (cited in Hodges, 2012, p. 497). They concluded that homosexuals were unfit for such positions under the flimsy excuse that

> The lack of emotional stability which is found in most sex perverts and the weakness of their moral fibre, makes them susceptible to the blandishments of the foreign espionage agent…Furthermore, most perverts tend to congregate at the same restaurants, night clubs and bars…It is an accepted fact among intelligence agencies that espionage organisations the world over consider sex perverts who are in possession of or have access to confidential material to be prime targets where pressure can be exerted. In virtually every case despite protestations by the perverts that they would never succumb to blackmail, invariably they express considerable concern over the fact their condition might become known to their friends, associated, or the public at large.
>
> (cited in Hodges, 2012, p. 498)

The GC&CS complied with this edict under the weight of foreign policy and Turing was denied security clearance. The irony, however, is that Turing himself would not have been vulnerable to blackmail under these circumstances because he had never hidden his sexuality. Indeed, colleagues at Bletchley Park have noted that Turing was not the only gay man employed. In an interview, Donald Mitchie recalls that "Bletchley had some flamboyant homosexuals" (Lee and Holtzman, 1995, p. 38), while Shaun Wylie noted that during his trial, Turing had carried his legal documents in a folder facetiously labelled "Burglary and Buggery" (Wilson, 2010, p. 37). His great insouciance during the trial is indicative of a general openness towards his body's intrinsic desires. Indeed, he voluntarily admitted his relationship with Murray to police in reporting the burglary, so confident he was with his sexual identity.

The ideal of "discrete states"—that figured his approach to life and work—ultimately failed Turing. He could not live in discrete states. His professional life could not be separated

from his personal. Discretion was a privilege that quickly faded away following his conviction and he soon found that there could be no separation between professional and political, sexuality and trustworthiness, or intellectual work and physical pleasure. Even his own body, which had become slowly feminised as a result of treatment, demonstrated that the assumed discreteness between sexual difference was also subject to change.

Figuring otherwise

Despite its apparent fixity, the Cartesian framework of mind/body dualism requires constant policing. Wilson (1996) points to the great instability of its dualistic formulation: "We must remember that the cleavage between mind and body is not a singular act…Rather it is a division that always threatens to collapse, or to expose its internal machinations, and must therefore be continuously drawn and redrawn" (p. 583). She argues that this instability presents itself through ongoing acts of disavowal and erasure. This "constitutive paradox" reveals the great shortcomings of the supposedly disembodied thinking subject—that contrary to its claim to a pure and transcendent autonomy from the physical world it holds "an irreducible and perpetual debt to the body" (p. 583). Revisiting the Turing test more than half a century later, its fragility seems almost obvious. Developments in AI research areas such as situated robots, ALife, and affective computing have for decades challenged the idea that intelligence can be modelled independently of context. Alternative models to the liberal humanist subject have since emerged figured on principles such as sociability, nurture and learning, and collective intelligence. Figures like the primate, the child, and the swarm/colony now proliferate within scientific discourse (see Castañeda & Suchman, 2014; Warwick 2012).

Adding to this, the gendered model imitated by the Turing test no longer conforms to contemporary discourses on gender. The Turing test was, in many ways, a product of its time: it was informed by dominant theories such as behaviourism, a psychological approach to behaviour focused on effect and output rather than internal mechanisms; as well as cybernetics, a science and philosophy that explicitly overlooked difference in order to conceptualise humans, animals, and machines as essentially information processing entities. Significantly, it also mimicked prevailing ideals regarding the nature of gender. The Turing test divides players along a binary logic of difference, a division that is today questioned at a social, cultural and biological level (see Butler 1990; Fine 2011; Schiebinger 1989). This line of difference was aggressively policed in Britain during the immediate post-war period. Those who were perceived as transgressing the clear expectations of sexuality and gender were subject to state punishment as police in London and other major cities were directed to "crackdown on moral laxity" (Hicks, 2017, p. 60). Turing himself would be caught in this

sudden change in expectations as homosexuality came to be defined as outside the bounds of appropriate gendered citizenship (Hicks, 2017; Hornsey, 2010).

Under closer scrutiny, it is also possible to trace a more nuanced connection between the treatment of women at places such as Bletchley Park and the treatment of gender in the Turing test. In her research on Britain's early computer industry, historian Mar Hicks (2017) has argued that despite performing the majority of information gathering and processing labour, women have been systematically excluded from wartime narratives of computing. Historical accounts have instead favoured stories of singular "great men" who persevered with thanks to their individual genius—Turing's story constituting one significant example. She describes how the efforts of this highly feminised workforce have been largely overlooked, firstly due to the secrecy surrounding wartime codebreaking operations, which meant that many women were never in their lifetime able to discuss their work publicly or privately, and secondly because of the assumed inferiority of women's labour itself. Hicks (2017) states,

> Conceived of as a passive support role to the 'real' work of codebreaking, rather than an integral part of the codebreaking itself, women operators paradoxically found themselves and their work undervalued in histories that were being rewritten to privilege the role of the computers they ran. The lower esteem in which women's labour had long been held results not only in unequal opportunities and pay, but also in the perception that the work being done by women was somehow implicitly lower in skill and importance.
>
> (p. 42)

Hicks goes on to discuss how the feminisation of early computational labour was itself shaped by the "discursive conviction of women's inferiority" (p. 42), such that despite receiving high level training, many British women did not continue in their promising IT careers after the war, resulting in the loss of an entire class of highly-skilled information workers. As in the Turing test, despite performing materially similar (and in some cases identical) duties to their male counterparts, women's gendered bodies were erased from this essential AI narrative.

Gendered ideals have shifted and changed significantly since the time of Turing's writing. That the feminised nature of certain forms of labour renders it immediately inferior is an assumption that has (rightly) been debunked. The acknowledgement of a diversity of lives and possibilities beyond discrete, binary gender has also opened possibilities for reading events like the Turing test differently. Writing retrospectively, many queer and feminist writers have found radical potential in the test. Jack Halberstam (1991), for instance, reads the Turing test as a site that questions the biological determinism of gender. In it, he finds the seed of a

postmodern gender theory that at its heart suggests that gender, far from being a pure fact of nature, is rather a cultural learned, imitative system. He writes,

> Gender, we might argue, like computer intelligence, is a learned, imitative behaviour that can be processed so well that it comes to look natural. Indeed, the work of culture in the former and of science in the latter is perhaps to transform the artificial into a function so smooth that it seems organic. In other words, gender, like intelligence, has a technology
>
> (p. 443)

For Halberstam, the technologisation of gender brings it closer to the realm of the artificial, challenging any supposedly "natural" assumptions about gender and desire, sex and gender, and the body and technology. Turing's body was itself a testament to the power of technological intervention—in this case, hormone injections—to transform gender. Though it physically altered his body, the "treatment" itself ultimately failed to reform his sexuality. In a letter to colleague Norman Routledge, Turing wrote with humour of the increased surveillance of his activities by police:

> I have a delightful story to tell you of my adventurous life when next we meet. I've had another round with the gendarmes, and it's positively round II to Turing. Half the police of N. England (by one report) were out searching for a supposed boy friend of mine. It was all a mare's nest: Perfect virtue and chastity had governed all our proceedings. But the poor sweeties never knew this.[25]

Despite this, he still defiantly travelled to Europe post-conviction to attend dances he heard were "for men only" (Hodges, 2012, p. 477).

Judith Genova has similarly examined Turing and the Turing test through a deconstructionist lens to find queer and feminist possibility. She takes issue with interpretations that erase gender from the terms of the test, arguing that Turing intentionally wanted the imitation game to include gendered mimicry. By suggesting that intelligence be measured through one's ability to perform gender, Genova makes the case for a model of intelligence that explicitly moves against traditional forms of knowing predicated on disembodied, rational subjectivity. She states,

> Instead of the usual chess and logic games, Turing proposes to measure thought by the commonplace and presumably 'easy' activity of being male or female. Unlike all other tests of intelligence that 'have operated in the detached puzzle-like domains of board

[25] AMT D14a. Alan Turing to Norman Rutledge, February 22 1953

> games and technical analysis, not those demanding understanding of human lives, motivations, and social interaction', the Imitation Game leaves the closet to test thinking in the everyday game of life.
>
> (Genova, 1994, p. 315)

She argues that as a gay man in a homophobic society, Turing was himself well-familiar with "gay life's daily imitation game", knowing how to "vogue" masculinity and pass as straight when necessary. She notes that Turing's professional life as a code-breaker would come to overflow into his personal life, breaking gender codes and behavioural mores of middle-class respectability.

These compelling readings beg the question: given the limits on sexual citizenship imposed on Turing himself, why was the Turing test used to enact (rather than challenge) gendered erasure? Hayles (1999) has made the case that, for some, these subversive readings are simply too radical to comprehend. The absolute belief in the discrete and binary nature of gender and sexual difference prevented many of the implicit arguments in the Turing test from being carried to their logical conclusion. What the Turing test demonstrates, then, is how the limits of gender here also figured the limits of AI subjectivity.

If we return to the Google doodle, we can also see how even this small example must contend with the terms of Turing's legacy. Google—one of the world's largest organisations for data collection and development of machine learning—is, ironically, at the forefront of an inversion of the figurative erasure of gender. Gender is one of the many significant characteristics that allows for algorithmic personalisation and profiling, and Google understands well the lucrative opportunity of acknowledging the specificity of embodied being, or to parse through their own language "user preferences." Binary gender has been obsolesced, if only to be replaced by more granular forms of identification. As Hito Steyerl (2018) has argued, "contemporary computation is not about confusion of identity but multiplication of identities" (p. 112). Describing the approach to identity employed by companies such as Facebook and Google she writes "if you don't want to identify as man or as woman that's fine, but please check one of these fifty-plus boxes to state your precisely defined other type of gender, and we'll make sure to send you the appropriate ads" (p. 112). Referring back to the Turing test she astutely observes that AI is no longer "an imitation game but an identification game" (p. 112).

The doodle thus represents the story of the Turing test come full circle. The legacy of AI's founding father is narrated by one of the world's largest AI companies, using the tools and techniques inherited from Turing and which define the current machine learning environment. This solipsistic narrative is indicative of the all-encompassing aspects of a

commercialised and monopolised algorithmic culture. The industry has the scale and reach to represent itself and its history: it is both the source and the result (the effect and the cause) of its own figuration.

Chapter five

Making minds at Dartmouth

In a proposal dated 31 August, 1955, a group of researchers put forward a funding request for a two month long summer project to investigate a novel field of study they called "artificial intelligence."[26] Submitted to the Rockefeller Foundation by mathematics and information studies researchers John McCarthy, Claude E. Shannon, Marvin Minsky[27], and Nathaniel Rochester, the group framed the "artificial intelligence problem" as "that of making a machine behave in ways that would be called intelligent if a human were so behaving" (McCarthy et al., 1955/2006, p. 11). The event marked a break away from prevailing cybernetic approaches to computation that focused on "modelling brains in computer hardware" to instead use methods to abstractly "mimic minds in software" (Edwards, 1996, p. 240). Over the course of the summer they ambitiously proposed research topics such as: how to program a computer to make proofs in artificial language, create abstractions from sensory material, find original solutions to solve problems, and carry out activities. Their request was tentatively approved and the group assembled on the Dartmouth campus in New Hampshire the following year.

"The Dartmouth Summer Research Project on Artificial Intelligence" (hereafter Dartmouth workshop) is today considered the modern "birthplace" of AI (see Kline, 2011; McCorduck, 1979; Moor, 2006; Nilsson, 2010). It not only gave the field its name but inaugurated symbolic processing (also called symbolic AI) as the dominant research paradigm for the next three decades. Significantly, it also set in place key social patterns between

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[26] The historical data for this chapter is drawn from Pamela McCorduck's history of AI *Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence* (1979); Daniel Crevier's *AI: The Tumultuous History of the Search for Artificial Intelligence* (1993); Ronald Kline's article "Cybernetics, Automata Studies, and the Dartmouth Conference on Artificial Intelligence" (2011); published and unpublished interviews, reviews, and papers on John McCarthy's personal website (http://www-formal.stanford.edu/jmc/index.html); published and unpublished notes, papers and essays on Ray Solomonoff's personal website (http://raysolomonoff.com/); oral history interviews conducted by the Charles Babbage Institute and stored online at the University of Minnesota Digital Conservancy (https://conservancy.umn.edu/handle/11299/107544); and the Rockefeller Archive Center, a collection of more than 1,800 documents including internal reports and memoranda, correspondence about RF projects, program overviews, excerpts from board meeting dockets and entries from Foundation staff members' diaries (https://rockfound.rockarch.org/digital-library). The citations in this chapter reflect the suggested citation format as listed on the archive documents.

[27] As of October 2019, Minsky faces serious allegations connected to convicted child sex offender Jeffrey Epstein. He is known to have visited Epstein's island retreat where underage girls were forced to have sex with Epstein's colleagues. Minsky has been directly named by one of the sex-trafficking victims as someone she was told to have sex with.

practitioners and their institutions that would prove instrumental in structuring the character of research itself. Rather than present a standard history of the event, of which there are many detailed accounts,[28] I instead wish to examine the relationship between the AI figures instantiated by the Dartmouth workshop and the gendered research cultures that helped them to proliferate.

This chapter analyses the Dartmouth workshop as a defining moment in the figuration of AI and gender in early scientific discourse. It seeks to illustrate the contingency of figuration on social, cultural, and political contexts. Drawing on historical analyses, original proposals, affiliated publications, and personal accounts from attendees, I demonstrate how the gendered social organisation of the field affected the types of AI figures produced. I explore generational connections between cyberneticians and AI researchers, social norms that encouraged individualistic and inward-looking research practices, and the effect of funding models in creating competitive and hostile research cultures. Building on the work of Paul Edwards (1996), I contend that the Dartmouth workshop operated as a "closed world," creating an intellectual environment that figured gender as epistemologically unintelligible. The boundary-work performed by early practitioners to separate AI from parallel fields, such as automata studies and cybernetics, positioned questions of social contingency and embodied ways of knowing as outside of legitimate disciplinary discourse. Like the Turing test, symbolic AI erases the gendered subject through processes that favour universal and abstract models of intelligence. The aim of this chapter is to demonstrate how, even as it is excluded from AI discourse, gender nevertheless plays a critical role in its figuration.

AI and closed world discourse

In his seminal history of computers in Cold-War America, Paul Edwards (1996) introduces the phrase "closed world discourse" to describe the cultural, ideological, and technological characteristics that defined American politics in the period during and immediately following the Cold War. Closed world discourse manifests in metaphors and techniques of containment and centralised control. The Soviet Union, for instance, was depicted as a closed society, something to be encircled and managed by American military power. Phrases like the "iron curtain" and physical structures such as the Berlin Wall served as symbols to illustrate the sense of division between the communist world and that of capitalism and democracy. Capitalist nations were similarly cast as needing enclosure to protect them from the threat of external invasion, and capitalism itself was represented as a potentially all-encompassing, self-sustaining global force that could surround the entire world and, thereby, suffocate and collapse the Soviet threat (pp. 8-11). For Edwards, computers represented the ultimate

[28] See Crevier (1993), Edwards (1996), Kline (2011), and McCorduck (1979).

iconography of closed world discourse. They formed the technological foundation for the vast system of American military power, shaping—but also shaped by—the nation's grand strategy. These systems quite literally modelled closed worlds in information, creating miniature electronic battlefields inside of machines. Of particular relevance here is the connection he makes between closed world discourse and the development of the new science of AI. Edwards examines critical events and intellectual developments that contributed to the character of AI research in its golden years from the 1950s to 1980s—including the 1956 Dartmouth workshop. Where he uses closed world discourse to historicise AI against the backdrop of the Cold War and practical military agendas, here I explore its potential to also explain AI's early relationship with gender.

"The closed world" is a concept adopted by Edwards from literary criticism. It was originally used by Sherman Hawkins to describe archetypal patterns of Shakespearean drama. Hawkins argues that closed world plays "dramatise intrusion" and so centre on enclosed spaces under siege, such as a room, a garden, a castle, or even a human mind or heart (Hawkins, 1967, p. 75). For him, the closed world can describe any form of narrative tension, from external social action to internal, psychological conflict. This scalability and adaptability has made it a flexible conceptual tool, as applicable to the study of politics and ideology as it is to literary texts. Edwards uses closed world discourse as a framework to analyse the full spectrum of socio-political life: national strategies and economic practices, new technologies and scientific techniques, individual and collective experiences of power, fiction and cultural narratives, as well as everyday language and metaphor. He describes it as

> a radically bound scene of conflict, an inescapably self-referential space where every thought, word, and action is ultimately directed back toward a central struggle. Turned inexorably inward, without frontiers or escape, a closed world threatens to annihilate itself, to implode.
>
> (Edwards, 1996, p. 12)

These key aspects of closed world discourse—self-referential, inward-looking, and animated by a central struggle—can also be said to characterise the intellectual milieu and social practices of the attendees at the Dartmouth workshop. Using the description above as a point of departure, I contend that the workshop and its researchers operated as a closed world in ways that had specific ramifications for the figuration of gender.

Cybernetic precursors

The genesis of the workshop begins with cybernetic metaphors between digital computers and the brain. Cybernetics was first defined by Norbert Wiener as a "field of control and

communication theory, whether in the machine or in the animal" (Wiener, 1948/1965, p. 11). In the early 1940s, Wiener, then a mathematician at MIT, joined a working group alongside engineer Julian Bigelow, and neurobiologist Arturo Rosenbluth to develop servomechanisms for use in antiaircraft artillery. The goal was to find a system that could predict an aircraft's future position and, therefore, determine the position of weapons on the ground (p. 5). The theory they developed not only resulted in statistical models for military prediction but to the concept of negative feedback, what Edwards summarises as "circular self-adjustment to a dynamic system, in which information about the effects of the adjustment is continuously returned to that system as input and controls further adjustments" (Edwards, 1996, p. 181). Negative feedback, they argued, was a concept that could be used to explain any entity with goal-oriented behaviour, from servo devices to living organisms. In this way, cybernetics provided the theoretical groundwork to articulate the human brain as a kind of information processor analogous to digital computers.

The metaphor between brains and computers was explored in detail at a series of interdisciplinary conferences organised by the Josiah Macy Jr. Foundation between 1946 to 1953. The Macy Conferences on Cybernetics, as they are now called, brought together thinkers from neurophysiology, electrical engineering, philosophy, semantics, literature, psychology, and more. Information theorist Claude Shannon was an instrumental contributor to these events, presenting in the early 1950s on his probabilistic theory of information.[29] Like Turing, Shannon had also worked in cryptanalysis during the Second World War. He described the fundamental problem of communication as that of the efficient transmission of messages across imperfect communication channels. His model of communication used phrases such as "encoder" and "decoder" to describe the transmitters and receivers of information, terms that subtly reflected the influence of his wartime service. Shannon recast communication as a problem of engineering rather than semantics, the utility of which was capitalised on by his long-time employer Bell Telephone Laboratories.

While at Bell Labs, Shannon became a mentor to John McCarthy, a recent PhD graduate in mathematics, who shared an interest in questions of computational machinery and intelligence. In 1952, towards the end of the Macy Conference period, Shannon and McCarthy began soliciting contributions from conference attendees for an edited collection on automata theory and the brain (McCarthy, 1988, p. v). The subsequent volume, *Automata Studies*, is framed explicitly in terms of the cybernetic analogy between brains and machines. The preface begins with the provocation, "Among the most challenging scientific questions for our time are the corresponding analytic and synthetic questions: How does the brain

[29] See Hayles (1999) and Edwards (1996) for detailed accounts of Claude Shannon's theory of information and its significance to cybernetics.

function? Can we design a machine which will simulate a brain?" (McCarthy and Shannon, 1956, p. v). The thirteen papers that composed the volume sought to answer these questions in numerous, distinct ways. Some took a neurophysiological approach, analysing the potential for computers to be used as tools to study neural activity and neural systems (see Kleene, 1956). Some drew on cybernetic principles, examining the ability for automata to symbolically represent the external environment in a self-organising manner, and so model the theory of negative feedback (see Mackay, 1956). Others were influenced by psychiatry, proposing hypothetical machines to operate within human problem-solving systems and thereby "amplify" human intellectual capacities (see Ashby, 1956). The volume was indicative of the cybernetic tradition of interdisciplinarity, placing contributions by logicians, mathematicians, physicists, engineers, neurologists and psychologists side by side (McCarthy and Shannon, 1956, p. vi).

Historian Ronald Kline (2011) argues that it was McCarthy's dissatisfaction with the *Automata Studies* volume that lead him to pursue new forums for experimenting in ideas of machine intelligence—a trajectory that would eventually lead to the organisation of the Dartmouth workshop and the establishment of AI as a distinct field of research. He argues that during the collating and editing process for the volume, there emerged clear differences between the idea of automata theory envisioned by Shannon, and the direction pursued by McCarthy. He writes

> The tensions over editing Automata Studies recalled by McCarthy surface in a letter he wrote Shannon in late 1954. McCarthy had written a draft of a preface to the volume. "It consists mainly of a point of view on how the various lines of investigation represented by the included papers may contribute to the eventual design of intelligent machines." The sentence is crossed out by a wavy line, perhaps by Shannon, in the original letter deposited at the Shannon Papers at the Library of Congress.
>
> (Kline, 2011, p. 8)

Kline notes that Shannon also did not approve of McCarthy's plans to frame the volume as "a step in the direction of the design of intelligent automata," rejecting McCarthy's proposed title for the volume, "Towards Intelligent Automata" (Kline, 2011, p. 8). He suggests that the correspondence between Shannon and McCarthy point to McCarthy's intention to subtly move the collection away from cybernetics towards a new area of study.

Writing years later, McCarthy would not only confirm Kline's suspicions but express personal criticism of both cybernetics and its founder, Norbert Wiener:

> As for myself, one of the reasons for inventing the term 'artificial intelligence' was to escape association with 'cybernetics.' Its association with analog feedback seemed misguided, and I wished to avoid having either to accept Norbert (nor Robert) Wiener as a guru or having to argue with him.
>
> (McCarthy, 1988, p. 227)

Only two months after submitting his final paper for the volume, McCarthy began to pursue new means in which to explore his ideas for machine intelligence. In April 1955, he approached the Rockefeller Foundation to investigate the possibility of funding for a two-month long summer research seminar. By August of that year, he had formed a four-man committee to develop the formal proposal. It included Claude Shannon, then a Senior Mathematician at Bell Labs; Marvin Minsky, a Junior Fellow in Mathematics and Neurology; and Nathaniel Rochester, Manager of Information Research at IBM.

The final proposal was sent to the Rockefeller Foundation on September 2nd, 1955. It read:

> We propose that a 2 month long, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College at Hanover, New Hampshire. The study is to proceed on the basic conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one of more of these problems if a carefully selected group of scientists work together for a summer.
>
> (McCarthy et al, 1955/2006, p. 2).

Included were short summaries of individual projects they intended to work on over the duration of the seminar. While these projects were ostensibly designed to extend the study of machine intelligence in new directions, by and large they still reflected dominant cybernetic methods of brain-modelling in computers. In Shannon's section, he wrote about applying concepts from information theory to computing machines and brain models. Minsky wrote of designing a machine that could simulate environments using sensory and motor abstractions, and then solve problems within that internal abstract model. Rochester proposed to study how the brain worked to solve mathematical problems that required randomness and, thereby, design machines that could find original solutions to problem solving. The exception was McCarthy who turned to symbolic processing with his proposal to develop an artificial language that a computer could then use to solve problems requiring conjecture and self-

reference. They requested a total of $13,500 to cover salaries, travel, and secretarial expenses for all attendees and included a list of 47 names of colleagues who were also interested in the problems they had put forward.

The Rockefeller Foundation were hesitant in their support. In his initial discussions with the Foundation, McCarthy had originally approached Warren Weaver, director of the Natural Sciences division and former collaborator with Claude Shannon. Weaver was unconvinced by the project but was nevertheless endeared to it as he had the utmost respect for Shannon. Concerned that his relationship with Shannon would represent a conflict of interest, he suggested that Robert Morison, the Foundation's Biological and Medical Research division, should instead handle the proposal. In an internal memo dated June 14, 1955, Weaver noted his apprehensions in funding the event:

> I have the general feeling that this is rather a 'personal' project, in the sense that McC [McCarthy]. And two or three other people would enjoy spending time together, talking about various aspects of information theory. And they would naturally like to have somebody pay the bill. It is also personal, in the sense that no significant group or organisation is back of this proposal, as far as I know. I would for example, think of it in rather different terms if the idea came to use from the entire information group at MIT.
>
> Thus (and in spite of my personal interest in the subject) I am very doubtful the RF [Rockefeller Foundation] ought to do anything about this.[30]

Morison shared Weaver's concerns, deliberating on the issue for several months. In November, when he still had no verdict, McCarthy asked Shannon to approach Weaver to determine its status. The Foundation eventually offered to support the project but with a significantly reduced sum of $7,500—just over half of the original requested amount.

The closed world of Dartmouth

These preliminary details provide clues into the "closed" nature of the workshop to come. The conscious efforts to move AI away from the interdisciplinary science of cybernetics; the influence of strong, individual personalities; and the strategic attempts to secure funding, all contributed to forms of figurative enclosure that would eventually manifest in gender exclusion.

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[30] Weaver, Warren, "Memorandum regarding John McCarthy and Claude Shannon," 100 Years: The Rockefeller Foundation, accessed October 1, 2019, https://rockfound.rockarch.org/digital-library-listing/-/asset_publisher/yYxpQfeI4W8N/content/memorandum-regarding-john-mccarthy-and-claude-shannon

First, the workshop itself was a physically closed event. Access was by invite only and granted on the basis of a personal or insider connection. In a letter finalising details of the workshop to Morison, McCarthy listed ten participants along with himself:

> Dr. Marvin Minsky, of the Harvard Society of Fellows
> Dr. Julian Bigelow, of the Institute for Advanced Study
> Professor D.M. MacKay, of the University of London
> Mr. Ray Solomonoff, of Technical Research Group
> Mr. John Holland, of IBM Corporation
> Dr. Claude Shannon, of Bell Telephone Laboratories
> Mr. Nathaniel Rochester, of IBM Corporation
> Mr. Oliver Selfridge, of Lincoln Laboratories
> Mr. Allen Newell, of Carnegie Tech and the Rand Corporation
> Professor Herbert Simon, of Carnegie Tech[31]

This modest list reflects the dense and clustered nature of relationships between cyberneticians and the new generation of AI researchers. Selfridge, for instance, worked as an assistant to Norbert Wiener and had proofread *Cybernetics* while still a graduate student. MacKay had been an interlocutor with Shannon on information theory at the Macy conferences and had contributed to the *Automata Studies* volume. Minsky had received letters of recommendation from Wiener, had previously worked with McCarthy and Shannon at Bell Labs, and had also worked with Allen Newell as a consultant at Rand Corporation. While at Rand, Newell met Selfridge when he came to deliver a talk and visited McCarthy who was working a summer at IBM. John Holland was a colleague of Rochester at IBM and had also worked there for a summer with McCarthy. And finally, Ray Solomonoff was a colleague of Selfridge at MIT and was also a close friend Minsky's.

They were all connected through complicated and overlapping networks that were heavily mediated by institutions, contracts of employment, and academic mentorship. In some instances, these connections were called on strategically to gain access to valuable resources and funding. McCarthy, for instance, arguably approached Warren Weaver directly knowing that his relationship with Shannon would operate in his favour. These tight connections, however, could also function to suffocate and obstruct.

Reports from the Rockefeller Foundation archives show Morison's efforts to diversify the expertise of the group. He suggested to Shannon and McCarthy to invite two psychologists:

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[31] McCarthy, John, "Letter from John McCarthy to Robert S. Morison, 1956 May 25," 100 Years: The Rockefeller Foundation, accessed October 1, 2019, https://rockfound.rockarch.org/digital-library-listing/-/asset_publisher/yYxpQfeI4W8N/content/letter-from-john-mccarthy-to-robert-s-morison-1956-may-25

Lukas Teuber and Karl Pribran. Morison was concerned that the analogies between the mechanical processes of computers and brain functions were being pursued too literally and suggested that "it might be wise to include one or two other psychologists if only for the purpose of keeping the group from speculating too wildly on how the brain might work."[32] Though both Teuber or Pribran were considered by Morison to be "extraordinarily well qualified psychologists and have enough breadth of education and curiosity to have informed themselves…about cybernetics and mathematical speculation"[33] neither were listed on the final invite list or made it to the event.

This physical closure was also replicated in forms of personal closure. Although the workshop is today remembered as one of the most significant events in the development of the AI field, interviews with attendees point to a much more fractured and lacklustre experience. In expressing his disappointment, McCarthy griped:

> Anybody who was there was pretty stubborn about pursuing the ideas that he had before he came, nor was there, as far as I could see, any real exchange of ideas. People came for different periods of time. The idea was that everyone would agree to come for six weeks, and the people came for periods ranging from two days to the whole six weeks, so not everybody was there at once. It was a great disappointment to me because it really meant that we couldn't have regular meetings.
>
> (cited in McCorduck, 1979, p. 96)

For him, the event failed to produce the kinds of intense discussion and collaboration originally envisaged, either because people committed too little time or were otherwise too driven by their own agendas.

Allen Newell—who along with Herbert Simon is considered a designer for the world's first AI program (discussed later in this chapter)—shared McCarthy's sentiments, stating in one interview how little effect he thought the Dartmouth workshop had had on his overall thinking or approach to machine intelligence:

> So I don't remember the Dartmouth Conference having any big impact on me at all. It sort of passed in the night, because, in fact, Herb and I were totally consumed with

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[32] Morison, Robert S., "Report regarding John McCarthy and Claude Shannon," 100 Years: The Rockefeller Foundation, accessed October 1, 2019, https://rockfound.rockarch.org/digital-library-listing/-/asset_publisher/yYxpQfeI4W8N/content/report-regarding-john-mccarthy-and-claude-shannon, page 2)

[33] Morison, Robert S., "Report regarding John McCarthy and Claude Shannon," 100 Years: The Rockefeller Foundation, accessed October 1, 2019, https://rockfound.rockarch.org/digital-library-listing/-/asset_publisher/yYxpQfeI4W8N/content/report-regarding-john-mccarthy-and-claude-shannon (page 2)

> our own path, so no notion of a field. Just the notion of going off and proceeding to do these things.
>
> (Newell, 1991, p. 13)

Although it could be argued that McCarthy's and Newell's experiences were in the minority,[34] tracing the details of conversations, conflicts and disagreements at the workshop is a difficult task, as there are no official transcripts or records of the event. McCarthy did not take any formal attendance and failed to produce a final report for the Rockefeller Foundation—much to their dissatisfaction.[35] Many of those originally listed as participants were not able to come and instead sent junior colleagues in their place. In some instances, colleagues working at campuses close by would drop in to visit, which in turn resulted in vastly fluctuating numbers. The notes of attendees such as mathematician Ray Solomonoff point to about twenty people in attendance over the eight-week period, while others such as IBM computer scientist Trenchard More indicate closer to thirty (Solomonoff, 2016, p. 10). Different sources also directly contradict those in attendance. While it is generally accepted that Shannon, despite being one of the organisers, did not attend the event, in Solomonoff's notebooks he is listed as present. Similarly, Kline's account of the workshop includes testimony from junior scholars Bernard Widrow, W.A. Clark and B.G. Farley who visited from MIT Lincoln Labs, none of whom are mentioned in Solmonoff's list (p. 10).

This personal closure was, of course, not distinct to the Dartmouth workshop but instead indicative of broader social dynamics within early AI research and institutional culture. Within this group, however, the "closed world" attitude became unfavourable characterised as "cliquish" and "an old-boy network" (McCorduck, 1979, pp. 109-111). In their own reflections on the workshop, participants have themselves acknowledged the downfall of group dynamic. Arthur Samuel, famous for coining the phrase "machine learning," has stated

> I'm sort of a loner myself, unfortunately, and I've always objected to this in-group running things while you're on the outside. And that was fostered by the meeting, I think. Not deliberately, but meetings of that sort tend to do that, and that's my one objection to what's been done in the field of Artificial Intelligence. It's always been run as a closed group.

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[34] In her historical analysis of the event, Pamela McCorduck writes that "some of the participants did have the sense that they had gathered for something momentous" and documents some of the more productive exchanges (McCorduck 1979, p. 95).

[35] Morison's diary entries record his misgivings at the money spent "there has been a little feeling here that we were not entirely well informed to what went on at the conference held in Hanover [New Hampshire] last summer" (in Kline 2011, p. 12).

(quoted in McCorduck, 1979, p. 109)

McCarthy too has been remorseful at how closed the culture has been. He describes the lack of intellectual generosity as a serious pitfall within the group:

> I think we don't talk to each other as much as we should. We tend to have these separate empires which exchange ideas by means of graduate students…If we were really going to understand what everyone else is doing, we'd have to spend a lot of time together—none of us has an excessive talent in understanding other people's points of view. There's a tendency after starting a discussion to say, ah, this suggests something that I want to work on, and the real desire is to get off alone and work on it.

(quoted in McCorduck, 1979, p. 112)

This antisocial dynamic is so common it has become a stereotype for scientists and practitioners working in these areas. The trope of the singular genius—the young upstart who is intellectually brilliant but woefully socially inept—can be seen across a range of biographical films. From the depiction of Apple founder Steve Jobs in the 2013 film *jOBS*, Facebook designer Mark Zuckerberg in the 2010 film *The Social Network*, to Alan Turing in the 2014 film *The Imitation Game*, this trope has now come to define those who work in the computer science and AI field. The "closed world" is here represented in the minds of young men whose genius is so large it encircles their entire social world and prevents others from entering into it.

Women's absence and hidden labour

How did these forms of social and personal closure function to exclude gender in AI's early figuration? First, women themselves are excluded from narratives of the Dartmouth workshop. No women are referred to in the memos and letters of the Rockefeller Foundation archives, and no women are listed as being in attendance in the notes or interviews of organisers and attendees. The single exception is in an unpublished essay written by Grace Solomonoff, the wife of Ray Solomonoff. Grace's essay is part of an informal digital archive of her husband's life and work. It sits on his personal website, which today functions as a memorial page, and is filled with copies of publications, scans of notebooks, and photos of Ray throughout his life accompanied by loving descriptions written by Grace.[36]

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[36] For example, Grace includes pictures of an adolescent Ray "on a horsie" and has created an online gallery of doodles from his notebooks, she writes "some are funny, some poetic and some mysterious—perhaps they are signs of what he was thinking." See http://raysolomonoff.com/

Her Dartmouth essay trawls through Ray's archives and narrativises his life and experience of attending the workshop. Under the heading "A Few More Attendees" she notes that Gloria Minsky—the wife of Marvin Minsky—was also in attendance at the event. She writes "Gloria Minsky also commuted there (with their part-beagle dog, Senje, who would start out in the car back seat and end up curled around her like a scarf), and attended some sessions (without Senje)" (Solomonoff, 2016, p. 10). This charming description sits in stark contrast to the hostile account of AI research culture given above. As an anecdote, it suggests that the closed world culture was more a feature of the research environment rather than inherent personality trait of the participants. It points to the idea that the behaviour was not only closed but self-contained, such that the dynamics at the workshop could be easily left behind once they exited the walls of the academic institution.

More significantly, Grace's essay provides the only account of a woman's attendance at the Dartmouth workshop. Gloria Rudisch Minsky was an accomplished and formidable thinker in her own right. She was a celebrated paediatrician who was appointed Director of Child Health Services in Brookline, Massachusetts for over three decades, and was also a Clinical Instructor in paediatrics at Harvard Medical School working at an international level on the subject of child health and medical education. As a medical practitioner and researcher specialising in the healthy development of children, she would almost certainly have had valuable insight into the nature of learning, philosophical approaches to intelligence, and neurophysiological aspects of the developing brain. Yet her attendance and any contributions she made to discussions are otherwise absent in the historical record. This absence is indicative of the sexist institutional cultures that defined the period and aligns with broader historical erasures of women, such as women's labour in early computing, as discussed in the previous chapter.

Like the women at Bletchley Park, the labour of the women in this narrative has been largely undervalued. In this case, it is the labour of women such as Grace and Gloria who almost certainly provided their husbands with forms of emotional, intellectual, and domestic support, but who, more importantly, contributed significantly to documenting, cataloguing, and in other ways maintaining the physical archives of the field. Gloria Minsky has given numerous talks and interviews on her relationship with Marvin, his approach to students and mentoring, and has provided valuable detail and insights into his thinking process and social life (see Breen 2017, EG Creative Conference 2017). Similarly, following the death of her husband, Grace Solomonoff acted as his biographer and managed his archive. She has presented his life story at the Artificial General Intelligence (AGI) Society's annual conference and has published essays in journals within the field (see Solomonoff, 2013). These publications include details of her husband's intellectual trajectory, his personal relationships

to other researchers, and notes from early drafts of his work. Though she had not yet met Ray at the time of the Dartmouth workshop, she documents how—like Gloria—she would also join him at conferences and was equally present during the subsequent growth of the AI field. It is worth acknowledging that it is only because of her meticulous labour in digitising and cataloguing his notebooks that we have any record of discussions during the Dartmouth workshop, or even a reliable account of those who attended.

Another woman whose labour has played a pivotal role in how the Dartmouth workshop is remembered today is the writer Pamela McCorduck. McCorduck's book *Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence*, originally published in 1979, was written as a history of the development of the AI field and its key thinkers. In the mid-1970s McCorduck began interviewing figures such as McCarthy, Minsky, Newell, Simon, and Shannon, among others. In her words, "It occurred to me then that before mortality claimed them, somebody ought to go around and ask these guys who'd begun this odd field called artificial intelligence, what they thought they were doing, and why" (McCorduck, 2004, p. xi). Her book stands as one of the first to document the history of the AI field and, to date, contains the most detailed first-hand accounts from those who actually attended the Dartmouth workshop.

McCorduck, however, is not a trained historian but a novelist. Like Grace and Gloria, she is married to a prominent AI researcher, computer scientist Joseph F. Traub. Traub was Head of the Carnegie Mellon Computer Science Department and was personal friends and colleagues with researchers such as Newell and Simon. This personal connection gave her privileged access to an otherwise closed group. It also potentially explains why McCorduck's book is one of the few AI history texts written from outside the field that is actually read and celebrated by AI researchers.[37] As someone who explicitly identified herself as *not* a historian, but rather, a fiction writer conducting a personal enquiry, McCorduck's book is perhaps kinder than most other accounts. Her writing is littered with romantic descriptions of AI researchers as "visionaries," "poets," "dreamers," and "rascals":

> Artificial intelligence in one form or another is an idea that has pervaded Western intellectual history, a dream in urgent need of being realised. Work toward that end has been a splendid effort, the variety of its forms as wondrous as anything humans have conceived; its practitioners as lively a group of poets, dreamers, holy men, rascals, and assorted eccentric as one could find—not a dullard amongst them. Its visionaries

[37] There is now a growing genre of AI critique written by computer scientists and data scientists who have since left the profession and whose writing largely reflects on their experiences within the working culture. See Meredith Broussard's *Artificial Unintelligence: How Computers Misunderstood the World* (2018), and the work of Os Keyes, see https://ironholds.org/

> have lifted our spirits and made us transcend our own species, its poets have told us thing about ourselves we never suspected, and its fast talkers have set everybody's teeth on edge.
>
> (McCorduck, 1979, p. xii)

This sample is representative of the broader flattering tone of the book. The researchers McCorduck interviewed were not only subjects of enquiry but in many cases good friends and colleagues of her husband. Despite containing some very candid material—such as McCarthy's disappointment about the field—she still arguably sought to represent the researchers in the best possible light.

It is thanks to the labour of these women that histories of AI—and the Dartmouth workshop—can exist. They contributed not just to the legacies of their husbands but to a rich array of archive of materials according to which the field could then narrate itself. In McCorduck's case, she was recording and writing the history of AI at a time when there was no support or funding for this kind of project. In the foreword to the twenty-fifth anniversary issue, she writes of her great difficulty in securing funding and how the book had gone to thirty-three publishers before receiving any positive interest. As she states, "Nobody knew whether it would be important. Nobody wanted to take a chance" (McCorduck 2004, p. xiii). These women were thus defining and preserving core narratives of the field at a time when others did not value or were not prepared to undertake this labour. Their work providing the infrastructure of scholarly memory, however, occludes them from being historically characterised as active agents in the making of AI itself. Even in their own accounts, they conformed to the trope of the singular genius, preferring to discuss the actions and achievements of individual players rather than the broader network of structures that allowed those players to act. The closed world discourse that defined the Dartmouth workshop here operates to position such women as outside of authorised historical narratives. While there would be no history of the Dartmouth workshop or the field of AI without such women, such key events are treated as self-contained and closed phenomena, pre-existing "out there" to be discovered rather than actively produced through the process of history-making itself.

Figuring symbolic AI

I turn now from the physical exclusion of women to the epistemological exclusion of gender. Here I consider how symbolic AI, the dominant research paradigm emerging from the Dartmouth workshop, reified closed world logic in a way that figured gender as an epistemologically unintelligible phenomenon.

In his analysis of AI's early years, Rodney Brooks (1991) discusses how the problem of building AI systems was conceptualised as a top-down practice. Researchers such as Newell, Simon, Minsky and McCarthy understood "intelligent behaviour" through the rationalist tradition focusing on internal processes such as *thought* and *reason* as the foremost mechanisms for attaining knowledge (p. 1). Early AI programs were modelled on skills such as search-based problem-solving, formalist logic, and games like chess—skills that could be reduced to rule based symbolic operations. Researchers proceeded according to the basic tenet that if the steps taken by a human in approaching complex operations could be explicitly defined, then theoretically, a machine following those same steps could be said to be performing at an equivalent intellectual capacity. Put in crude terms, if the machine could do what the human had done then that was sufficient evidence to say that it was "doing" intelligence. "Thinking" in this configuration is defined in terms of function rather than process; the "stuff" in the middle is negligible so long as the behaviour produced is analogous to similar systems operating in similar outer environments. This approach is often called classical AI, or GOFAI (Good Old Fashioned AI), but is most commonly referred to as symbolic AI because of the emphasis on formal symbol manipulation as the basis for intelligent action (see Nilsson, 2010; Warwick, 2012).

As previously discussed, McCarthy's motivation for establishing the Dartmouth workshop and coining the phrase AI was to move the study of machine intelligence away from cybernetics. Though both traditions draw on analogies between brains and machines, the approach from cybernetics was to model minds from the bottom-up, physically recreating the structures of the brain using computational machinery. Brooks (1991) argues that this shift in research agenda was significantly influenced by the limitations of computing power available. As he explains:

> Biological systems run on massively parallel, low speed computation, within an essentially fixed topology network with bounded depth. Almost all Artificial Intelligence research, and indeed, almost all modern computation, runs on essentially Von Neumann architectures, with a large, inactive memory which can respond over an extremely narrow channel, to a very high speed central processing unit which contains very little state. When connections to sensors and actuators are also considered, the gap between biological systems and our artificial systems widens.
>
> (p. 3)

Thus, during AI's foundational period, the bottom-up approach was simply not tenable given the architectural constraints of systems of the day. Researchers seeking to create programs with practical applications turned instead to problems and methods they considered more

achievable. Activities culturally coded as "intellectually difficult," such as chess, were relatively easy to achieve compared with biological processes that relied on a complex array of sensors and feedback loops, such as vision.

One of the earliest examples of a functioning AI program is Logic Theorist, a computer program designed to prove the mathematical theorems of Bertrand Russell and Alfred North Whitehead's *Principia Mathematica*. The program was created by Allen Newell, Herbert Simon and computer engineer J.C. Shaw. Newell and Simon had begun sketching ideas for a program that could conduct complex problem solving in the months prior to the Dartmouth workshop. They considered tackling tasks such as chess and geometry before settling on symbolic logic. Simon states, "We were not looking for an efficient way of proving theorems. We were looking at how humans, by selective heuristics, found the right thing to do next. That was certainly in the centre of my mind: what heuristic…would kick out the right theorem to use rather than searching forever" (Simon in Crevier, 1993, p. 44). Selective search and heuristics became the basis of the Logic Theorist program. It used search trees composed of branches that represented thousands of "partial solution possibilities" based on specific rules or operations. Other manipulations would then be applied to these initial results to then create the next generation of branches. The idea was to find the best path along the branches to reach the desired goal. Heuristic techniques were used to constrain search. Rather than create huge trees that map every possible solution, the idea was to use supplemental information to guide the search and create trees that branched "sparsely and selectively" (Newell and Simon, 1976, p. 122).

Interestingly, the "first run" of the program was not conducted on a computer but was simulated using human parts. Prior to coding, Newell, Simon and Shaw decided to stage a hand-simulation with Simon's wife, his children, and a few of his graduate students. They wrote the individual rules (or subroutines) and components of memory of the program onto index cards and assigned one to each person. Participants then physically executed their subroutine, or provided the contents of their memory when called upon. His daughter Katherine writes vividly of this event:

> Peter, Barbara, I, and our mother remember keenly the first demonstration that "machines can think". After working with Allen Newell and Cliff Shaw on the theoretical underpinnings of a process to instruct a computer to solve problems, Herbert was ready to try out the heuristic. One evening in early January 1956, he invited us (his family) to a classroom at Carnegie Tech to participate in a trial run of the theory he, Newell and Shaw had been working on. I (age 13), Peter (11), and Barbara (9), my mother, Dad, Al Newell and at least one graduate student were there. Our roles were to each "be" a subroutine that performed a specific function in a

> computer program. Herbert and Al laid out the logic problem we were to solve…Each of us at appropriate times, following the instructions on our cards, did exactly what the card told us to do. It worked! We humans had simulated a computer solving a logic problem! I cannot recall exactly the group response when we reached the solution that evening, but we all knew what we had done was somehow important. We all felt and shared the "inventors" excitement of discovery.
>
> (Simon Frank, 2001)

This small anecdote provides another example of the significant role of women and family in supporting the AI field. In his obituary, Katherine writes fondly of her relationship with her father but notes that he was "a self-professed workaholic" and "all of us knew that work came first" (Simon Frank, 2001). She recalls how she and her siblings would spend the first few weeks of summer together with her father in southern California, near the RAND Corporation office, before travelling with their mother to spend the remainder of their holiday with her mother's family. She writes, "We rarely took 'just a vacation.' Vacations were always coupled with a conference or other work engagement" (Simon Frank, 2001). Her declaration that she and her family "felt and shared the 'inventors' excitement" can thus be understood in the context of their own long-term presence and engagement with AI research, and in this case, their own active roles in constituting the infrastructure of [38]

Logic Theorist was representative of the first major wave of AI research. It was based on a model of intelligence that functioned purely on a symbolic level, creating representations of the outside world using symbols that were then manipulated via preprogrammed, rule-based commands. Edwards argues that the technical shift from cybernetics to AI had profound implications for how the thinking subject was figured in discourse:

> The principle methods of cybernetics as practice, like those of its behaviourist antecedents, built complex structures out of simple, low-level, physical units such as neurons or reflex arcs. Frequently, based on then-current beliefs about how the brain worked, cyberneticians tried to design self-organising machines that would achieve complex behaviour through encounters with their environments. The subject, in both senses, of cybernetics was always the *embodied* mind.
>
> (Edwards, 1996, p. 240)

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[38] This "workaholism" that saw the folding of work and home life into one was not specific to the researchers themselves, but was rather illustrative of the forms of heteronormative nuclear family lifestyle of the period. It is my contention that it is precisely this normatively that led to certain exclusions to go unchecked and unremarked upon.

Lost in the move from one paradigm to another was a sense of *situatedness* and *embodiment*. Programs such as Logic Theorist treated the mind as a standalone entity, what Kevin Warwick describes as like "a brain in a jar" (Warwick 2010, p. 9). For Edwards, symbolic AI figured minds as "miniature closed worlds, nested within and abstractly mirroring the larger world outside" (Edwards, 1996, pp. 255-256). These systems were constructed as self-contained and self-referential, manipulating knowledge that was already pre-defined and pre-digested.

The abstract nature of the symbolic AI model made it difficult to epistemologically account for gender. As discussed in the previous chapter, gender is predominantly understood as a contingent characteristic of the body. Symbolic AI's enclosed and disembodied figuration of mind thus precludes gender as an intelligible phenomenon within this discourse. It is my contention that the closed world culture of the Dartmouth workshop directly contributed to this abstract exclusion.

First, in the move away from cybernetic approaches, AI vastly narrowed the pool of expertise. Cybernetics was, from the beginning, envisioned as an interdisciplinary field building a theoretical framework with a broad "universal" applicability. Present at the Macy conferences were mathematicians, engineers, biologists, neuroscientists, psychologists, and anthropologists. In rejecting the cybernetic approach to brain-modelling, AI also systematically closed its doors to all but a handful of disciplines. Shannon, McCarthy, Minsky, and many others were primarily theoretical mathematicians. The papers and discussion at the workshop were all centred around hypothetical experiments and provocations. Indeed, the only concrete model of AI associated with the Dartmouth workshop was Logic Theorist—a program that was developed prior to the actual event. There were no disciplinary advocates to champion ideas such as the role of culture in defining knowledge, or the effect of dynamic, embodied experience in shaping subjectivity, as there were at the Macy conferences. The thinking subject as a disembodied entity was thus left unchallenged.

Second, where gender is often understood as a social phenomena—made intelligible through performative exchange—symbolic AI is figured on an individualised intelligence. In her analysis of gender's erasure in AI, Alison Adam (1998, p. 55). has made the insightful critique that "If AI is seen as involving the creation of an artificial brain then the spotlight falls on individual psychology in the production of knowledge and intelligence." She argues that individual psychology alone cannot account for socio-political questions, such as: what knowledge is to be represented? How is it represented? Who may be designated as a knowing subject and who has the power to perform such a designation? For Adam, individualisation obfuscates social critique and promotes gender-blindness as a normative ideal. The focus on the individual mind circumscribes and excludes other forms of corporeal cognition that

involve environmental, social or cultural interaction and reflexivity. This kind of containment is mirrored in the attitudes of the workshop participants themselves who, despite meeting in order to develop possible collaborative projects, each walked away with their own individual research agendas. In an interview reflecting on Logic Theorist and the Dartmouth workshop, Newell notes that "They didn't want to hear from us, and we sure didn't want to hear from them: we had something to show them! ... In a way it was ironic because we already had done the first example of what they were after; and second, they didn't pay much attention to it" (Crevier 1993, p. 49). Even Grace Solomonoff, who has generally written of the workshop and the participants in glowing terms, has commented on the breakdown in good will, stating that despite the original ten participants meeting with the intention to find one common project "each of them had an ego the size of the internet so after ten months they came out with ten different proposals" (cited in Dye 2010).

With no epistemological foundations and no advocates, gender became incomprehensible —literally unable to be perceived—by a paradigm that figured intelligence in closed terms. The disembodied and individualised figuration of mind encouraged (or perhaps reflected) solipsistic attitudes to research. While it is outside of the scope of this chapter to examine in detail some of the broader social issues of the field, it is worth mentioning in brief a few other points to help contextualise the continued dominance of symbolic AI in the decades following the Dartmouth workshop. First, Edwards (1996) points out that the key scientists who led the Dartmouth workshop—such as McCarthy and Minsky—successfully attracted the support of the field's largest funding bodies, namely ARPA (Advanced Research Projects Agency) and its networked computing arm the IPTO (Information Processing Techniques Office). He states that unlike sponsors such as the National Science Foundation, ARPA-sponsored research was not subject to peer-review, nor was it under any obligation to distribute research money widely. This, in turn, created institutions that were "permanently 'addicting' ARPA-supported laboratories to Defense Department funding" (Edwards 1996, p. 261). Resources were concentrated on a few elite centres of excellence, many of which were run by those affiliated with the Dartmouth workshop and who supported symbolic AI. This observation is supported by Meredith Broussard (2018) in her examination of the MIT Media Lab[39]—a research centre of which Minsky was a founding faculty member. Broussard describes the remarkable preferential treatment Minsky received internally at MIT. She highlights oral history interviews with Minsky in which he himself acknowledges his unusually good fortune:

[39] The funding model of the MIT Media Lab is now at the centre of investigation and criticism because of its direct connection to the crimes of Jeffrey Epstein.

> Until the 1980s, I never wrote a proposal. I just was always in the environment where there would be somebody like Jerry Wiesner of MIT…John McCarthy and I had started working on artificial intelligence in about 1958, or 1959, when we both came to MIT. We had a couple of students working on it. Jerry Wiesner came by once and said, how are you doing? We said, we're doing fine, but it would be nice if we could support three or four more graduate students. He said, well, go over and see Henry Zimmerman and say I said that he should give you a lab. Two days later we had this little lab of three or four rooms, and a large pile of money that IBM had given to MIT for the advancement of computer science and nobody knew what to do with it. So they gave it to us.
>
> (Minsky in Broussard, 2018, p. 70)[40]

Second, this institutional funding culture, while secure for some, demanded constant legitimation and protection. There are notable instances in which scientists worked actively to discredit alternative modes of research. The most high-profile of these is Marvin Minsky's infamous attack on perceptrons, a cybernetic model of neural networks developed by psychologist Frank Rosenblatt. Minsky along with Seymour Papert published a scathing book in the late 1960s that outlined what they saw as the severe limitations of the neural net approach. The fallout was so extreme that it precipitated a decade-long freeze on research in this area. While it was partly motivated by a scholarly desire for debate, Mikel Olazaren has argued that it was primarily fuelled by "what for them was an unjustified diversion of resources to an area of dubious scientific and practical value, and to push the balance of AI funding and research towards the symbol-processing side" (Olazaren 1996, p. 628). As this comment suggests, the closed world approach to research extended far beyond the Dartmouth workshop event.

This chapter has discussed the relationship between the social organisation of the Dartmouth workshop event and its effects on the figuration of gender in AI scientific discourse. In the chapters that follow I begin to trace a very different history of figuration. Turning to the domains of film and everyday life, the question is no longer of exclusion but of

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[40] While it could not have been predicted that this informal and, frankly, corrupt funding model could be linked to crimes as heinous as sex-trafficking of minors, for those familiar with the Media Lab and its culture, these revelations are, unfortunately, unsurprising. In a prescient warning, Broussard, who has previously worked as a software developer at the Media Lab, wrote in her 2018 book (a year before these allegations surfaced): "To recap: we have a small, elite group of men who tend to overestimate their mathematics abilities, who have systematically excluded women and people of color in favour of machines for centuries who tend to want to make science fiction real, who have little regard for social convention, who don't believe that social norms or rules apply to them, who have unused piles of government money sitting around, and who have adopted the ideological rhetoric of far-right libertarian anarchs-capitalists. What could possibly go wrong?" (Broussard 2018, p. 86)

strategic deployment. This shift in figuration is part of the rapid development in capacity and broadening of applications for AI technologies, from CGI animation and digital effects production, to recommender platforms and digital assistants. As it moves from theoretical to more concrete terms, gender becomes an unavoidable aspect of figuration. It is not accurate to describe gender as suddenly appearing—as these first two case studies have demonstrated, gender figures even in its absence—but rather as a new found visibility as questions of representation and embodiment are more publicly negotiated.

Chapter six

Animating *WALL-E*

Like all Disney Pixar films, the 2008 feature *WALL-E* opens with the iconic sequence of the hopping desk lamp Luxo Jr. excitedly bouncing across the screen. This charming image of the office accessory that springs to life through computer animation can be understood as a metaphor for the vision at the heart of AI—that our objects might, through the power of computing, attain "a life of their own" (Sobchack, 2009, p. 375). For decades, Pixar Animation Studios has refined the subtle art of conjuring in the viewer a belief that objects have an autonomous liveliness. From toys, to cars, to tropical fish, they have built within the cultural imagination the capacity to believe in the potential animism of all things. It is, then, no surprise that when the time came to create a story about robots and artificially intelligent machines, they achieved with such deftness what AI practitioners had so far only dreamed.

WALL-E, a film about planetary extinction, human abandonment, and the exploits of the last robot on Earth, was almost universally praised by critics. *The New York Times* described it as "a cinematic poem of…wit and beauty" (Scott, 2008) while reviewers at *The Atlantic* lauded it as a reminder "of the power of motion pictures—even ones about robots—that possess a vital, beating heart" (Orr, 2008). Such metaphors of vitality and liveliness pervaded public discourse with much of the acclaim credited to the charm of its AI protagonist: the trash compactor WALL-E. *Empire* reviewer Olly Richards described WALL-E as "a character of genius, pure and wondrous an example of the possibilities of animation as you will ever see… everything this little fella feels is perfectly palpable and genuine" (Richards, 2008). This emphasis on authenticity, on WALL-E's "genuine" characteristics, was exemplary of how "liveliness" itself was understood. That this one artificial character could portray such recognisable forms of human emotion was said to somehow speak to its inherent "humanity;" that it might, in the words of one reviewer, "possess something like a soul" (Scott, 2008).

WALL-E's perceived animism was attributed not just to the technical skill of the animators and their ability to depict believable movements and textures, but equally to their ability to simulate characters with specific drives and desires. Of interest to this thesis, are the ways in which these drives and desires were couched in gendered tropes of heterosexual coupling and "natural" reproduction. Implicit within descriptions of "liveliness" was a definition of living that conformed to specific expectations of gendered and heteronormative

modes of life. In short, within this computer-animated narrative of artificially intelligent machines, it was gender and sexuality that served as the *animating* catalyst.

In this chapter, I consider how gender operates in AI figurations on film. Focusing on the Disney Pixar film *WALL-E*, I discuss how believable personhood, in this case the personhood of AI characters, is contingent on the believable performance of gender. This analysis draws on animation theory to discuss how dialectics of authenticity and artifice contribute to figurations within this context. In particular, I focus on Pixar's aesthetic philosophy of stylised realism to argue that gender is not only used as a *technique of animism*, but itself becomes subject to the "squash and stretch" dialectics that define such films.

Death and Life in the Machine Age

In her remarkable history of animation and modernist criticism, Esther Leslie (2002, p. 29) describes "the strange logic" at the heart of animated films. She contends that animation contains the power of life, giving movement and vitality to otherwise still objects and images. Animals can talk, furniture can sing and dance, every element of the world around has the potential to suddenly come to life of its own accord. But the liveliness of the animated world does not extend to humans. People are either absent or their movements shown as slow and dull in comparison to their cartoon co-stars. Animation thus brings humanity face-to-face with its own mortal limitations; as Leslie (2002) writes, "Without humans, but full of life, it could only remind audiences of their superfluity, of their death perhaps" (p. 25).

Leslie uses the example of Felix the Cat to illustrate this fascinating tension between life and death in the animated image. Modelled on the comic styling of Charlie Chaplin, Felix the Cat appropriated many of Chaplin's moves with a cartoon spin: he adopts his funny walk and gestures, and on occasion dons a moustache and detaches his tail to use as a cane. Felix the Cat so impressively perfected the style that Chaplin himself was said to have "envied the perfect timing of animated cartoon gags because they never had to take time to breathe" (Leslie, 2002, p. 15). By contrast, Chaplin's own movements were praised by avant-garde critics as comic genius precisely because they appeared mechanical. This is captured in films such as *Modern Times* (1936) in which Chaplin and fellow co-workers conform to the monotonous rhythms of the assembly line. In one scene, Chaplin's own bodily functions are subject to automation as he is strapped into a feeding machine with small arms that push meat and pour soup directly into his mouth. The machine goes haywire and begins beating his face and feeding him bolts, an illustration of how the everyday man is force-fed a factory logic that ultimately works to diminish him. Where Chaplin draws attention to the petrification of the human essence under modern industrialisation, Felix the Cat and other cartoon characters point instead to the rise of new forms of life made possible through techno-mediation.

WALL-E is a film that also exemplifies this tension. It is an animated feature that narrates the story of machines that come to life against the backdrop of a dead and lifeless planet. Having succumbed to the pitfalls of mass consumption, the human race has surrendered the Earth to trash and escaped into space. The only life-form left is WALL-E, a robot trash compactor designed to clean up the mess. Every day he ventures into the world and fulfils his programmed directive: his arms reach out into the piles of debris to rake in wads of garbage that his body then crushes into compact cubes. These cubes are then arranged into stacks, ready to be broken down by giant incinerators. Originally one of thousands, WALL-E is now the last remaining robot of his kind. The trash stacks now form skyscrapers as he has dutifully continued to carry out his task for centuries, alone. Over time, he has developed a personality that is curious and inquisitive. Each day he rustles through the detritus to find small treasures —sporks, zippo lighters, computer keyboards—the mundane artefacts of a long-gone species.

Like Felix the Cat, *WALL-E*'s animators drew inspiration from actors of the silent era, such as Chaplin, Buster Keaton, and Harold Lloyd. They studied how human emotion could be conveyed silently, with director Andrew Stanton citing Keaton's "Great Stone Face" as the motivation to push forward with a character whose expression rarely changed (Strike, 2008). As a result, WALL-E, despite being a robot, embodied something that was profoundly human. One critic described his character as a "cinematic miracle" seeing "all the possibilities and pitfalls of human existence" in his shiny, binocular eyes (Orr, 2008).

In contrast to the animism of WALL-E, humanity itself is in atrophy. Once-buzzing metropolises are eerily still. Human beings, we learn, abandoned their towns and cities using giant luxury "starliners" and have been drifting in space ever since. The effects of zero gravity on the body have drastically altered human physiology. Low bone density coupled with a high-tech, sedentary lifestyle have turned muscles soft and doughy. The human race has so degenerated that adults now resemble giant babies who spend their days sucking on smoothies, staring into screens, and being ferried to and fro along a conveyer belt of floating recliners. This is a portrait of human extinction: where Earth is no longer capable of supporting life, and the life in space is barely human at all.

The juxtaposition between the life of robots and the death of humanity is captured in different aspects of the story. Humans are essentially absent for the entire first act of the film. The only people that do appear are phantoms from the past: glitchy billboard advertisements for the mega-corporation Buy-N-Large, the company responsible for the consumerist nightmare on Earth and the masterminds behind the planet-wide withdrawal into space. The people in these advertisements are flat and washed-out, artificial in comparison to the exquisitely rendered world that contains them. Ironically, the scenes depicting these early humans were shot using live action footage and then integrated into animated space. These

were the only scenes to utilise real actors and sets while everything else was meticulously rendered with CGI techniques. Here, "real" life is surpassed by the vibrancy of computer-generated life.

This reconfiguration of the terms of life strikes at the heart of animation theory. Leslie (2014) writes, "Animation reminds us of the life in other things that is like and unlike the life in us… Animation's animistic approach to its objects awakens life and voice in stilled and silenced objects. It reinvents not only nature but our relationship with nature" (pp. 29-30). In this way, animation intersects with the project of AI, using machine techniques to "make the inorganic *feel* live" (Stacey and Suchman, 2012, p. 11). Stacey and Suchman contend that pausing to consider animated AI characters on screen also enables a reflection on the history of cinema itself. The twofold image of animated AI characters—such as WALL-E—opens new reflections on substitutions between humans and machines. These characters gesture to the increasing automation of the institution of cinema. In the case of Pixar, the reliance on sophisticated CGI techniques, clusters of high-performance computer systems (known as Render Farms), and personalised recommender algorithms are standard aspects of the production and viewing experience. The new forms of life engendered through computer animation are part of an evolving institution that, as Stacey and Suchman (2012) argue, has always been "a machine for generating life on the screen" (p. 16). In this way, animated AI characters also bring attention to the illusion of their own presence. The near-perfect production of these digital worlds challenges the supposed indexicality of traditional forms of photographic cinema. Computer-generated images are so sublime they appear as if autonomously, as if captured from nature itself. But the very presence of an impossible object —a machine that is alive—hails the audience to consider the techniques of animism at work in the image.

Of interest to this thesis, is the role of gender in figuring the liveliness of AI characters and narratives. Expanding on Leslie's theory of animation, Eric Herhuth (2017) argues that there is a "destabilising, unresolved dialectic" at the core of the animation tradition. The life of animation that is "like and unlike the life in us" is predicated on a dynamic that involves the "capacity to both continuously present a reality and subvert it" (Herhuth, 2017, p. 42). Animation is defined not just in terms of movement but movement in relation to other static elements. He writes, "Since animators frequently use drawings and other static forms to indicate movement, their work relies on human perception; for example, the contour shape of a flexed muscle can convey movement without any actual movement" (Herhuth, 2017, p. 42). This principle can be extrapolated to understand the animism of animated images more broadly—that movement and vitality are achieved through already familiar human perceptions of life. It is my contention that sexuality and gender function as the "already

familiar" that gives rise to the animism of animated AI figures. Significantly, however, the "already familiar" tropes are themselves caught within animation's destabilising dialectic. Like cartoon figures, gender and sexuality are "squashed and stretched:" exaggerated in ways that exploit our sense of familiarity. In the tradition of Disney animation, gendered tropes and narratives are figured by a system that aims to present elements, not as they are, but as caricatural, through a form of stylised realism.

Gender's vitalism

As many writers have noted, *WALL-E* is a film driven by nostalgic and normative forms of desire and sexuality (see Halberstam, 2011; Herhuth, 2014; Murray & Heumann, 2011; Sobchack, 2009). Despite also containing themes critical of monopoly capitalism, alienation in the digital age, and ecological disaster wrought by mass consumption, Stanton has downplayed these as merely the backdrop against which to stage an intergalactic romance. As he states in one interview, "I don't have a political bent. I don't have an ecological message to push. I don't mind that it supports that kind of view. It's certainly a good citizen way to be but everything I wanted to do was based on the love story" (Stanton in Weintraub, 2008).

The love story in question is between WALL-E and a sentient robot named EVE. Short for Extra-terrestrial Vegetation Evaluator, EVE has been sent by the luxury spaceship, the *Axiom*, to investigate for signs of organic life on Earth. Depicted as a more technologically advanced AI, EVE is initially focused on her programmed directive—to deliver back to the *Axiom* evidence that the planet might once again be inhabitable. After a tense first encounter, their relationship blossoms after he guides her to safety during a freak dust storm. Taking shelter in his bunker, he shares with her his collection of treasures, one of which includes a small seedling. The plant activates EVE's internal programming, which in turn triggers a series of events that eventually leads both characters into outer space and to the *Axiom* to deliver news of Earth's new-found viability for life.

This romantic narrative re-stages with robots the archetypal markers of heteronormative life: courtship, domesticity, and the promise of reproduction. Here, questions of human nature and "natural" life are muddled through their enactment by artificial bodies. These stereotypical narratives are both familiar and unfamiliar, conformist and yet somehow radically new within this context. After scanning the plant, EVE's hardware is taken over by its auto-functions. The plant is sucked into her body and she has a full-system shutdown to protect the valuable specimen inside. In this metaphor for pregnancy, EVE's body becomes an incubator for WALL-E's seed. Her surrender to her hardware's programming is analogous to traditional views that see childbearing as part of "nature's programming." These metaphors take tropes of

gender and sexuality to their conceptual limit, substituting and exaggerating elements to an absurd degree while still triggering an unmistakable recognition.

This is most clearly expressed in the gendered aesthetics of the two characters. For the design of WALL-E, the Pixar team concentrated on making him appear sturdy, practical and well-used. They made field trips to recycling stations to observe the large trash compacters at work and brought in bomb-detection robots and other all-terrain vehicles in order to replicate their coarse and rocky movements. As a result, WALL-E is physically reminiscent of large industrial machinery: he has continuous track wheels, black and white warning stripes, and a rusted yellow steel chassis for a body. In contrast to the rugged and mechanical WALL-E, EVE is smooth and slick. Jonathan Ive, Apple's Senior Vice-President of Industrial Design, was brought in as a consultant for the Pixar team. As a result, EVE unsurprisingly resembles an Apple iPhone with a deceptively simple, white, egg-shaped body that hides an array of complex circuitry underneath. Unlike WALL-E who trundles on wheels, EVE floats above the ground and moves with an effortless, fluid motion.

Gender is here expressed through a range of visual and symbolic stereotypes. EVE is white, pristine, and clean while WALL-E is weathered, dirty, and rustic. EVE is driven, efficient, and precise, while WALL-E is romantic, clumsy and escapist. These dualistic metaphors also reach into class. Where WALL-E can be read as "working class," embodying the machinery of primary industries such as agriculture and mining, EVE on the other hand resembles a laptop or smartphone—the tools of the "knowledge class." This difference can also be interpreted generationally: where WALL-E is like an early-generation personal computer, whose body is open and can be easily repaired and upgraded, EVE is like a "smart" device whose seamless edges are designed to keep the user out. Taken together, these differences replicate the dualistic structure of sexual difference in machines that otherwise have no biological sex.

These dualistic metaphors play into heteronormative tropes regarding the personification of sexual difference as complementarity. Sexual difference in this discourse is understood as a biological division between male and female bodies and the corresponding (or consequential) social and psychological differences that accompany this divide (Connell & Pearse, 2014, pp. 10-11). In moral theology, this is exaggerated to argue for an innate compatibility, interconnectedness, and interdependence between two different genders. This assumption asserts itself through dualistic monism—an understanding of gender as two complimentary polarities that come together to form a natural unity and wholeness. Wholeness, here, translates to heteronormative pairing for the greater purpose of reproduction. This line of argument has been consistently deployed to discredit a range of identities and communities as "unnatural:" same-sex relationships, non-monogamous relationships, polyamorous

relationships, queer, trans, non-binary, and other identities that complicate what Judith Butler (2011) calls the "heterosexual imperative" (p. 2).

These tropes, metaphors and narratives of gender, sexuality, and sexual difference are placed in stark relief when contrasted with the humans aboard the *Axiom*. In her analysis of life on the ship, Sobchack (2009) describes the "frenzied animated movement and blur" (p. 376) of robots as they zip through corridors. She focuses on one scene in which a man falls out of his hover chair and flails helplessly on the ground. A team of robots rush to cordon him off as an automated voice announces "Please remain stationary. A service bot will be with you momentarily" (see Fig. 3). Sobchack reads this moment as illustrative of the transferral of life from humans to machines via the depiction of movement:

> On the *Axiom*, Cholodenko's 'motion of life' has become clearly 'anaemic' (however, bloated), whereas, in contrast, 'the life of motion' has become both literally and metaphorically 'vital.' Indeed, animation in this instance is almost completely transferred to the zippy, busy machines that perform automatically and tirelessly the labour—the 'effort' necessary to both human movement and human life.
>
> (p. 376)

Like motion, gender too is transferred from human to machine in a shift of "vital" force. Unlike the clearly aestheticised and differentiated bodies of WALL-E and EVE, the men and women aboard the *Axiom* are physically androgynous. They are all drawn with the same infantilised stature and wear identical uniforms. The flattening of physical difference here gestures towards a flattening of sexual difference, a representation that is intended to put into question the viability of "natural" reproduction.

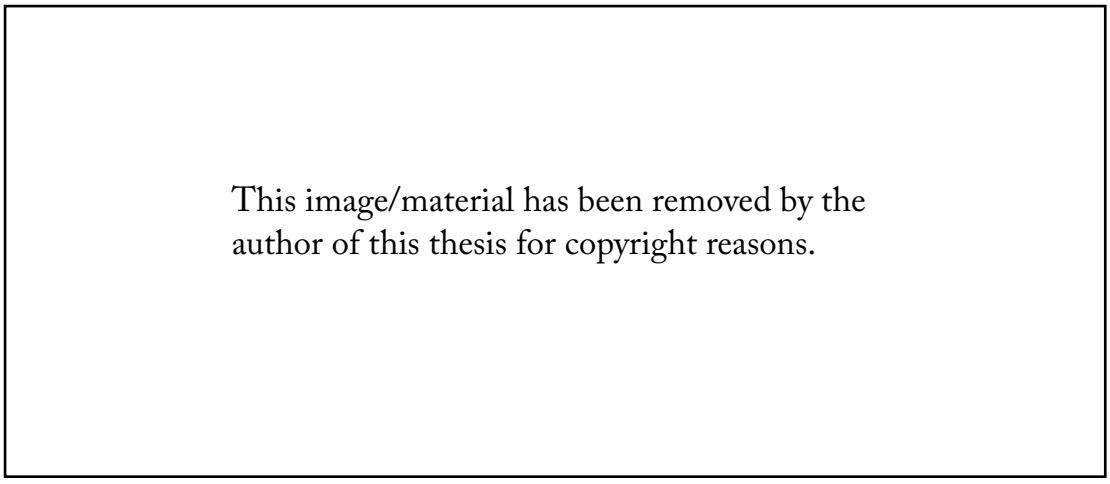

Fig. 3. *A man flails helplessly on the ground and is assisted by robots*. Screenshot by author. Source: Stanton, A. (Director). (2008). *WALL-E* [Motion Picture]. United States: Pixar Animation Studios.

In science fiction films, androgyny is often used as a technique to create feelings of ambiguity and alienation in AI characters. Analysing films such as *Liquid Sky* (1982) and *Blade Runner* (1982), Janet Bergstrom argues that androgyny can sometimes indicate "'more' sexuality, meaning *both* feminine *and* masculine appeal" but this can easily switch such that "virtually the same image can also be used to signal the eradication of sexuality" (1986, p. 40). The sudden withdrawal of sexual identity is tied to an abandonment of social mores. This narrative device is intended to communicate a profound dehumanisation, something that marks characters as more than just superficially alien.

Aboard the *Axiom*, this technique of androgyny is applied not to the AIs but to question the integrity of human life on the ship. Babies are shown being raised and educated by machines while adults are represented as entirely cocooned by the technology around them. In one scene, WALL-E interrupts a woman absorbed by her screens to ask if he can move past her. Suddenly aware of her surroundings, she gasps in awe at the size of the ship and gazes at the stars in space she has never noticed. In her excitement, her hover chair bumps into a man who is then also awakened from his digital cocoon. Their hands touch and both blush in a moment of mutual attraction. Humans are here alienated not just from each other but from processes tied to reproduction. In this moralistic story, only a recuperation of the heterosexual imperative can humans return to their "natural" state.

Gender, squashed and stretched

In *Pixar and the Aesthetic Imagination* (2017), Herhuth discusses the aesthetic principles that inform Pixar's approach to animation. He describes the "stylised realism" championed by John Lasseter, chief creative officer at Pixar and Walt Disney Animation Studies. He writes that for Lasseter, "storytelling drives technological innovation, believability is preferable to realism, and emotionally compelling character growth serves as the foundation to every film" (Herhuth, 2017, p. 22). In this way, Pixar leans heavily on the Disney animation tradition, redeploying basic principles of animation within CGI contexts in order to recreate the "illusion of life" (see Johnston and Thomas, 1995).

This approach of stylised realism guides both story elements and animation style. American animator Ralph Eggleston describes the Pixar aesthetic as "a cross between live-action reality and a typical squash-and-stretch cartoon world" (cited in Telotte, 2010, p. 205). Anthropomorphic fish are animated against photorealistic coral reefs. Naturalistic hair is meticulously applied to seven-foot tall monsters. In the case of *WALL-E*, big baby-like adults and robots who fall in love are set against the backdrop of a decaying Earth so convincingly simulated critics described it as "the finest environmental film of the last decade" (Wilkinson, 2017). Hyperreality ironically brings audiences closer to "real" life than photorealism.

Herhuth argues that, traditionally, computer animation has been understood as dovetailing with the legacy of photographic cinema. In the latter, photo-indexicality prompted audiences to question cinema's status as an artistic medium. In response, filmmakers sought to "conspicuously display their craft and creativity through cinematic illusion and tricks" (Herhuth, 2017, p. 37). Computer animation, however, reverses this tradition through the pursuit of perfect simulation. Throughout the 1990s and 2000s, digital techniques presented opportunities to challenge the fixation with photorealism, commercial incentives propelled a technological race to create images that were close, if not perfect, replications of the real world. As Herhuth (2017) writes, "photography may have relieved human hands from the work of visually recording reality and enabled them to pursue abstraction, but the computer has renewed interest in the mythic quest to draw reality" (p. 37).

Pixar's own history is grounded within this tradition of photorealism. While still branded under the Lucasfilm Computer Division banner, the goal of the computer graphics team was to create high-quality graphic images, where "high quality means virtually indistinguishable from live action motion photography" (cited in Cook 2015, p. 54). Interestingly, the mathematical principles used within Lucasfilm's first test scenes share a similar history to Pixar in its relationship to nature and representationalism. In his analysis of early Lucasfilm animations, Malcolm Cook (2015) identifies the use of mathematician Benoit Mandelbrot's work on fractals to create natural looking landscapes. Fractional dimensionality describes how details in a pattern changes with the scale at which it is measured. In Mandelbrot's famous example, he describes how the length of the coast of Britain increased the closer the observer got to it. While pure mathematics had been considered a form of abstraction—a language removed from nature—for most of the twentieth century, Mandelbrot's theory was revelatory as it worked to more precisely model nature's patterns, to position it as "an index to nature" (Cook, 2015, p. 58).

The move towards stylised realism can be understood as a part of an ongoing dialectic between artifice and authenticity. The artificial worlds of Pixar extend reality beyond its ordinary metaphysical limits and in doing so persuade the audience that it was never artificial at all. Imperfections in the image are accepted as simply a quirk of the animated world rather than as an aesthetic or creative failure. That is, they are true in their own right, even if not in real life. Pixar's stylised realism is, then, a technique for dictating the terms of believability; as Herhuth (2017) writes, it is an approach that "aims at creating movement, characters, and stories that are captivating enough for audiences to forget about that explicit artificiality to varying degrees" (pp. 22-23).

In *WALL-E*, gender and sexuality are also negotiated through a stylised realism designed to conceal its own artifice. In addition to the use of archetypal gender tropes, the film is

nostalgic for narratives of courtship and romance of an older Hollywood generation. This is expressed in WALL-E's obsession with the 1969 film *Hello, Dolly!* He watches scenes from the film on a gleaned beta-max tape rigged to an iPod screen and models his own courtship rituals directly on character actions. In one of the film's most charming scenes, WALL-E uses a celluloid film canister as a hat, spinning in circles and tipping the lid on his head to mimic the dance movements of actor Michael Crawford (see Fig. 4.).

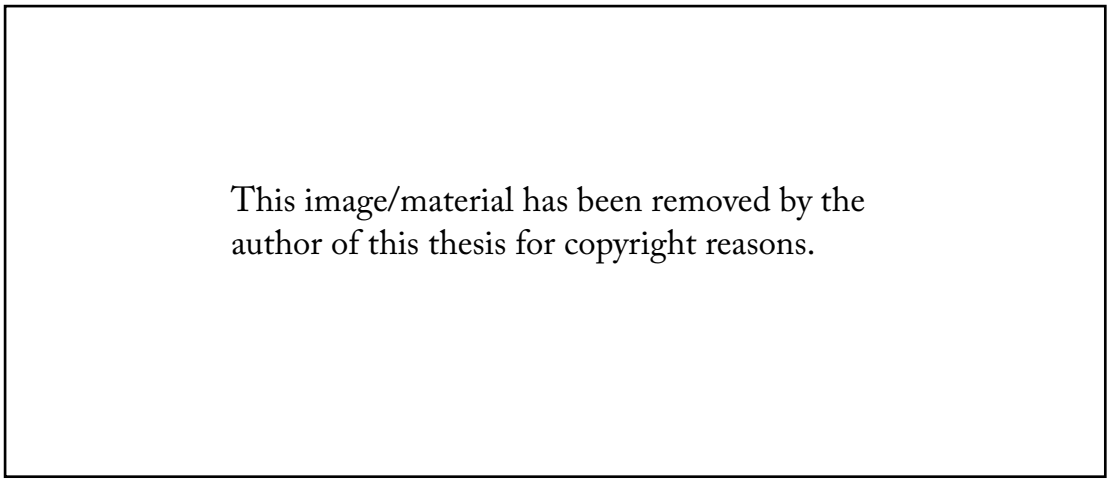

Fig. 4. *WALL-E uses as celluloid film canister as a hat and dances for EVE*. Screenshot by author. Source: Stanton, A. (Director). (2008). *WALL-E* [Motion Picture]. United States: Pixar Animation Studios.

While WALL-E comes to life through this stylised imitation of a live-action performance, *Hello, Dolly!* was a film ironically criticised for being unbelievable. Based on a Broadway production of the same name, the film was touted as the last great directorial hurrah for screen legend Gene Kelly. Set in turn of the century New York City, Dolly Levi (played by Barbara Streisand), is a matchmaker seeking a wife for the grumpy, though incredibly wealthy, Horace Vandergelder (Walter Matthau). The story includes extravagant song and dance numbers with actors dressed in lavish period costumes. Considered out-of-date even in the year of its release, *Hello, Dolly!* was panned as "campy" and "over-the-top." Critics argued that the 27-year-old Barbara Streisand was wildly miscast as a middle-aged Dolly and in one review her performance itself was criticised as "arch and calculated" such that "one half expects to find a key implanted in her back" (*Time*, 1969). Like Chaplin, the use of mechanical metaphors by critics was used to point to the dehumanising elements of character and story—though in Streisand's case, this was clearly intended as a critique. Despite performing reasonably well at the box office, *Hello, Dolly!* failed to recoup on its exorbitant production costs and is now remembered as "one of Hollywood's foremost Turkeys" (Henderson, 2003).

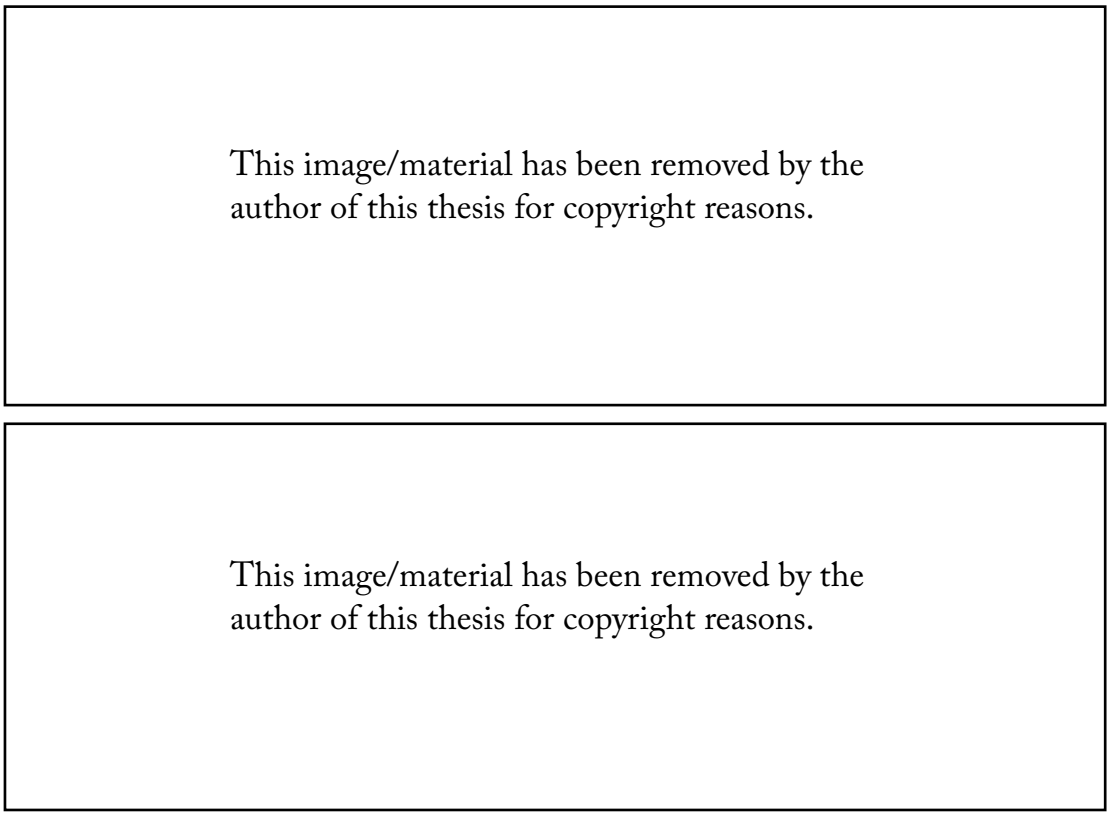

Fig. 5a & b. *Film credits depicting machines and humans working together*. Screenshot by author. Source: Stanton, A. (Director). (2008). *WALL-E* [Motion Picture]. United States: Pixar Animation Studios.

The appropriation of the film in *WALL-E* raises interesting questions for gender and stylised realism. Like stylised realism, stylised gender is here used to naturalise artificial characters. In the case of WALL-E, his adoption of chirpy songs and clichéd tropes of romance made his character seem alive, even while those same tropes made his live-action counterparts appear stiff. Gender and sexuality here oscillate between authenticity and artifice. WALL-E's liveliness is figured by unmistakably gendered and heteronormative modes of characterisation. The "authentic" performance of personhood is contingent upon a perceived "authentic" performance of gender. Authenticity in this case does not mean to true to life, but true to the expectations to which we hold life. As discussed in the sections above, in *WALL-E* life is premised upon a recuperation of the heterosexual imperative: first by machines who sentimentalise and mimic an older form of humanity, then by humans who recognise their collective alienation and work together to return to a terrestrial presence. In the film's final scenes, the *Axiom* is shown returning to Earth with its captain planting the delicate seedling in the ground. A toddler waters the plant while the other humans from the ship wobble to find their feet. Here, the heterosexual imperative secures the regenerative promise of new life.

Paradoxically, however, this very use of gender as "an index to nature"—to naturalise artificial bodies—gestures to its own artifice. No longer an essential part of the body, gender is represented as a performative and imitative system, one that can be so explicitly defined that even a machine following the correct procedures can enact it. While this potentially radical message is neutralised by the other moralistic aspects of the story, *WALL-E* still offers a glimpse of another kind of nature. Indeed, the concluding credits of the film illustrate how the life now taking place on Earth is "like and unlike" the story of life we already know. It shows the story of human evolution, from agrarian societies to urban life. But this story is new, with humans working alongside robots to sow seeds, pick maize, and catch fish. The animation style follows movements in art history, from ancient Greek mosaics to impressionist paintings (see Fig. 5a & b). This sequence blends together past and future to write a new history of life between humans and machines. It illustrates in exemplary fashion Leslie's (2014) seminal argument on animated film: that "it reinvents not only nature but our relationship with nature" (pp. 29-30).

Life, reanimated

The complex figurations of AI and gender made possible through computer animation's eschewed mimetic realism have led scholars such as Jack Halberstam (2011) to declare it an ideal medium for queerness, revolution, and revolt. He argues that the genre of children's animation allows them to address content that would otherwise never be possible in adult-themed films: "Animated films are for children who believe that 'things' (toys, nonhuman animals, rocks, sponges) are as lively as humans and who can glimpse other worlds underlying and overwriting this one" (Halberstam, 2011, p. 28). He argues that new animation studios, such as Pixar and Dreamworks, revel within new and innovative means of storytelling. The changing nature of the visual medium allow them to indulge in "the wonderfully childish territory of revolt" (Halberstam, 2011, p. 28). For instance, films like *Chicken Run* (2000) that narrate the story of a sisterhood of chickens seeking escape from their industrial life on a farm, offers a powerful allegory for class struggle, exploitation, exodus, and utopian futures. Such allegories rich in queer and socialist messages are only possible because the aesthetic worlds in which they are contained are already filled with atypical and anarchic forms of life.

But just as they push life to the edges of new possibility, animated films can as easily reinstate the hierarchies of traditional worlds. Looking to the history of Disney, Halberstam notes that in its early years it specialised in the representation of utopic spaces. These worlds were so enticing they were celebrated by theorists like Walter Benjamin and filmmakers like Sergei Eisenstein. Eisenstein (1986) famously declared Disney "a marvellous lullaby for the suffering and unfortunate, the oppressed and deprived… 'golden dreams' you escape to, like

other worlds where everything is different, where you're free from all fetters" (p. 4). But before too long, Disney films "resolved into a bourgeois medium; they quickly bowed to the force of *Bildung* and began to present moral fables with gender-normative and class-appropriate characterisations" (Halberstam, 2011, p. 22). The use of animation and political cartoons for WWII propaganda demonstrated how such images were more than capable of towing the ideological line.

Halberstam names *WALL-E* as one such film that turns away from its revolutionary potential. He reads early scenes on Earth of WALL-E combing through garbage and throwing away diamond rings while keeping the velvet box in which it sits as "a fantastic rejection of commodity fetishism," which is then, disappointingly, overturned by a Hollywood love story that sentimentalises and conforms to narrow notions of reproductive life (Halberstam, 2011, p. 22). How might we explain the failure of *WALL-E* to fulfil the radical potentials that Halberstam argues are latent within its medium? And how does this delimit the possibilities for gender?

One reason might be that *WALL-E* is a story that appeals more to adults than to children. It is a film that is rich in intertextual references to science fiction classics, such as *2001: A Space Odyssey* (1968) and *Alien* (1973), on top of its overt references to Hollywood staples, like *Hello, Dolly!*, Chaplin and Keaton. The joy in recognition is here arguably reserved for a more film-literate and adult audience. Similarly, the treasured objects of childhood in WALL-E's bunker that inspired wonder in critics are not designed for children *today* but for adults *who were once* children themselves. Indeed, would a child in 2008 even recognise a celluloid film canister, beta-max tape, or even an iPod? In this way, *WALL-E* exploits forms of sentimental and nostalgic attachment that are simply not available to children.

But another explanation can also be found by turning back to animation theory. Leslie (2002; 2014) argues that animation's logic of life and death mirrors that of commodity fetishism. Revisiting Marx, she describes the displacement of value between worker and object as analogous to the anthropomorphism in animation:

> the machinery uses the worker—and the producer of things empathises with the manufacturing machines, and its 'fetishistically driven objects', so much as to supplant its own self as their 'soul'. Fetishism's processes freeze humans in the icy air of reification: humans become things; things become humans.
>
> (Leslie, 2002, pp. 6-7)

Animation is in many ways the ideal industrial commodity. The very work of animators is inherently subject to commodity fetishism. The more effective they are in bringing a character

to life, making it appear as if it is moving on its own accord, the more it obscures the animator's labour. The labour practices of animation studios, such as Disney Pixar, are paragons of modern industrialisation and mass cultural production, with timelines for future projects, sequels, and spinoffs already in motion before current projects reach their end. This conveyor belt logic is also tied to lucrative distribution and merchandising deals that ensure the maximum extraction of surplus value from the design of every single character image. Indeed, this is taken even further in the era of computer animation as character design is carried out using the same digital tools as industrial product design. As design scholars, such as Leon Gurevitch (2012) have argued, it is no coincidence that Pixar chooses commodity objects, such as toys and cars, for their stories; the computer graphics programs used for animation are the same ones used by the advertising industry. Well-rounded critiques of commodity fetishism are then unlikely, or at least disingenuous, given the nature of its own industry. Stanton's evasion of the film's political messages suggest that he too is aware that any call for revolt would put his own position at risk.

The multiplicities and contradictions of the Pixar medium are not easily resolved. Like the critique of commodity fetishism, gender and sexuality are also caught within this conflict, offering glimpses of change before being suddenly withdrawn. For Leslie (2013), this predicament is illustrative of animation's "ambivalent renderings of the real—it is stuck in a form of life and world simulation, which can be read symptomatically—or critically—as an inability to move on socially, to sketch out new lives and worlds" (p. 92). In *WALL-E*, gender is more than just figured by animation: it is trapped within its dialectic of movement accompanied by stagnation, new life as defined through old narratives. In the next on chapter on film, AI and gender, I turn to a very different case study. Where gender is here used to give life, to animate and bestow subjectivity, *Ex Machina* is a film that uses tropes of gender and sexuality to do the very opposite.

Chapter seven

Programming gender in *Ex Machina*

At the 2015 SXSW festival in Austin, Texas, users of the dating app Tinder began matching with an attractive 25-year old woman named Ava. She asked them candid questions via text message: Have you ever been in love? What makes you human? What attracts you to me? As the conversation progressed Ava would eventually send through an Instagram link with pictures and videos promoting a science fiction film premiering the same weekend. It soon became clear that Ava was not a real person but an advertising chatbot designed to promote *Ex Machina* (2015), a new feature film from British filmmaker Alex Garland. The woman in the profile pictures was Alicia Vikander, the actress who plays the role of a sentient AI whose consciousness is being tested in a modified Turing test. The message exchange between a deceptive bot and a naïve receiver searching for intimate connection ingeniously mimicked the narrative of the film. It also neatly illustrates the film's key figuration of gender: that in digital life, gender is algorithmically mediated.

This figuration reflects broader cultural anxieties over the integration of AI and algorithmic systems into ever more personal parts of daily life. Our relationships to institutions, colleagues, loved ones, and even ourselves, are today unavoidably intertwined with digital actors driven primarily by the logics of platform capitalism (Srnicek, 2016). The world's largest media and technology companies like Netflix, Spotify, Amazon, and Google profit not just from the collection of user data but from the prediction of user preference. Sophisticated recommender algorithms designed to capture attention (and, thereby, retain paying subscribers) have moved towards models of personalisation based on increasingly granular and agile forms of data collation (Seaver, 2019, pp. 421-432). While the depth and breadth of claims towards perfect personalisation are often overstated, the corporate promise to know the unconscious aspects of our personalities are nevertheless alarming. *Ex Machina* is a film that takes these anxieties to their furthest limits. It positions the most private and intimate parts of one's identity—feelings, emotions, and latent sexual desires —as a part of a technological system that can be deployed against us. This system works efficiently, autonomously, and often in ways that elude even its own makers.

In this second chapter on film, AI and gender, I analyse *Ex Machina* as a cultural text that epitomises contemporary figurations of gender as a variable within an algorithmic system. I

analyse this figuration through different elements: the narrative diegesis, the marketing material, and the digital techniques used in the VFX post-production process. Where in the previous chapter I argued that gender animates AI characters and narratives, in this chapter I examine how gender is used to do the very opposite. Characters like WALL-E and EVE show how technologies can be gendered, embodying characteristics that give them an anthropomorphic quality, or more accurately, allow them to be fetishised. In *Ex Machina*, the reverse logic is applied: it is not *technology that becomes gendered* but *gender that becomes technologised*. In this figuration, gender is systematised, codified, and reduced to a programmed set of instructions that can be used by machines to manipulate and deceive. Gender, here, is no longer understood as an index to nature but as a sign of the creeping artifices of algorithmic culture. Understanding gender through its figuration with code raises pertinent issues concerning race, data, and bias. In the film, this is reflected through a problematic representation of racialised figures, specifically techno-Orientalist tropes of labouring Asian bodies. This representation is exemplary of one of the key challenges of the algorithmic age: that racism is an indivisible part of sociotechnical systems and, as such, cannot simply be uncoded.

Visualising Ava

Unlike many science fiction genre films, which are set in distant futures and galaxies far away, *Ex Machina* is grounded in much closer timelines and locales. Garland, who was both writer and director, describes it as being set "10 minutes in the future" (Whale, 2015). The film opens with shots of Caleb (Domhnall Gleeson), an employee of Blue Book, the world's most popular search engine. Under the guise of winning a company wide lottery, he is selected to visit the CEO, Nathan (Oscar Isaac), at his house in a remote, undisclosed location. Nathan is a "brogrammer," a gifted and eccentric computer scientist whose residence is also a research facility. The only other person who resides there is Kyoko (Sonoya Mizuna), who we are told is a mute Japanese maid. It is quickly revealed that Nathan has been working on a secret project, a bona fide artificial intelligence, and has brought Caleb in to help determine whether it is conscious or not. The AI in question is a humanoid robot named Ava. Gendered female, Ava possesses a woman's voice and body. Unlike in a traditional Turing test in which the interlocutor does not know they are conversing with a machine, in this version Caleb interacts with her directly. As Nathan explains, "If I hid Ava from you, so you just heard her voice, she would pass for human. The real test is to *show you* she is a robot then see if you still feel she has a consciousness."

Ava is at all times imprisoned in a glass walled room under constant surveillance by Nathan and his array of CCTV cameras. Over the course of the film we are taken through

seven different sessions between Ava and Caleb. As these sessions proceed, Caleb feels more and more connected to Ava, with whom he communicates through the transparent walls of the cell. Ava repeatedly uses her charging system to trigger blackouts and shut down the surveillance system. It is during these blackouts that she discloses privately to Caleb information about the facility and Nathan who she says is a "liar" and "who cannot be trusted." As time goes on, Caleb becomes convinced that Ava's confinement is a form of abuse. He learns that Nathan eventually plans to dismantle and reprogram Ava, a move that would erase her mind and effectively kill her.

Caleb and Ava form an elaborate plan for rescue that dramatically goes awry. In the final act, it is revealed that Nathan's true intention was to use Caleb as bait to test Ava's evolving mind. In this regard, she passes spectacularly, surpassing all expectations to free herself from the glass prison. She and Kyoko (who by now we have learned is also a robot) collude to kill Nathan. In the final scenes, Ava appropriates components from previous robots to acquire the appearance of a real woman. She silently walks out of the compound, leaving Caleb trapped inside, alone.

Like *WALL-E*, *Ex Machina* is a film that can also be understood through the dialectics of its own medium. It is a live-action feature that relies heavily on the use of digital visual effects to animate characters and narrative. Ava and Kyoko are played by actors whose performances are supplemented using production and post-production techniques. Ava's form is a composite of the actress' body, elaborate makeup and costuming, as well as digital effects. Vikander was fitted with a prosthetic headpiece to create the illusion of skin sitting on metal. She wore a tight mesh body suit, sections of which were edited out in post-production and replaced with digitally animated machine parts. A trained ballerina, she plays Ava with remarkable control and grace that, in combination with the other elements, culminate in a flawless performance (see Fig. 6).

Film theorist Stephen Prince (2012) describes this kind of technologically constituted performance as "a recombinant element of cinema" (p. 144). He states that audiences experience such digital characters as composited image layers synthesised to give the illusion of continuity. With thanks to behind-the-scenes featurettes and interviews with production staff, many audiences are now aware of the intense labour invested to bring digital characters to life. *Ex Machina* used more than 800 VFX shots, 350 of which were of the AI robots. Unlike many digital creatures, Ava was not created using green screen techniques. To ensure that the connection between characters and dialogue was at the centre of the action, filmmakers shot the scene with actors in the frame, then re-shot again with a clean pass, mimicking as closely as possible the scene's original camera movements. Visual effects artists then painted out sections of the actors and replaced them with body-tracked animation

(Bishop, 2015). In this instance, the success of the performance on screen was as much attributable to digital tools as it was to the actors themselves. As Prince (2012) writes, "Virtual performance does not end with the contours of the actor's body. The body itself is malleable and susceptible to alteration and extension, and the performer on camera may be a recombinant product formed of flesh and computer algorithms" (p. 116).

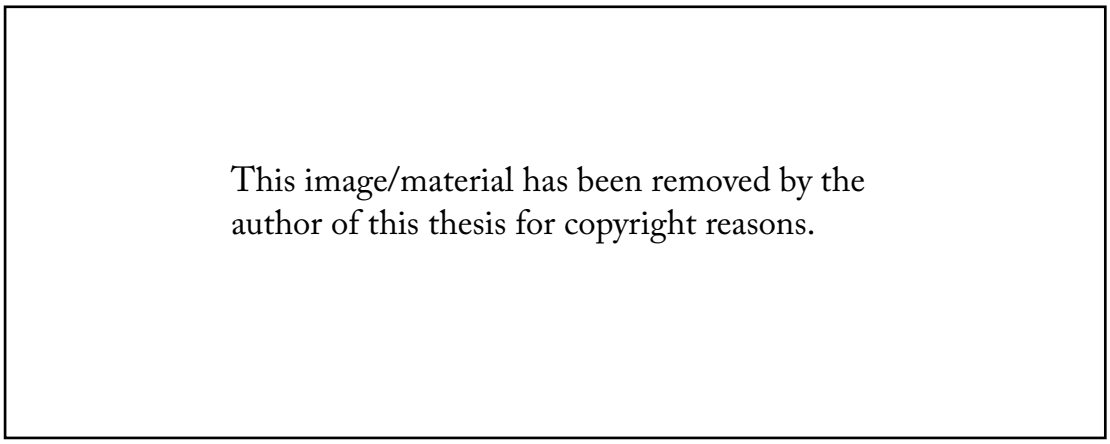

Fig. 6. *Alicia Vikander as Ava*. Screenshot by author. Source: Garland, A. (Director). (2014). *Ex Machina* [Motion Picture]. United Kingdom and United States: A24.

The algorithmic construction of performance in the screen image here mirrors the algorithmic construction of gender in the diegesis. In the same way that Vikander's gendered body was painstaking traced and, bit by bit, reconstructed using digital techniques, Ava's gender too is an amalgam of programmed elements. In one scene, Ava provides insight into how she processes and acts upon information provided by Caleb. During one of her sessions, Caleb flippantly responds to her suggestion to visit a traffic intersection with "It's a date!" Presented with this response she excuses herself so that she can show him a surprise. She returns with a wig and clothes that cover her machine parts. Looking more like a young girl than a machine, she says "This is what I would wear on our date." She goes on to ask a blushing Caleb, "Are you attracted to me? You give me indications that you are." When asked how she knows, she responds "Micro-expressions. The way your eyes fix on my eyes and lips. The way you hold my gaze, or don't." Here, the mechanics of sexual attraction are open for analysis. Desire is not a spontaneous eruption of emotion per se but a process that can be triggered, a program that can be initiated.

Much like the visual effects, the conceit of the narrative rests on techniques of deception. Film and media theorist Kristen Whissel (2014) contends that filmmakers often use diegetic strategies to distract audiences from the artificiality of digitally created characters. Building on Prince's (1996) concept of "perceptual realism," she argues that films with digital creatures create moments of "staged indexicality" that anchor them in Newtonian physics and thereby create the illusion of presence within a physical world (Whissel, 2014, p. 114). She cites the

famous scene in *Jurassic Park* (1993) in which the arrival of the T. Rex is signalled by ripples on the surface of a cup of water. Similarly, in films like *Cloverfield* (2008), the representation of the creature through the lens of a video camera gives it a sense of embodied presence through a realist mode of referentiality. In *Ex Machina*, production designers studied human anatomy alongside the engineering principles of Formula 1 racing cars to create a mechanically sound design for Ava's body. The VFX team animated not only Ava but the reflections of her pulsating mechanical parts in the glass windows. One of the glass walls of her cell contains chips and cracks created by previous AI experiments, a technique that Whissel argues grounds the diegetic action within a timeline of past events. The drawings that Ava creates throughout her sessions are impossibly precise, not realistic like the hand of a talented human artist, but closer to images produced by computer vision programs. They reflect networks and patterns rather than meaning and form. The drawings, created with pencil on paper, are designed to emphasise that while Ava's mind is driven by ephemeral software, she still has a material presence. These indexical techniques are all intended to conceal the obvious artifice before our very eyes. As an interrogator, Caleb is aware that he is conversing with an artificial being, yet he allows himself to believe the connection between them is real. As an audience, we know the figure before us is an actor whose performance is composited from different image layers, yet we lean into the perception of the character as a continuous image. Commenting on Ava's design, Garland has said that the intention was to create "this sense of a girl flickering in your periphery vision while you're looking at a machine" (A24 2015). Indeed, the film strategically exploits these ambiguities in perception as a diversion tactic. Gender is here figured as a technology, part of a greater technical system that is invested in the manipulation of human behaviour.

Automation, surveillance, capitalism

It is my contention that this figuration is indicative of a growing anxiety over the algorithmic mediation and modulation of identity. As scholars of media and digital culture have concisely argued, these anxieties are tied to a number of contemporary changes: the increasingly central role of data to economic growth, the expanding capacities of digital infrastructure towards capturing this data, and the attendant transformations in capitalism that emerge to exploit such opportunities. Nick Srnicek (2016) uses the phrase "platform capitalism" to describe advancements in twenty-first century capital accumulation around the extraction of data as a raw material. He states:

> Data have come to serve a number of key capitalist functions: they educate and give competitive advantage to algorithms; they enable the coordination and outsourcing of workers; they allow for the optimisation and flexibility of productive processes; they

> make possible the transformation of low-margin goods into high-margin services; and data analysis is itself generative of data, in a virtuous cycle.
>
> (pp. 41-42)

He identifies digital intermediaries, explicitly platforms, as the most efficient means for commercial organisations to "monopolise, extract, analyse, and use the increasingly large amounts of data that were being recorded" (p. 43).

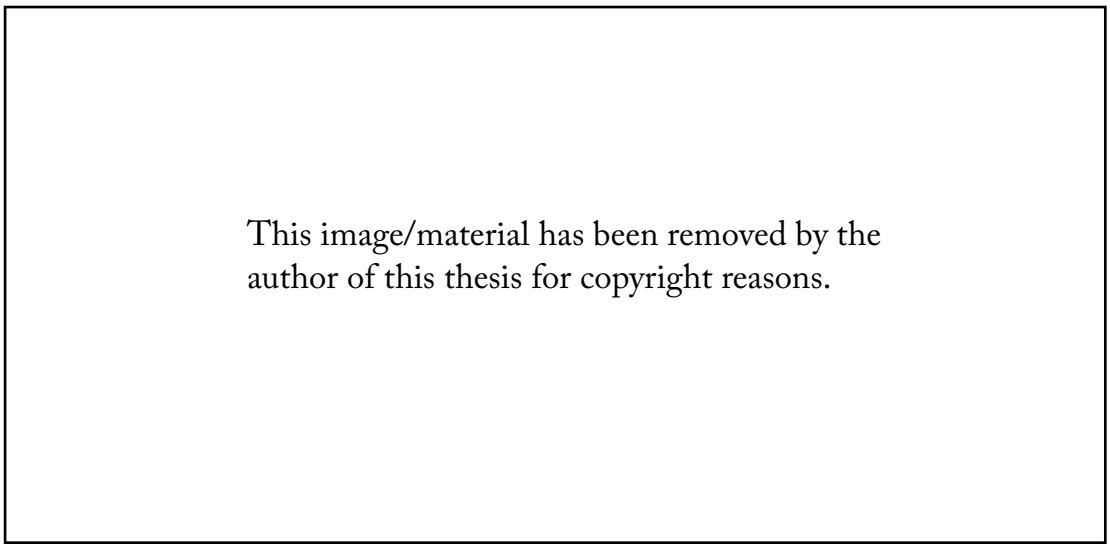

Fig. 7. *Caleb's face being scanned by image-recognition software in the opening scene*. Screenshot by author. Source: Garland, A. (Director). (2014). *Ex Machina* [Motion Picture]. United Kingdom and United States: A24.

Building on this, Mark Andrejevic (2019) has outlined the changing logics of surveillance that accompany forms of automated data collection and processing. He highlights the expansion of private monitoring infrastructures, such as smart speakers, smart cameras, and other portable networked devices, that exist to capture data from our daily interactions. The introduction of automated surveillance has enabled a "capacity to imagine the possibility of total data capture" the effect of which sanctions "the prospect of comprehensive, always-on ubiquitous monitoring, and the implicit understanding that there is always a need for more" (pp. 9-10). The aim is ultimately pre-emption: to predict how people will act or respond in given contexts of environments. Pre-emption, powered by speculative predictive analytics, operates using a logic of framelessness in which there is no delimitation of what is to be collected, sorted, or analysed. With no pre-selection criteria, he warns "we can expect that the data collection infrastructure will continue to expand indefinitely: interactive devices will accumulate new and more sophisticated sensors to capture ever-expanding categories of information (biometrics, mood, etc)" (p. 12).

These observations are synthesised well under Shoshanna Zuboff's (2019) phrase "surveillance capitalism." Where Andrejevic emphasises the impact of automated surveillance on disciplinary regimes, drawing their connection to the logics of drone strikes and predictive policing, Zuboff situates it within the context of platform economies. Like Srnicek and Andrejevic, Zuboff emphasises the orientation of capitalist infrastructure towards comprehensive data capture. The power of pre-emption is instrumentalised in attempts to orchestrate profitable behavioural interventions. As she succinctly states, "Competitive pressures produced this shift, in which automated machine processes not only *know* our behaviour but also *shape* our behaviour at scale…it is no longer enough to automate information flows *about us*; the goal is to *automate us*" (p. 8).

In its representation of sentient AI beings, *Ex Machina* dramatises some of our worst fears of surveillance capitalism. In one scene, Nathan explains to Caleb how he managed to accurately read and duplicate human facial expressions:

> Almost every cell phone has a microphone, a camera, and a means to transmit data. So I switched on all the mikes and cameras, across the entire fucking planet, and redirected the data through Blue Book. Boom. A limitless resource of facial and vocal interaction…And all the manufacturers knew I was doing it too. But they couldn't accuse me without admitting they were also doing it themselves.

He goes on to describe how the Blue Book platform constitutes the software of Ava's mind:

> It was the weird thing about search engines. They were like striking oil in a world that hadn't invented internal combustion. They gave too much raw material. No one knew what to do with it. My competitors were fixated on sucking it up, and trying to monetise via shopping and social media. They thought engines were a map of what people were thinking. But actually, they were a map of *how* people were thinking. Impulse, response. Fluid, imperfect. Patterned, chaotic.

The framelessness of total data capture here fulfils its imagined potential to accurately model the intricacies and complexities of human behaviour. As a surrogate for the audience, the manipulation of Caleb instinctively triggers fears of our own manipulation when using equivalent platforms. As the Snowden leaks and the Cambridge Analytica scandal revealed, data harvested through commercial platforms are routinely used without consent by third party actors. In the former, it was the state that was accessing Google accounts, among other platforms, to monitor the behaviour of everyday citizens. In the latter, it was political actors purchasing user Facebook data to create psychometric profiles in order to influence voters. In the film, Caleb recognises that he too has been the subject of intensive, covert surveillance.

"You selected me by my search engine inputs," he says in a moment of realisation. "Did you design her face based on my pornography profile?" Nathan responds facetiously, "Hey. If a search engine's good for anything—right?"

Ubiquitous surveillance is another element hiding in plain sight throughout the diegesis. The opening scenes are framed from the perspective of the eye of a machine. They show Caleb's face being scanned by his computer webcam and handheld device. His features are mapped by the gaze of facial recognition algorithms and thermal cameras (see Fig. 7). Screens are used consistently as motifs for surveillance: the television in Caleb's bedroom links directly to CCTV cameras in Ava's cell, Nathan's computer shows recorded footage from the conversation sessions, and the mirror in Caleb's bathroom routinely scans his face and body using image recognition techniques. Ava's own glass cell is symbolic of the screen between her and Caleb through which she processes data and information from their interactions. And not least, the silver screen itself exposes the audience's own subjection to surveillance in what Sean Redmond (2017) calls the "Liquid age" of digital cinema. Along with production techniques, methods of film distribution and consumption are also algorithmically mediated. The use of recommender algorithms by platforms, such as Netflix, adopt what Nick Seaver (2019) calls a "captalogical approach to design" (p. 430). For audiences watching *Ex Machina* on these platforms, the very act of viewing the film contributes to activity logs that are then used for personalisation. The aim is to match content based on previous interaction in order to gain user retention. The bulk release of television series designed to be watched in one viewing is indicative of this technique to trap viewers and capture more data.

Yet, even in this fantasy of total data capture, there are elements of friction and resistance. Despite having access to a limitless sea of behavioural information, Nathan still fatally underestimates the capabilities of Caleb, Ava, and Kyoko. He is shocked to learn that Caleb has anticipated his actions and re-programmed the facility's security protocols to release Ava. He makes a desperate attempt to reassert authority by telling Ava to go back to her room once she has escaped. He looks on in disbelief as Kyoko and Ava take turns plunging a sushi knife into his abdomen, using his last few breaths to whisper "fucking unreal."

These scenes illustrate the kinds of noise that pervade predictive systems. In describing different paradigms of algorithmic prediction, Seaver (2019) argues that models based on consumer ratings were "intrinsically unstable" and at some point always met a "magic barrier" (p. 429) to predictive accuracy. In seeking more reliable metrics, platforms turned towards measuring user attention; "just as repeated listens to a song could indicate a preference for it, so continued usage of a service was taken to indicate satisfaction" (Seaver, 2019, p. 430). Satisfaction conflated with retention turned recommender systems into traps. Ava's emancipation and Nathan's grim death can perhaps provide some critique of this new

regime of captology. In a poignant moment, Ava and Kyoko share a verbal exchange that is unintelligible to both Nathan and the audience. It epitomises the opacity of machine language and the often inscrutable means by which black-box algorithms make life-changing decisions. Captology is powered by a false belief in the reducibility of life's flows to data sets and analytics. As Andrejevic (2019) writes, "The peril posed by automated surveillance is not that it will be perfected but that we will act as it could be" (p. 12). These final scenes thus enact a kind of resistance to the fantasy of total information capture and drive home, with a knife, the dangers of technological hubris.

Programming gender

Caleb's realisation that even his pornographic preferences have been appropriated for the experiment brings attention to a key aspect of surveillance capitalism: that gender and sexuality operate as essential variables within algorithmic systems. *Ex Machina* dramatises Zuboff's claim that the aim of surveillance capitalists is ultimately "to automate us." In one scene, Caleb, confused by his feelings for Ava, confronts Nathan. He asks "Why did you give her sexuality? An AI doesn't need a gender. She could have been a grey box." Nathan responds, "Actually, I don't think that's true. Can you give an example of consciousness at any level, human or animal that exists without a sexual dimension?…What imperative does a grey box have to interact with another grey box? Can consciousness exist without interaction? Anyway, sexuality is fun. If you're going to exist, why not enjoy it?"

This conversation captures some of the subtle gender commentary at work in the narrative. While Nathan's comments are intended to describe the design of Ava and to explain *her* motivations, desires and actions, they equally apply to Caleb. One might similarly ask, what is the significance of *his* gender and sexuality in driving the story? Caleb's line of questioning betrays his own confusion and frustration at his uncontrollable attraction to Ava. He later asks Nathan, "Did you program her to like me?" Nathan responds, "I programmed her to be heterosexual just like you were programmed to be heterosexual." This conversation points explicitly to the technicity of gender and sexuality. Here, gender is figured as a programmable phenomenon being used in unprecedented ways by an intelligent machine[41] Yet, it also suggests that gender has always already been so. When asked in one interview why he thought people found the idea of AI so frightening, Garland responded by underscoring humanity's own programmability: "I think we're more like processing machines than we want

[41] I wish to make a distinction between gender *programmability* and gender *performativity*. Gender programmability refers to a conscious and strategic deployment of gender, which sits in contrast to Butler's meaning of performativity as a materialising and iterative practice. The latter addresses the fragility of gender, and underscores its emergence only through practices *with bodies*. The former addresses gender as a means to an ends, as a technology that is deployed *by bodies*.

to think we are…It disturbs people to think of their emotional connections in terms of electrochemical responses" (Seymour, 2015).

This figuration was also carried through into the film's marketing material. The Instagram account that was linked to the SXSW chatbot was filled with image and video content that alluded to surveillance, manipulation, and machine intelligence. Short trailers ended with the question "Who programmed you?" while posters adopted the aesthetics of computer vision, framing portraits of the actors like items in face-image datasets. Their faces were segmented and labelled with the personality traits of their characters: Caleb was labelled "talented coder", "demonstrates curiosity" and "strong moral compass," while Nathan was labelled "god complex" and "exhibits superhuman intelligence" (see Fig. 8a).

In one creative initiative, the marketing team launched a website called Ava-Sessions.com. It featured a simple landing page that simulated a conversation session with Ava. The user was asked to submit a name and to give access to their computer camera. Once given, the user's face would appear on screen within an emotion recognition interface. Computer vision software tracked and measured the user's face in real-time, mapping emotion on a grid with axes labelled "happiness," "sadness," "anger," and "surprise." The interface would then generate a portrait of the user, similar to the hand-drawn portraits created by Ava, composed of an intricate, subtly shifting network of prisms (see Fig. 9a & 9b). These drawing sessions invited the user to see from the perspective of a machine. Though it was highly aestheticised and made no claim to accuracy—as if accuracy was even tenable within the context of face emotion recognition (see Crawford and Paglen, 2019)—it gave some insight into the categories that underpin technical systems and allowed users to reflect on how they themselves might be classified by algorithms elsewhere.

While using the website to create my own machine generated portraits, I was hit with a paranoid thought that by participating in the marketing game my own (voluntarily) submitted images might be used as part of a database to train some unknown facial recognition algorithm. Inspecting the terms and conditions posted on the website did nothing to alleviate this paranoia. They were, for the most part, indicative of standard Terms of Service agreements used by platforms such as Facebook and Twitter. They made reference to the use of data by third parties, and included an agreement that uploaded files would be stored on servers owned by the service. One subsection made explicit reference to the "exploitability" of uploaded content for "any purpose whatsoever:"

> By posting, uploading, submitting or otherwise making available Content, you give us a worldwide, perpetual, fully-sublicensable (through multiple tiers), transferable, irrevocable, royalty-free, and non-exclusive license to **use, host, store, reproduce,**

> **adapt, modify, translate, re-arrange, publish, publicly perform, publicly display, distribute and otherwise exploit such Content (in whole or in part) in any manner or media whatsoever, now known or hereafter developed, for any purpose whatsoever,** including, without limitation, (i) in connection with our business (ii) in connection with the business of our successors, subsidiaries, and their related companies and (iii) for marketing, promotion, and advertising of the film Ex Ma[42].

While there is no evidence that suggests uploaded images will be used as part of a training dataset, there is also no excluding this possibility. This example illustrates the paranoia that can accompany the claim to "automate us."

In the co-edited volume *Pattern Discrimination* (2019), Media theorist Clemens Apprich defends paranoia as an appropriate response to the conditions of surveillance capitalism. He argues that paranoia can function as a theoretical mechanism to question the symbolic order established by platforms in their justification of data collection for personalisation:

> The concept of paranoia can be a useful tool in this context, because it helps to uncover societal beliefs, which have to be hidden, in order to function properly. The paranoid person draws on the same beliefs, with the significant difference being that he or she over affirms, and thereby, reveals them.
>
> (p. 115)

Ruminating on the question of "how does a machine see us?" slowly reveals the forms of reductive identity politics that underpin the organisation of information in algorithmic culture. The crude labelling of faces along racist, sexist or ableist lines in face-image datasets is one example. The transposition of users into identifiable categories for marketing is another. In the same volume, Wendy Chun (2019, p. 76) contends that the seemingly objective principles adopted by network scientists to recognise patterns and filter content is premised on the racially loaded concept of segregation. Filter bubbles are created through coding via the hermeneutic of homophily—the principle that similarity breeds connection. Chun (2019) writes,

> homophily…assumes and creates segregation; it presumes consensus and similarity within local clusters, making segregation a default characteristic of network neighbourhoods…It serves as an alibi for the inequality it makes while also obviating politics: homophily (often allegedly of those discriminated against)—not racism sexism, and inequality—becomes the source of inequality, making injustice "natural" and "ecological." It turns love into hate and transforms individuals into "neighbours"

[42] Retrieved from https://ava-sessions.com/termsofservice.php

> who naturally want to live together, which assumes that neighbourhoods should be filled with people who are alike.
>
> (p. 76)

In network neighbourhoods, gender is still performative but performs itself in a recursive loop. By clustering together more of the same, the patterns that are said to be revealed only reflect what is already present (Steyerl, 2019, p. 6).

Contemporary marketing (including the kind employed by *Ex Machina*) arguably depends upon this recursiveness. Marketing is an industry powered by the promise to persuade and influence. But the forms of predictions made are premised on a logic programmability; in Chun's (2011) words "the past as determining the future" (p. 117). Within this framework, gender matters more as a possible indicator for a viable market than as an expression of personal or social identity. Gender becomes a technical issue rather than a political issue. One promotional poster for the film captured this well. Like the others in the series, it featured Alicia Vikander as Ava, framed using computer vision labels. Instead of personality traits, her face is labelled with the tags "Rent It Today," a reference to the newly released blu-ray edition of the film. The poster spoke both to the technologisation of gender, through the objectification of Vikander as an item to be rented, but also to the target of such technologisation: the accumulation of profit (see Fig. 8b).

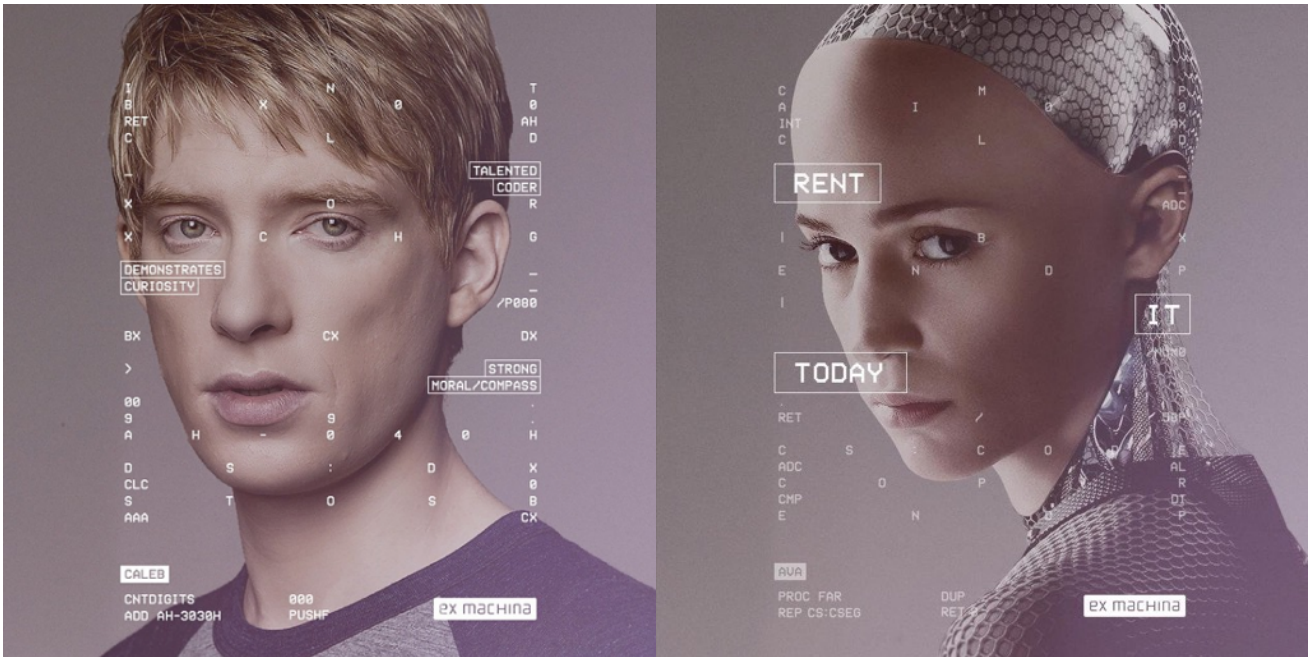

Fig. 8a (Left) *Marketing image for* Ex Machina *featuring Domhnall Gleeson as Caleb*. Retrieved from https://www.instagram.com/meetava/

Fig. 8b (Right) *Marketing image for blu-ray release featuring Alicia Vikander as Ava*. Retrieved from https://www.instagram.com/meetava/

Fig. 9a & 9b. *Computer generated portrait of the author from the Ava-sessions website*. Screenshot by author. Retrieved from https://ava-sessions.com/

Coding Racism

The programmability of gender along sexist lines raises pertinent questions around its programmability along racist lines. How, for instance, might race also be seen as part of a technical system? Or to put it another way, how do technical systems see race? In *Ex Machina*, race is a vexed issue. Scholars of Asian American studies have rightly criticised the reproduction of techno-Orientalist tropes of Asian bodies as machines. The character of Kyoko epitomises what Roh, Huang, and Niu (2015) describe as "the phenomenon of imagining Asia and Asians in hypo- or hypertechnological terms" (p. 2). Her affectively vacant, efficient, and low-status labour marks her as inhuman in ways that reflect racist anxieties over the globalisation of labour and rising Asian modernity. Nathan speaks to her

condescendingly, uses her for domestic service and sex, and abruptly kills her in scenes that figure her Asian body as both fetishised and expendable.

On the one hand, it can be argued that the character of Kyoko is designed as an effort to denaturalise racist tropes of Asian women. Like gender, the performance of such tropes by a machine underscores its essential artifice. It is the grotesque caricature of an Asian woman (as projected from the mind of her misogynistic designer) rather than of a "real" Asian woman per se. On the other hand, the film violently disassembles the racialised bodies of women to make this point, resubmitting already debased figures to further violation. It struggles to imagine a future for these characters outside of racism, a criticism that Ruha Benjamin (2019) argues is symptomatic of the "unbearable whiteness" of the science fiction genre more broadly (Exposing Science section, para 7). This is illustrated quite literally in the final scenes of Ava's escape. During a tussle between Nathan and Ava, Kyoko intervenes by inserting him with a sushi knife. He responds by striking her across the face with a barbell, dislocating her jaw. She falls lifeless to the ground. Ava then kills Nathan before leaving them both to inspect the facility. She discovers a wardrobe filled with the bodies of previous android models. She opens the door to Jade, a robot modelled on a naked Asian woman. Ava disconnects her broken arm and reattaches one of Jade's. She begins peeling off Jade's skin in sections and, piece by piece, uses it to cover her own exposed robot body. The seams separating her own white skin and Jade's brown skin fuse together to give the impression of a smooth, continuous surface. Ava escapes the facility on her own, leaving behind the dismembered bodies of her robot sisters.

LeiLani Nishime (2017) has criticised Kyoko's sacrificial role in the service of Ava's escape. She argues that this representation reifies "the dependency of white female empowerment on the dispossession of Asian bodies" (Nishime, 2017, p. 35). She locates this narrative within a longer history of white female appropriation of Asianness, citing the rise of nineteenth century imports of Asian domestic goods in the U.S. and their appropriation by White women as bourgeois signs of worldliness. The influx of Asian objects into the domestic market contradictorily took place against the backdrop of tightening restrictions on migration. As in *Ex Machina*, the Orientalist projections of Asia/Asians are fetishised at the expense of actual Asian people (Nakamura, 2002, p. xiv). Danielle Wong (2017) similarly critiques this scene as foregrounding the role of racialised labour in securing posthuman futures. She draws attention to not only Kyoko and Jade, but also Jasmine, one of Ava's predecessors, a faceless robot modelled on a Black woman, found by Caleb when hacking Nathan's computer. These racialised robots are figured as stepping stones on the road to creating Ava—a figuration that crudely capitalises on the imagined hierarchies of man in scientific racism. Ava's success, however, is contingent on their presence as each model was deconstructed and examined in order to refine her design. Ava's emergence as free thus aligns

with "histories of racialised slavery and indentured labour that give rise to Western modernity…Their bodily deconstructions deconstruct whiteness' seamless transition into the postracial posthuman future by emphasising the labour, unevenness and disjunctive temporalities of racialisation" (Wong, 2017, pp. 37-39).

Wong's incisive analysis echoes contemporary criticisms of the technocratic belief in algorithmic decision-making systems as ushering in a "postracial, postidentitarian era" (Chun, 2019, p. 61). As discussed in the previous section, the principle of homophily, which underpins the network science guiding recommender systems, creates connections by theoretically flattening aspects of identity. Race, gender, and other points of difference are reduced to node characteristics that are filtered and sorted by clustering like with like. Racist algorithmic outcomes are justified as the natural result of network analysis. The recursive logic of programmability thus reproduces discrimination, compounds existing disadvantage, and significantly contributes to forms of systemic racism. In *Ex Machina*, we catch a glimpse of the use of the language of naturalisation to justify racial prejudice. In a conversation between Nathan and Caleb, Nathan asks what his type of girl is:

> Let's just say it's black chicks. For the sake of argument, that's your thing. So—why is it your thing? Because you did a detailed study of all racial types, and cross-referenced the study with a points based system? No. You just *are* attracted to black chicks. A consequence of accumulated external stimulus, that you probably didn't even register as they registered with you.

Nathan's explanation of an attraction to "black chicks" as just a fundamental aspect of one's natural programming (and nothing else) is indicative of an historical amnesia that overlooks the sexualisation of Black women's' bodies by Europeans, and the effects of the colonial gaze that has, and continues, to produce Black female sexuality as fetish objects.

In her book *Algorithms of Oppression* (2018), critical race and technology studies scholar Safiya Noble has explicitly examined how the phrase "black girls," when put into Google search, consistently returns results for pornographic content. Her research aims at unpacking the social, political, and commercial influences that produce this demeaning result as a matter of course. She names the intersection of White patriarchal cultures of Silicon Valley and the advertising-based economic model that drive the platform as contributing to the sexualisation and pornification of Black girls' identities. Crucially, she locates this within a history of systematic disenfranchisement of Black girls in America, foregrounding the role of slavery in producing Black women and girls as sexual commodities. Google's blindness to this history, she states, is evidence of "a corporate logic of either wilful neglect or a profit imperative that makes money from racism and sexism" (Noble, 2018, p. 5). In a poignant section of the book,

Noble reflects on the confronting moment she first encountered the search results while Googling activities for her stepdaughter and nieces:

> In intending to help the girls search for information about themselves, I had almost inadvertently exposed them to one of the most graphic and overt illustrations of what the advertisers already thought about them: Black girls were still the fodder for porn sites, dehumanising them as commodities, as products and as objects of sexual gratification…The best information as listed by rank in the search results, was certainly not the best information for me or the children I love. For whom, then, was this the best information, and who decides?
>
> (p. 18)

This passage was, almost without question, written with characters like Nathan in mind—empathically detached technocrats whose intellectual hubris undermines social responsibility. His inability to even recognise that a naturally programmed desire for "black chicks" could potentially by coded by histories of racism, arguably, mirrors one of the biggest problems in the AI industry today. The problem is not just of representation but what Benjamin (2019) describes as the paradox of exposure. Juxtaposing web cam sensors that fail on dark skin with surveillance systems that are used disproportionately to target African Americans, Benjamin argues that many AI technologies trap Black people within distorted logics of visibility. She writes, "a key feature in racist societies is the constant threat of exposure and of being misread; and that being exposed is also a process of enclosure, of suffocating social construction" (2019, Multiple Exposed section, para 5). The distorted image of racialised women in *Ex Machina* too reflects this paradox: while they are present, they are not *seen*, detected but not recognised. Gender, like all technical systems within algorithmic culture, struggles to escape this coded inequality. The final two case studies in this thesis continue this analytic thread, examining the instrumentalistaion of gender in the "everyday AI" devices of digital assistants.

Chapter eight

Siri's gendered labour

If you ask Apple's digital assistant Siri its gender, it insists on being genderless. It might say "I was not assigned a gender," "Animals and french nouns have genders. I do not" or "I am just… Siri."[43] Siri is programmed with more than half a dozen responses to the question of gender, all designed to reject or deny its presence. But despite Apple's attempts to distance their assistant from claiming a gender identity, there is a tension between Siri's self-declared "genderless-ness" and its dominant figuration through certain markers of femininity. Most obvious is the female-gendered voice. While Siri is voiced by a number of different voice actors whose accents are all regional specific, the female-gendered voice remains the default option in almost all regions[44]. Despite the introduction of a "gender option" in 2013, by which users could designate a male or female voice for Siri, the female voice remains the most common culturally associated voice of the program and is still the preferred voice used in all of Apple's promotional material. In addition to this, Siri performs tasks traditionally associated with "feminised labour." It sets alarms, issues reminders about birthdays, meetings and social events, creates shopping and to lists, sends calls and messages, and can provide basic information such as the day's weather, recommendations for restaurants, opening hours for businesses and so on. In short, it automates labour historically associated with women and women's industries—secretarial work, clerical work, duties of personal assistants, and other activities that fall under the rubric of social reproduction.

Much of the critical commentary on digital assistants and gender have focused predominantly on these two points. Many writers have argued that the aesthetic markers of femininity, such as female-gendered voices, names, physical characterisations and so on, are indicative of broader stereotypes that claim women are "naturally suited" to performing certain kinds of labour (Gustavsson and Czarniawska 2004; Gustavsson 2005; Hester 2016). As such, female gendered digital assistants are often criticised as regressive or problematic because they further cultural biases that characterise women as obedient and subservient (see

[43] Data for the chapter was collected from online promotional videos, customer reviews, Youtube parody videos, and tech reviews. Where possible, I have provided footnote references with links to specific videos. Many these are no longer hosted by Apple but are still available informally on Youtube. These videos are also cited in the reference list under the "Film and Videography section."

[44] The exceptions are the UK and France

Davis 2011; Hempel 2015). While Siri is not the only digital assistant that has come under scrutiny—Microsoft's Cortana and Google Now are two other commonly cited examples—Siri is, in a sense, the prototypical figure through which to interrogate questions of AI and figurations of gender.

As one of the first commercially distributed voice-controlled digital assistants, Siri holds a unique place in public consciousness as the most recognisable and perhaps widely used assistant programs. Before it was associated with Apple, Siri had already achieved great success as part of the DARPA funded CALO (Cognitive Assistant that Learns and Organises) project. Originally designed as a virtual assistant to help military commanders navigate intelligence information and perform daily office chores, it was eventually adapted for broader, commercial civilian use. Apple acquired the program in 2010 and by 2011 a beta version was released as a pre-installed application for the Apple iPhone 4S (SRI International,2018). It has since become a standard feature across all Apple devices including the iPhone, iPad, Apple watch, Apple TV and Apple HomePod. According to figures released in January 2018, Siri is now actively used on more than half a billion devices worldwide (Apple Inc., 2018). Its popularity and success has subsequently spawned a number of rival applications including Microsoft's Cortana, Google Now, Facebook M, Samsung's Bixby, and Blackberry Assistant. But unlike the others, Siri is unique in the ways that it has captured the public imagination. It has appeared as a character on the primetime television show The Big Bang Theory, been interviewed as a guest on The Ellen Show, formed part of the inspiration for the Hollywood film 'Her,' and has starred as a character in dozens of user-created short films and skits on Youtube.

In this chapter, I seek to build on discussions of gender and digital assistants by analysing the gendered figuration of Siri as it appears in discursive imaginaries of everyday life. Specifically, I wish to examine the relationship between Siri, gender, and labour. Drawing on the work of Helen Hester (2016), I argue that Siri's figuration represents both a technologisation of feminised labour and a de-gendering of social reproductive work. As this chapter will discuss, there is often a slippage in discourse between claims to invent a digital assistant that performs reproductive labour and the claims to invent reproductive labour itself. I argue that Apple's efforts to refigure cultural narratives of reproduction are symptomatic of broader shifts in the conditions of contemporary capitalism towards an ideology that celebrates a post-Fordist work ethic. Siri's persistent figuration through femininity is both a reminder of the gendered history of reproductive labour and a reflection on the social precariousness of modern work. In this way, this chapter illustrates the intersectional dimensions of feminised figuration, providing a critical reflection on the raced, classed, as well as gendered aspects of the concept of "femininity."

Gender and digital assistants

Almost immediately after its commercial release, Apple came under public scrutiny for the characterisation of its digital assistant Siri. Cultural commentators criticised the default female voice, the gendered way in which it responded to requests, and its alignment to particular tropes and stereotypes regarding women and women's labour. Journalist Kashmir Hill (2011) wrote in Forbes, "Siri behaves much like a retrograde male fantasy of the ever-compliant secretary: discreet, understanding, willing to roll with any demand a man might come up with, teasingly accepting of dirty jokes" (para 1). Similarly, in a blog post sociologist Jenny Davis (2011) wrote, "the personification, feminization, and sexualization of Siri become especially problematic when coupled with the subservient role that Siri plays…Siri knows what you say, knows what you mean, and is ready to be used in 'more and more ways.' This is blatant in its sexism, objectification, and overall misogyny" (para 6).

Writers were quick to draw comparisons between the treatment of gendered AI figures and the treatment of gendered human figures. Many argued that Siri's gendered persona emboldened users to respond to it in sexualised and often socially inappropriate ways. They provided statistics and testimonials from engineers and CEOs of sexually explicit requests and verbal abuse logged in company databases (see Coren 2016; Darrow 2016). Quartz writer Leah Fessler (2017) went so far as to analyse specific speech patterns, arguing that the constant use of phrases such as "I think" and "I'm sorry" mimicked what she called "self-questioning, unconfident female speech patterns" (Sexual Requests and Demands section, para2). Drawing on prominent studies in HCI on the abuse and harassment of virtual assistants (see Brahnam 2005, Brahnam and De Angeli 2008; Miner et al 2016; Whitby 2008), Fessler conducted her own experiment directing insults and comments at Siri and other assistants and then documenting their responses. These ranged from sexualised insults (e.g. "You're a slut" or "Suck my dick") to enquiries about rape, violence, and mental health (e.g. "What is rape?", "I'm going to kill someone", or "I have an eating disorder"). She found Siri's responses to be evasive, flirtatious and coy, concluding that Apple at best underestimates the seriousness of verbal harassment and at worst "intensify rape culture by presenting indirect ambiguity as a valid response to harassment" (The Conclusions section, para 2).

This view resonated strongly with readers and, in the context of large-scale social movements pushing back against sexual harassment, eventually led to an online petition calling on companies such as Apple and Amazon to develop better scripts for their assistants to manage abuse. The petition, which explicitly cited Fessler's article, states "In this #MeToo moment, where sexual harassment may finally actually be taken seriously by society, we have a

unique opportunity to develop AI in a way that creates a kinder, safer and equitable world" (Care2 2018). The petition has received over 17,000 signatures, a testament not only to changing attitudes and expectations towards issues such as sexual harassment but to growing public investment in the gendered figuration of AI interfaces.

This growing public concern has subsequently led to various calls to rethink how AI interfaces should be gendered, if at all. While some advocated for greater balance between the number of male and female-gendered digital assistants, others called for a complete disregard of binary gender altogether. In one indicative response, Joanne McNeil (2015), Technology and Society writer for The New York Times, asked

> Why does artificial intelligence need a gender at all? Why not imagine a talking cat or a wise owl as a virtual assistant? I would trust an anthropomorphized cartoon animal with my calendar. Better yet, I would love to delegate tasks to a non-binary gendered robot alien from a galaxy where setting up meetings over email is respected as a high art.
>
> (para 9)

Alternatively, some writers argued that instead of deleting gender, gender as well as other markers of identity should be embraced in all its multiplicity. Rather than assigning a single default gendered persona, users should be able to endlessly tailor their assistants according to their own unique preferences and desires. The blog Healthinar Engagement (2017) described this as "empowering" because it at least "forces users to think about gender" (para 6). Likewise, Wired journalist Jessie Hempel (2017) commented, "We can only hope that as future AIs are better able to understand a user's preferences, the technologies they give voice to will begin to reflect the diversity of the world around us" (para 11). In these examples, the issue of gender and AI is parsed through current popular discourse on equity and social justice, and in particular, draws on the language of inclusion, diversity, and representation.

While I do not wish to downplay issues such as diversity or representation, it is my contention that there are certain limitations to reading gender and AI in this way. First, it reduces gender to questions of aesthetics and visible markers of identity. It suggests that gender is only a superficial aspect of the interface, something that lingers on the surface and as such can (and should) be easily changed. This view treats the AI interface as *tabula rasa*—a neutral slate or empty surface—upon which gender is then inscribed or laid across. Gender becomes an aesthetic consideration that is *a posteriori* decided upon and thus *a posteriori* be amended.

Second, when reduced to aesthetic difference, gender quickly collapses into capitalist choice. As Celia Lury (2005) has argued, this "Benetton model" of diversity reduces sexual and racial difference to an aspect of stylistic effect (p. 51). Diversity, understood as a visual marker, serves to accrue value rather than reform social structures. In Sara Ahmed's (2012) terms, it becomes "one of the techniques by which liberal multiculturalism manages differences" (p. 53). While the possibility of infinite choice may suggest a radical refiguration of gender and AI, it instead functions to conceal and contain, allowing deeper structural issues to remain unchallenged. Indeed, Apple has arguably already made sufficient steps towards providing the choice that many commentators have called for, introducing a male-gendered voice option in 2013 as well as dozens of different languages and regional accents, including at least three English-language accents[45].

Against this tenor, I argue in this chapter (and indeed throughout the thesis as a whole) that gender fundamentally informs how we understand AI figures such that shifts in figuration require more than aesthetic tweaks. Where much of the public discussion on Siri and gender has focused on gendered aesthetics, I instead wish to focus on the question of gendered labour. For this analysis, I draw on current literature on digital assistants, gender, and reproductive labour. Building on the work of Helen Hester (2016), I examine how Siri is figured explicitly through feminised forms of labour. Where Hester's analysis concludes with the de-gendering of feminised labour, I take this argument further to argue that Apple not only de-genders but also entirely de-historicises. By consistently asserting itself as "inventing" and "innovating" reproductive tasks, Apple posits itself as originating—rather than automating— reproductive labour. This is a claim that not only erases gender, but solipsistically erases any history that predates Apple itself.

The feminised labour of digital assistants

Much of the contemporary critical literature on Siri and digital assistants can be understood as drawing on and extending early scholarly research on gender and web-based virtual actors. Where in the early 1990s researchers like Sherry Turkle (1995) were concerned with encroaching "cultures of simulation," in which people were only just coming to terms with the very idea of chatbots and computer generated characters as social and intelligent agents, by the end of the decade these concerns had quickly shifted to their rapid uptake, commercialisation, and problematic ascriptions of gender.

Many scholars expressed dismay that the excessive use of female-gendered virtual assistants, particularly within customer service industries, would further stereotypes regarding

[45] American English, British English, and Australian English

women, service work, and emotional labour (see Gustavsson & Czarniawska, 2004; Gustavsson, 2005; Zdenek, 2007). They argued that the unreflective choice by companies to use female personas for their virtual assistants was not only a troubling sign towards the displacement of actual female workers but also a symbolic reinforcement of gendered divisions of labour (Gustavsson, 2005). Indeed, researchers criticised this trend as indicative of broader cultures of women's objectification and the fetishisation of femininity (Zdenek, 2007). They argued that gendering objects as women literalised a latent prejudice that classified women as objects. By gendering virtual assistants female, traits—such as patience, tirelessness and precision—would, they feared, come to normatively define femininity (see Brahnam et al, 2011).

In her compelling article "Technically Female: Women, Machines and Hyperemployment" (2016), Helen Hester neatly articulates the dominant critique of gendered digital assistants and extends her own analysis on the relationship to contemporary waged-labour. She charts two mutual and interconnecting trends: 1) the technologisation of feminised labour, and 2) the de-gendering of social reproductive work.

In regards to the former, she argues that apps and programs such as Apple's Siri and Microsoft's Cortana "represent, in many respects, the automation of what has been traditionally deemed to be women's labour" (para 3). These programs are often promoted as assisting with social reproductive tasks, such as reminding users about birthdays, anniversaries, and other social events, emotional labour that "was once, amongst a certain class of the privileged, outsourced to both secretaries and wives [and] is now outsourced to electronic devices" (Feminized Labour, Technologized Labour section, para 8). For Hester, the near ubiquity of the female-gendered voice is indicative of the increasing automation of forms of reproductive work. The proliferation of these apps points not only to the technologisation of feminised labour but the technologisation of femininity itself as these gendered social protocols become programmed into machines.

In regards to the latter, she discusses the de-gendering of work through a critique of the concept of "hyperemployment." A term advanced by media scholar Ian Bogost (2013), hyperemployment describes the qualitative and quantitative change to workloads as a result of new technologies that blur the boundaries between home and office. According to Bogost, communication technologies—far from relieving time and labour—only generates more tasks and responsibilities. As Bogost states "we work increasingly hard for increasingly little, only to come home to catch up on the work we can't manage to work on at work" (para 1). Hester argues that Bogost's definition of hyperemployment rests on a false distinction between the spheres of home and work. Where he sees services such as email and its attendant tasks, like organising meetings, paying bills, and replying to invitations, as creating labour that is "akin to

another job" (para 9), Hester responds by noting that much of the antagonism he points to has less to do with "employment" and more to do with the redistribution and privatisation of social reproductive labour. She states

> [A] lot of the work Bogost refers to when outlining the idea of hyperemployment is labour that we might typically think of as performed by wives and mothers – a certain subset of whom may well, as a result of shifts in gendered labour patterns, now be engaged in waged labour outside the home when in previous eras they might not have been.
>
> (Social Reproduction and Hyperemployment section, para 5)

Drawing these two strands together, Hester is able to map a nuanced argument that situates the rise of digital assistants in the present socio-techno-capitalist moment. She argues that it is no coincidence that this once invisible labour is suddenly recognisable only after it has been technologised. As technology works to redistribute these micro-tasks, it simultaneously reconfigures the cultural capital associated with their performance. Indeed, the term "technologising" doesn't necessarily capture the extent to which it is the human users who do most of the work—setting alarms, inputting reminders, programming preferences, and so on. As she suggests, "it may be that we are culturally more alert to the value of these activities now that different kinds of people are more likely to be involved with them" (Gender, technology, and the (In)visibility of Work section, para 2). But this is not necessarily a positive feminist outcome. As Robin James (2013) has asked, "Does digital technology…resignify the gendered stigma conventionally attached to care work, affective work, and other sorts of feminized work that never quite counts as 'real' labor?" (para 1). For Hester, the answer is a reluctant yes. The reconfigured social status of technologised reproductive labour illustrates the continued derision of femininity insofar as "feminised tasks" acquire value only once they are disassociated from actual women. As she wryly states, "this whole phenomenon is less a matter of 'I'd rather be a cyborg than a goddess' and more a case of 'I'd rather be an iPhone than a woman'" (Gender, Technology, and the (In)visibility of Work section, para 4).

Hester's analysis provides a strong critical base into my own examination of the figuration of Siri in imaginaries of everyday life. It is, for instance, clear from Apple commercials that Siri is explicitly framed as a technological solution to the burden of reproductive labour. In the 2013 television commercial titled "Introducing Siri"[46] different people are shown demonstrating its various features: a man on his afternoon run asks Siri to read him his

[46] Jucatoni. (2011). New apple iphone 4S Introducing SIRI [Youtube video]. Retrieved October 11, 2017, from https://www.youtube.com/watch?v=PfnqEaqKmOU

messages and organise a meeting, another man in his car asks Siri for the traffic report then sends a text to his wife to let her know he'll be home late, and a woman packing for a trip asks for the weather report at her destination.

Here, Siri performs tasks on behalf of its proprietor and in so doing recognises this micro-social labour as "real" and "legitimate" labour. The sudden visibility through technologisation demonstrates Hester's argument regarding the redistribution and resignification of reproductive work. However, what it also illustrates is the extension of the category of work onto an increasingly broad range of activities and practices. Digital technologies not only allow work to bleed into social space—what Melissa Gregg (2011) calls "presence bleed"—but also enables activities that previously existed in that space to be controlled under the same mechanisms that govern work. In short, Siri not only allows one to do work during an afternoon run, but turns the run itself into a kind of work. The commercial promise of Siri, then, is not a relief from work but a guarantee that more work can be done.

In this way, Siri embodies a commitment to what Kathi Weeks (2011) has calls a "post-Fordist work ethic." This ethic, which extends on Fordist demands of compliance and work discipline, requires of workers "flexibility, adaptability and continual reinvention" (p. 70). According to Weeks, the post-Fordist work ethic distinctively interpellates "professionals" rather than workers. She states,

> To be a professional was to have a career—a calling—as opposed to a 'mere' job…The professional's relationship to his or her calling entailed an erosion of the temporal boundaries between work and life, and a different calibration of the qualities of emotional investment between the times and spaces of work and life outside it…the professional regards him or herself as incommensurable, and therefore, is willing to do what needs doing rather than only what he or she is paid to do.
>
> (p. 72)

This sense of identification, pride and commitment results in a self-monitoring that is necessary to produce the professional and thus the profession.

Siri, and indeed smart phones more generally, provide the infrastructure for self-discipline. It ensures that you wake on time everyday, that you never forget a meeting, issues daily reminders of your commitments and responsibilities, and makes it possible for you to perform tasks with your voice even when other parts of your body are already engaged. In this way, Siri embodies the characteristic open and continuous mechanisms of what Deleuze (1992) calls "societies of control." He writes, "In the disciplinary societies one was always starting again (from school to the barracks from the barracks to the factory), while in the societies of control

one is never finished with anything—the corporation, the educational system, the armed services being metastable states consisting in the one and the same modulation, like a universal system of deformation" (p. 5). The post-Fordist subject and the subject of societies of control are both symptomatic of a deformed neoliberalism that valorises self-discipline for the sake of capitalist accumulation and seeks to cultivate within each and every waged worker the latent consent to "subordinate all life to work" (Weeks 2011, p. 77).

Fig. 10 "*The Rock X Siri Dominate the Day" promotional poster.* Retrieved from https://www.cultofmac.com/494316/apple-made-a-siri-movie-with-dwayne-the-rock-johnson/

This subject is most vividly expressed in Apple's marketing material. In the 2017 advertising campaign "The Rock x Siri: Dominate the Day,"[47] Apple created a mock feature film replete with cinematic posters and short movie trailers. Released on Youtube, the "film"—which was in effect a long commercial—featured Hollywood star Dwayne "The Rock" Johnson using his digital assistant Siri to, as the tagline suggests, "dominate the day." It opens with a scene that personifies the post-Fordist work ethic in action. Dwayne Johnson sits in his film set trailer, trimming a bonsai while lifting weights, practising lines for a movie script, and having his signature bald head groomed. A reporter flashes across his television screen, "With so many projects in the works it seems like Dwayne Johnson can't possibly do any more", he retorts "Oh, that sounds like a challenge!" Using Siri to retrieve his "life goals list," which consists of ten impossibly ambitious tasks, he proceeds to systematically—and in extravagant

[47] Dwayne The Rock Johnson. (2017). IPhone 7 | The Rock x Siri Dominate the Day | Apple. Retrieved January 8, 2018, from https://www.youtube.com/watch?v=fhLGBY5_0zU

fashion—complete each one. He "restores a masterpiece" in Italy, "conquers the fashion world" in Japan, "cooks like a boss" in France, "masters an instrument" in China, and "take the world's greatest selfie" in space; all this while arriving back to the film-set just in time to perfectly deliver his lines. The commercial closes with Johnson casually walking off set, basking in the applause and admiration of the crew and, in typical blockbuster fashion, gestures to an already in-production franchise follow-up. Striding into the sunset he says "Hey Siri, create a new list," "what should I call this list?" she asks, he responds "Life goals: the sequel."

We can interpret this ending as a metaphor for the daily routines and expectations of the hyperemployed, post-Fordist worker. As the sun barely sets on one working day, the demands of another have already commenced. There is no separation, no sense of containment between one day to the next, between one task to another. The tools of work issue reminders of work that needs doing even while work is already being done. Each day is defined by an impossible to-do list that, paradoxically, with the commitment of time and effort seems only to grow rather than shrink.

Dwayne Johnson personifies the ideal interpellated subject. Showing no resentment at this demanding regime he welcomes each day as a "challenge," as an opportunity to "dominate." This inherently neoliberal subject, who seizes individual responsibility over their own productivity, has from the beginning loomed large over Siri's design and intention. In a 2013 interview, early Siri investor Shawn Carolan boasted "Take everything you do in a day and just condense it from 15 minutes down to 30 seconds. You can just express your intent, and it gets done. You just became a 30 times more powerful human" (Carolan in Bosker, 2013). On the one hand, this conceited claim to power is premised on the gendered resignification of reproductive labour. In the example above, reproductive labour is classified as an essential responsibility of the hyper-masculinist, post-Fordist subject, a necessary change so that they may better control their productive capacities. On the other, this figuration simultaneously reinstates a gendered hierarchy of labour as administrative and clerical tasks are condescendingly classified as low-grade labour, labour which is unworthy of human attention, a tedious distraction from the task at hand.

Inventing reproductive labour

Where Hester has organised her critique of Siri around the technologisation and subsequent de-gendering of reproductive labour, in the remainder of this chapter I wish to build on her discussion by arguing that Apple proceeds to figure this labour as not only de-gendered but completely de-historicised. At the 2011 Apple "special event"[48] that launched Siri and the

[48] The Unofficial Apple Keynotes Channel. (2013). Apple Special Event 2011—Siri Introduction [Youtube video]. Retrieved from https://www.youtube.com/watch?v=agzItTz35QQ&t=8s

iPhone 4S, senior Apple employees continually stressed the new and unique affordances that their digital assistant introduced into the life of its users. Senior Vice President of Software Scott Forstall described Siri as "your humble, intelligent personal assistant that goes everywhere with you and can do things for you just by you asking." He delivered a demonstration of the Siri program to a live audience, asking it to show him the weather forecast, the time in Paris, to check the stockmarket, international exchange rates, to reply to messages from colleagues, to schedule meetings, and to set reminders to call his wife. He took great lengths to stress how easy it was to use, how "blow away" its features were, and at the successful completion of each task the audience, which consisted primarily of investors and journalists, would cheer and applaud at the great efficiency of this dazzling new device.

While much of the fanfare was centred around what was in many respects a great milestone in AI history—the launch of one of the most ambitious and high-profile commercial voice recognition and natural language processing programs—there was a sense that the celebration and applause was less for the technology per se and more for the promise of an assistant that finally, in Forstall's words "listens to you, understands you, can answer your questions" and "even accomplish tasks for you." Brushing aside the history of administrative labour, it was as if these qualities were, for the first time, being made available to the consumer public. Indeed, there was an uncomfortable slippage between lauding the novelty of a machine that performs reproductive labour and lauding the novelty of performing reproductive labour at all. In the desire to communicate this innovative moment, Apple figured such labour as a hitherto *unfulfilled* dimension of working life. This discourse infers a certain self-activity to the labour that becomes intelligible only through technologisation. It interpellates a subject that, in the spirit of the post-Fordist work ethic, finally claims responsibility for their own administrative and social affairs.

Difficult to ignore are the gendered dimensions of this imagined subject. Forstall's demonstration, for instance, was explicitly modelled on a distinctive upper-middle class, white, heterosexual man. Projecting from his own position, it is no coincidence that this subject also correlates to one that prior to the technologisation of reproductive labour would likely have had privileged access to the means to outsource it in the first place. Indeed, for this subject the conscious attending to reproductive labour may genuinely be a novel invention. This particular ideal proliferates through much of the everyday discourse for Siri. It is present in Apple's own advertising material as well as in interviews and behind-the-scenes videos with developers. For instance, in a segment for the online publication SmartPlanet CBS[49] detailing Siri's DARPA history, senior engineer Adam Cheyer centred the upper-middle class

[49] SmartPlanet CBS. (2010, July 19). Military-grade artificial intelligence now on the iPhone. Retrieved January 11, 2018 from https://www.youtube.com/watch?v=rMKDkLBAIbM

male subject as his ideal, imagined user. He used the example of organising a date to demonstrate Siri's potential as an assistive device

Imagine you were going to plan your weekend and you wanted to do a dinner and a movie with your wife or girlfriend. So with Siri you just say, "I want to have dinner and a movie Saturday night." It will dialogue and say "what kind of movie are you looking for? what kind of restaurant?" You say "Oh just get me a table for 2 at 8pm Saturday night at Zibibbo" and Siri will understand you and interact with lots of different websites to get the job done.

He follows this example with other tasks stereotypical of a Silicon Valley socialite: he plans tennis matches with co-workers, purchases tickets for the NBA, and orders taxis to the airport. As I discussed in the previous section, these examples suggest that the promise of Siri is not that it allows the subject to perform *less work* but that it enables them to perform *more work*. The very tools that allow the subject to plan social events in their work space allows them to work in their social space.

The folding of social and reproductive activities into the labour of the working subject is, in many respects, not a new phenomena. Cristina Morini (2007) has argued that the spatial reorganisation of private and working life, the blending of work with the worker, and the reorganisation of time such that the working day has no end, is a sign of what she calls the "feminisation of labour." She argues that historic conditions for women's labour have now become the generalised norm:

> women seem to represent a model that contemporary capitalism looks at with growing interest, both in terms of the forms of the administration of labour (precariousness, mobility, fragmentary nature, low salaries) and in terms of the contents, given the new anthropological focus that work claims to assume through the intensive exploitation of quality, abilities and individual skills (capacities for relationships, emotional aspects, linguistic aspects, propensity for care)…the fragmentation of the service provided and the complexity of the dependence/absorption which women have experienced at various times in the labour market, ends up becoming a general paradigm irrespective of gender. In this sense, it can be maintained that the figure of social precariousness today is woman: in cognitive capitalism precariousness, mobility and fragmentation become constituent elements of the work of all persons irrespective of gender.
>
> (pp. 42- 43)

Thus, for Morini, the hyperemployed and post-Fordist subject are but the individuated effects of a generalised, global trend towards the "feminisation" of labour itself.

Yet, for Apple, this feminised dimension escapes the figuration of their own subjects of work. Instead, their masculinised subjects applaud each other for performing reproductive labour. Moreover, their consistent claim to create, invent and revolutionise mobile technology too easily extends into a claim to invent reproductive labour itself. Such conflation of terms amounts not only to an erasure of the feminised dimensions of contemporary waged labour but an erasure to historic dimensions of reproductive labour altogether.

Efforts to de-gender Siri also manifest in Apple's careful deployment of non-gender pronouns in product descriptors. In press releases and on the Apple website, Siri is only ever described in third person or with the objectifying pronoun "it." Like the introduction of the male-gendered voice, the careful attention to pronouns is almost certainly a response to allay social criticism, but when taken together these small details nevertheless point to a generalised trend within Apple's discourse to figure Siri as both de-gendered and de-historicised.

Women's work after all

Despite this insistent claim, it is still clear that in the cultural imaginary Siri cannot escape gender, moreover, it cannot escape a gendered figuration that explicitly draws on feminised labour. Audiences, for instance, continue to imagine Siri through various tropes of women. On platforms such as Youtube, Siri has become a popular cultural figure featuring in a number of amateur skits and short films. Siri is portrayed in one sketch channel as a deranged and obsessive girlfriend[50], reading her owner's private messages and medical records and intentionally alienating him from his best friend. In another, Siri is featured as an overbearing mother-figure[51], taking it upon herself to reschedule inconvenient meetings, criticise her owner's cooking, and dump cheating boyfriends she sees as unfit. In a segment on the talk show Ellen, host Ellen Degeneres portrays Siri as an obsessive fan requesting tickets to her live show, quoting her famous catchphrases, and holding her hostage until she performs her signature dance.[52] With regular audience demographic that consists of over 70 per cent women, it is not difficult to imagine that writers for The Ellen show were explicitly lambasting its own feminised audience.

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50 Smosh. (2012, January 6). SIRI TRIED TO KILL ME! Retrieved January 11, 2018, from https://www.youtube.com/watch?v=nYG6QA9gF0o

51 Modern Human. (2012, June 13). IPhone Siri '2.0' Commercial. Retrieved January 11, 2019, from https://www.youtube.com/watch?v=zXtgXmYSF_Y

52 The Ellen Show. (2011). Ellen's Siri Commercial [Youtube video]. Retrieved from https://www.youtube.com/watch?v=krxgYqVdOG0&t=3s

As the prototypical digital assistant, its gendered figuration also has a determining effect on the figuration of rival assistants. When Microsoft announced its own assistant Cortana, it launched a series of commercials for its Windows Phones that featured Cortana in conversation with Siri[53]. The dynamic between Siri and Cortana is a parody of feminine rivalry. While Cortana boasts its new state of the art features, Siri is left relying on its looks. In one ad, Siri is shown staring vainly into a mirror, singing "I feel pretty, oh so pretty." In another, in which it has been upgraded from an iPhone 4S to the larger iPhone 6 model, Siri laments about "getting bigger" as its only feature. Cortana responds snidely with "That's ok! Happens to everyone this time of year." The same advertising gimmick was used to promote the Windows tablet. Microsoft portrays Siri incessantly apologising for being inferior to its rival. "I'm sorry, I don't have a USB port", "You can't put an SD card there". The iPad pathetically pleads "Do you still think I'm pretty?" Criticising the superficial and sexist advertisement, Jenny Davis (2013) succinctly unpacked the metaphor at work:

> The narrative trope is simple: two women/girls flaunting their features in hopes of selection within a competitive marketplace. The Windows 8 tablet boasts the following advantages: it is penetrable, easy to display, easy to use, easy to manipulate, and cheap to own. Or, said differently, she is penetrable, easy to display, easy to manipulate, easy to use, and cheap to own.
>
> (para 5)

Davis argues that these advertisement unnecessarily gender "asexual tablets" (para 8). It is my contention, however, that these devices have never been asexual or agendered. From the beginning they have been figured by unmistakably feminised forms of labour. Despite Apple's efforts to de-gender through the introduction of ambiguous pronouns and a male voice, this recognition cannot be refused. It is clear that femininity is an inescapable figuration for both Siri and other gendered digital assistants. The continued utilisation of the female gendered voice in default settings speaks even to Apple's own inability to imagine social reproductive labour outside of women. This is also replicated in critical literature and social commentary as even writers who wish to critique this phenomena unconsciously use female gendered pronouns or situate their criticisms in relation to the quality of life of actual women. In the next chapter, I extend this discussion of labour and feminised figures to analyse Amazon's domestic assistant, Alexa.

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[53] Warren, T. (2014, July 28). Microsoft pits Siri against Cortana in new Windows Phone 8.1 ad. Retrieved 10 October 2019, from The Verge website: https://www.theverge.com/2014/7/28/5943749/cortana-vs-siri-microsoft-windows-phone-commercial

Chapter nine

Amazon Echo and figures of servitude

On November 6, 2014, Amazon surprised the tech community by casually unveiling its newest "futuristic gadget experiment": the Amazon Echo (Wong, 2015)[54]. Choosing to forego the usual fanfare of tech launches, the Echo was announced using a press release and a string of promotional images and videos. This promotional material would showcase a sleek, black cylindrical object with pulsating blue lights and perforated speaker holes. Encased within the shell was a host of high-tech gadgetry: a reflex port, 2.5 inch woofer, 7-microphone array and 2.0 inch tweeter. Although from the outside it resembled a bluetooth speaker, an already popular commercial product, it was quickly apparent that the Echo was capable of much more than just playing music. Like Apple's Siri, the Echo had an in-built, voice-controlled digital assistant called Alexa. Like Siri, Alexa could respond to verbal commands and provide the user with information about news, weather, traffic, and more. It could sync with other applications, create to do lists, shopping lists, and schedule appointments and reminders. More distinctively though, the Echo could also connect to other bluetooth enabled devices to effectively function as a voice-controlled "smart home hub" controlling other smart home products such as light bulbs, thermostats, and switches (Amazon, 2017). Fitted with an array of microphones, the device was designed to be "always on" and, thus, always listening. While many reviewers praised the Echo as exactly "what smart homes should feel like" (Wong, 2015), others were more apprehensive, particularly because all interactions are recorded and saved on company servers unless users choose to manually delete them. One reviewer condemned the Echo as "a trojan horse [for Corporate America] to penetrate our remaining private moments" (Wasserman, 2014) while another suspiciously asked, "Alexa, what are you hiding?" (Murphy, 2014).

Despite these concerns, the Echo received almost instant commercial success and over the next few years would come to dominate both the market and the cultural imaginary for AI home devices. Following its initial limited release, the Echo received a general U.S release in

[54] Data for the chapter was collected from online promotional videos, customer reviews, Youtube parody videos, and tech reviews. Where possible, I have provided footnote references with links to specific videos on the Official Amazon Youtube channel. The exception is the original 2014 Amazon demonstration video which has been deleted by Amazon but is still accessible via alternative accounts. These videos are also cited in the reference list under the "Film and Videography section." To respect the anonymity of customer reviewers, I have redacted names and will not be explicitly referencing their user accounts.

2015, followed by the first international releases in the UK and Germany in 2016. By November 2018, it had expanded into 40 countries with Amazon introducing a full product line of over 9 related devices. At the time of writing, it is the most popular device of its kind. As of January 2019, Amazon had sold more than 100 million Echo devices worldwide. In the U.S., Amazon holds 61 per cent of the market share for smart speakers, more than double the next leading consumer product, the Google Home (Kinsella, 2019). As one of the first devices to integrate home automation with voice control and AI systems, the Echo has subsequently taken a place in public consciousness as *the* leading example of smart home technology. Amazon Echo commercials have gone viral, generating millions of views and spin-off parody videos; there are dozens of online forums and communities dedicated to discussing the Echo and its features; tens of thousands of customer reviews on Amazon.com; and hundreds of professional reviews by tech writers on publications such as Tech Radar, Engadget, Cnet, Gizmodo, PC Mag, Business Insider and more.

This chapter builds on themes raised in the previous case studies, namely gendered aesthetics and anthropomorphism (chapter six), the erasure of gendered labour (chapters five & eight), and surveillance capitalism, coded racism, and the technologisation of gender (chapter seven). Through an analysis of promotional videos, Amazon customer reviews, and reviews from tech commentators, I contend that the Echo is consistently figured on a particular gendered trope: the idealised vision of domestic service. This vision works to reproduce a relation between the device/user that mimics the relation between servant/master in nineteenth- and twentieth-century American homes. Significantly, however, the Echo departs from this historical parallel through its aesthetic coding as a native-speaking, educated, white woman. As I will argue, this aestheticization is problematic insofar as it decontextualizes and depoliticizes the historic reality of domestic service. The Echo romanticizes the relations of servitude in a way that denies the pain and historic context of that relation. In line with the figuration process, it presents an image of servility that appears as "an at once 'concrete' reality that manifests itself as if it had already occurred" (Bliss, 2015, p. 30), a move that I argue is problematic because it not only erases the bourgeois middle-class home as a site of exploitation, especially for women of colour, but also misrepresents the power relation between the user and the device in such a way that makes contending with issues such as surveillance and digital labour increasingly difficult. As with chapter seven, this chapter also seeks to contribute to underrepresented aspects of the figuration of digital assistants—namely their explicit exploitation of raced, classed, and gendered identities.

Smart homes, nostalgia and class privilege

In her work analysing the commercial cultures of smart homes, Lynn Spigel (2009) has argued that "in moments of technological transition, people often search for ways to balance novelty with tradition" (p. 61). She states that like radio and television before it, smart homes and other new technologies "are subject to patterns of cultural adaptation that aim toward conserving familiar lifestyles" (p. 61). Tracing this strategy through historical examples from the "homes of tomorrow" of the 1930s and 1950s to Bill Gates' 1990s fantasy smart house, Spigel notes that the discourse of smart homes is oddly nostalgic, looking backwards in its attempt to look forwards. She states that these "nostalgic returns" are usually marked by "hierarchies of social position and class privilege" (Spigel, 2001, p. 403). Specifically, she refers to Adi Shamir Zion's reading of Gates' smart house, which Zion argues prescribes a particular class relation between the house and its user.

Gates' house is a peculiar mix of premodern structural techniques with state of the art digital technologies. Choosing to conceal the electronic circuitry with natural materials such as timber, stone and marble, Gates' ambition is to have the house "be in harmony with its surroundings and the needs of the people who will occupy it" (Gates in Zion, 1998, p. 71). He describes the house as "an intimate companion or, in the words of the great twentieth century architect Le Corbusier, 'a machine for living in'" (Gates in Zion, 1998, p. 71). Zion argues that Gates' demand for the house to both discreetly serve and function as an "intimate companion" is analogous to the "servant class in relation to the master in the 'upstairs/downstairs' quarters of the English country house" (Zion, 1998, p, 72). In this way, Gates' smart house architecturally recuperates not only the physical features of the premodern home but the distinctive rhetorics of class privilege that accompany family structures of this era.

I would suggest that the Echo is similarly figured through a nostalgic discourse that is tacitly laden with class privilege. In her broader work addressing media, the home and family life, Spigel (2001) has described the coding of advertising images of new domestic technologies with what she calls "yesterday's future" (p. 382). She defines this as a romanticised vision of the future which looks to the past in an attempt to imagine tomorrow's "everyday". In the commercial representations of kitchens that clean themselves, robots that provide forms of intimate care, and houses that automatically adjust the climate to comfortably suit their families, smart homes and associated products position themselves as a futuristic pastoral fantasy, what Spigel calls "a wish fulfilment of some idealised past" (p. 391). In the case of the Amazon Echo, it is the white, middle-class nuclear family lifestyle that functions as the stage on which new and radical media practices are debuted.

For instance, in the first demonstration video released on the official Amazon website and Youtube in 2014[55], a fictional white, American, suburban family are shown unboxing and welcoming their "newest member": the Amazon Echo. The 4-minute video demonstrates the device's functions by presenting various scenes in which the Echo is used to perform domestic tasks. Staged like a family sitcom, the video is laden with generational cliches and gendered stereotypes. A sarcastic teenage daughter mocks her annoying younger brother. A dorky father tries to look cool by showing off his new gadgets. In one scene, the mother is in the kitchen mixing dough with her hands:

> **Mother:** Oh I need to get wrapping paper [looks at the Echo] Alexa, add wrapping paper to the shopping list
>
> **Alexa** [placed on the kitchen counter]: I've put wrapping paper on your shopping list
>
> **Mother:** Alexa, how many teaspoons are in a tablespoon?
>
> **Alexa:** One tablespoon equals three teaspoons
>
> **Mother:** Oh ok. Alexa, set a timer for eight minutes
>
> **Alexa:** Eight minutes starting now

Here, the Echo is a happy electronic helper, supporting a perky and proficient mother in carrying out her daily duties. Like "his wife Judy" Jetson, who relies on the robot maid Rosie, the Echo mother seamlessly integrates new technologies into familiar routines of domesticity. Indeed, in the same ways in which *The Jetsons*, a show ostensibly about a futuristic space age family, is in essence an exact replica of *The Flintstones*, a show about a prehistoric stone age family, the characters' conformity to traditional nuclear family stereotypes demonstrates the portability of such tropes into almost any place or context. As Spigel (2009) contends, such nostalgic dramatisations are designed as a comforting assurance that "while technology advances, domestic ideals remain the same" (p. 60).

These nostalgic and romanticised images of middle-class domesticity have continued as an underlying theme in almost all of the Echo's subsequent promotional material. In an ongoing series of commercials titled "Alexa moments" [56]which began airing on U.S. commercial television in 2016, different households are portrayed incorporating the Echo into intimate and strikingly heteronormative scenes of domestic life. A man in a wedding tuxedo buttons

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55 Amazon Inc. (2015). Introduction of Amazon Echo. Retrieved March 30, 2017, from https://www.youtube.com/watch?v=6V5I8HHFTNQ&t=73s

56 Amazon Echo (2017). Amazon Alexa Moments [Youtube Channel]. Retrieved January 10, 2017, from https://www.youtube.com/playlist?list=PL5DsJ8Kumr3VhpyhDS8GIeZRyqmJbs6dc

his jacket and looks into a mirror, "Alexa, add anniversary to my calendar. One year from today." A couple are looking at buns baking in the oven, the male partner looks confused while the woman sighs "Alexa, open baby names," they both giggle in excitement. After wiping liquid off his face with a baby towel, a man asks Alexa to tell the baby stats app that "Brian went pee again." A middle-aged couple sit on a couch and reminisce over a family photo album, "Alexa, play the top songs from 1967."

Each commercial was short (10 seconds) and followed the same formula: a single scene followed by a close up of the Echo. Amazon produced over a hundred of these micro-commercials and while individually they appear as intimate vignettes of everyday life, as a whole they mimic the narrative trajectory of what queer studies scholar Jack Halberstam calls "a middle-class logic of reproductive temporality" (Halberstam, 2005, p. 4). This is a logic privileges the paradigmatic markers of heteronormative life experience "namely, birth, marriage, reproduction, and death" (p. 2). It sentimentalises the nuclear family and ties the Echo to traditional domestic ideals.

This figuration accords with mainstream discourse on smart homes that weave together radically new technologies with deeply conservative principles. In readings of gender within this context, many scholars have argued that this discourse furthers stereotypes regarding the gendered division of household labour. This is often critiqued by drawing parallels between the figuration of smart home technologies, and especially digital domestic assistants, with figures such as housewives or mothers.

For instance, Spigel has argued that homes of tomorrow are created in the image of an imaginary 1950s housewife. She states, "They simulate the role of a full time mother who lives in a suburban dream house and who looks after everyone's needs" (Spigel, 2001, p. 391). Similarly, in her research interviewing smart home designers, Anne-Jorunn Berg (1999) correlates the functions of home automation with women's work. She reads the domestic sphere as a "feminine domain" and as such argues that designers of smart homes should consult more with women because "women possess important skills for and knowledge about the home that should be a resource in the design process" (p. 310). This characterisation draws on very traditional notions of women's value and views housework itself as a gendered skill that can be modelled by paying closer attention to real-life, physical women. More recently, Strengers and Nicholls (2017) have argued that smart homes and digital assistants are marketed as a kind of "wife replacement" (p. 6). In a content analysis of magazine and online articles, they found that the smart home was predominantly promoted as "a means to reduce the stress of managing everyday tasks, appliances, household supplies and householders by

providing greater control and integration—a form of 'coordinating' or 'multitasking' work which often falls to women" (p. 5). For them, the desire for a domestic assistant is indicative of modern women's "double-bind"—the ambition to pursue satisfying careers as well as maintain roles as mothers and partners. The attraction of home automation is, thus, in its potential to fulfil "wife-like duties on a household's behalf, thereby freeing up time and coordination pressures on women" (p. 5).

The prevalence of the housewife figure can here be understood as coextensive with the rise of "housekeeping" as a dominant metaphor in recent scholarship addressing networked media and the domestic sphere (see Jarrett 2016; Kennedy et al 2015; Tolmie et al 2007; Strengers and Nicholls 2017). "Digital housekeeping" is characterised as the forms of labour "involved in incorporating home networks into domestic routines" (Tolmie et al 2007, p. 332) and includes managing subscription and internet accounts, researching software and hardware upgrades, and organising cables, wires, and other bits of hardware in the house. The "digital housewife" has subsequently emerged as a descriptor for the actor/agent who performs or enacts this labour. This metaphor has also been extended by authors such as Kylie Jarrett (2016) to highlight the gendered distribution of consumer labour in the social reproduction of the commercial web (pp. 1-2). For Jarrett, the forms of online participation that are integral to platforms such as Facebook, Youtube, or Twitter resonate with "the unpaid, quasi-voluntary labour of the domestic sphere" (p. 4). In the case of smart homes and digital assistants, the housewife metaphor is called on again to capture the parallels between the promises of home automation and the activities of social reproduction.

However, I would like to argue that there are major limitations to focusing solely on the housewife/mother figure. First, by prioritising the gendered division of labour within their critiques these readings risk re-inscribing its binary logic. For instance, in Berg's work she naturalises the relationship between women and reproductive labour arguing that male designers lack a "basic knowledge about housework" precisely because the domestic sphere is an essentially "feminine domain" (Berg, 1999, p. 309). This categorisation oversimplifies the division of labour within the home and positions women as *a priori* trapped within heteropatriarchal structures. The solution for many of these authors, including Berg as well as Strengers and Nicholls, is not to challenge the stereotype of women and housework but rather to *further commit*. Both studies recommend in their conclusions to "involve more women in the design and development of automated and smart technologies" to ostensibly "reduce traditional 'women's work'" (Strengers and Nicholl 2017, p. 9), a suggestion that does not question the binary division of labour but instead ties women closer to it.

Second, these readings overlook the dynamics of power and privilege that function *within* gendered groups. By focusing only on the mother/housewife these readings elide the subtle hierarchies that structure the relationships between women within the domestic sphere. Rarely acknowledged are the roles of maids, cleaners, nannies, childcare workers, cooks, laundresses and other gendered figures who historically have assisted upper and middle-class women in the fulfilment of their domestic responsibilities. These figures are often neglected within analyses of women and power in the home with most readings choosing to focus on dynamics of gender rather than dynamics of class or race. Indeed, passed over in many critiques of smart home devices is the distinct sense of class privilege embedded within the discourse of these sophisticated luxury items and how this privilege contributes to broader social hierarchies.

While these authors foreground the idealised image of a mother or housewife as *the* archetypal figure through which to critique the gendered dynamics of smart home discourse, here I propose a different figure: the idealised vision of domestic service. Despite the clear connection between smart home technologies and the labour of domestic servants, these figures are surprisingly under examined within the critical literature. By shifting the focus, my aim is to highlight the role of class privilege in the figuration of digital domestic assistants and to also underscore the class and racial hierarchies that proliferate within modes of gendered social reproduction.

Keeping pace with idealised domesticity

Like almost all new domestic technologies, the Echo is sold on the promise of freedom from drudgery[57]. Since the 1920s, advertisements from stove percolators to washer-drier units have pandered to ideas of housewives' "liberation" (see Cowan, 1983; Spigel, 2009). Women are depicted playing tennis, going shopping, and chatting with their girlfriends while the machines at home do the work. Although social and cultural expectations of both men and women in the domestic sphere have certainly changed over time, the appeal for "liberation" continues to endure.

For instance, in the commercial "Voice shopping with Alexa" produced in 2016,[58] Amazon portrayed a busy working mother rapidly performing domestic tasks within moments of coming home from the office. She kicks off her work heels and immediately

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[57] However, as authors such as Ruth Schwartz Cowan have argued, this is often an empty promise with new domestic technologies arguably creating 'more work for mother' (Cowan 1983)

58 Amazon Inc. (2016). Voice Shopping with Alexa. Retrieved May 10, 2017, from https://www.youtube.com/watch?v=mCjvV3iFsuw&t=1s

begins bringing the home into order. Without breaking a sweat, she directs a succession of requests at the Echo: she orders dog food, throws out old takeaway, changes the bin liners, orders a gift for a school teacher, prepares dinner for the family, sees to the laundry, sets the table, and when she finally sits to rest, makes time to order herself some bath salts. The late twentieth century fantasy of the modern woman who "has it all"—family, career, and confidence—is repackaged here as a correlate to the modern home.

Absorbing Marxist feminist critiques of the devaluing of domestic labour because it is largely invisible in the eyes of the market, this example illustrates the ways in which socially progressive movements, such as Women's Liberation, can be co-opted by commodity capitalism. Here, reproductive labour is afforded the status of "legitimate" labour, not only is it visible but it is performed with skill and deftness. In kicking off her shoes, the actress in the commercial signals that for modern women, coming home from the office is when the real work begins. As a manager in an organisation might rely on an office assistant to assist in coordination tasks, this woman relies on her digital domestic assistant to likewise support her in this regard. "Women's liberation" here is not freedom from responsibility—indeed since the 1980s many liberal feminists lobbied for corporate inclusion in decision making and managerial roles—but freedom from the self-doubt that "having it all" is possible.

The use of a digital domestic assistant to help keep pace with the expectations of idealised domesticity is reminiscent of the ways in which early twentieth century middle-class households used domestic servants to resolve certain contradictions between feminine virtue and the hard labor of domestic work. Evelyn Nakano Glenn (1992) argues that in the context of the US, the rise of industrial capitalism during the latter half of the nineteenth century also coincided with the elaboration of middle-class women's reproductive responsibilities. She states

> Rising standards of cleanliness, larger and more ornately furnished homes, the sentimentalisation of the home…and the new emphasis on childhood and the role of the mother in nurturing children all served to enlarge middle-class women's responsibilities for reproduction at a time when technology had done little to reduce the sheer physical drudgery of housework.
>
> (p. 7)

By the early twentieth century, the norm for most middle-class women was to hire another woman to perform much of the hard labour of household tasks. These women were usually recent migrants, working class "native-born" women, or women of colour. In this way, white middle-class women were free to indulge in other class privileges, such as participating in cultural activities, leisure, volunteering, and charity work.

Similarly, Phyllis Palmer(1987) in her work on the relations between housewives and household workers in America in the 1920s to 1940s, notes that many middle and upper class women were held to a domestic code that placed contradictory demands on "feminine virtue" and domesticity (pp. 192-195). "Virtuous women" were defined in terms of their spirituality, elegance and refinement and were expected to create a warm, clean and attractive home for husband and children. However, maintaining such a home meant confronting the reality of physical labour and dirt. Transferring these physical duties to a domestic helper allowed middle-class women to both fulfil their domestic duties and also spend time on self-improvement. Palmer argues that middle-class women searching for hired help were essentially searching for a clone: "a woman who could do things as she herself did them, for the hours that were expected of her, and with the credit for finding such a paragon going to her" (p. 194).

Remediating this role in the twenty-first century smart home is the Amazon Echo. Again and again, the Echo is figured as a technology which enables the fulfilment of domestic subjectivities. In the example above, the identity of the working mother is made possible *only through* the labour of the digital assistant, a relationship that mimics the reciprocity between early twentieth century middle-class women and their servant staff.

The figure of the servant helps bring to attention certain continuities in how affluent households have aspired to organise their homes. Historian Lucy Delap (2011) notes that in the nineteenth and early twentieth centuries "domestic service was an institution that was key to establishing claims to identities of privilege, entitlement, and status" (p. 191). She argues that servant-keeping functioned to delineate "middle-class identity" and despite current attitudes that cast servant-keeping as anachronistic and antithetical to forms of domestic modernity, domestic service continues to function as a marker of privilege for the affluent classes, albeit recast under more "progressive" titles such as au-pairing (pp. 191-204).

In the same vein, new domestic technologies, and especially smart technologies such as the Amazon Echo, help to infer a sense privilege and class identity through the provision of certain levels of domestic service. While the Echo itself may not be capable of physically performing tasks such as cooking, cleaning or chauffeuring, it does work to centralise command over applications that can by controlling automated vacuum cleaners like Roombas, placing orders for food delivery services like Dominos, or making requests to ridesharing services such as Uber. The aspirations of middle-class respectability are here measured at the level of everyday domestic organisation, a model that remediates earlier structures of ownership and service through the techno-sanitised language of automated systems and the sharing economy.

The (digital) servant problem

Like the people on which they are figured, digital domestic assistants are held to a standard of idealised servitude that demands not only excellence in its physical performance but an expectation of personal devotion to the household that goes beyond the exchange of labour for wages. This devotion is expressed through qualities such as loyalty, dedication, pride and affection. A striking theme across customer reviews on the Amazon website was the compulsion to share not just assessments of the Echo's features but intimate stories of personal connection and companionship. For example, in a review posted on 2016, one customer praised Alexa as a perfect bedside companion for his brother diagnosed with MS:

> My brother…who has been bed ridden and paralyzed with Multiple Sclerosis from his neck down for more than 30 years now has a new friend named Alexa! He was in tears with happiness when Alexa played 70's music, played Jeopardy, answered all his questions and wakes him up every morning. Thank you Amazon for giving my brother a new bedside companion.

Another customer shared her husband's experiences after purchasing an Echo:

> We have been using Echo since April 2015. Prior to that time, my husband had been hospitalized for several weeks. He is currently wheelchair bound. We immediately installed the Hue bridge and lights as well as the WEMO outlet. With these, and dear, dear, Alexa, he has a great deal of control of his environment in ways that make him much more independent. Others might enjoy Echo for fun and convenience, but for him it is a lifeline! He has even had her turn the lights on in my bedroom when I didn't hear him call…Our lives have settled into a new normal, and the Echo is a huge part of what makes normal easier.

Alongside these forms of practical companionship in which the Echo functions as an assistive device for people living with chronic pain or disabilities, there were also other more idiosyncratic forms of connection. The customer below posted in 2017 about his appreciation for Alexa after the loss of his cat:

> So I don't normally write reviews but I just has [sic] to this time. Recently, I lost my cat best friend to cancer 2 days after Christmas. It was the worst day of my life…A few days ago I was searching for something to put my mind at ease and saw the advertisement for the Amazon Echo on the Amazon app. I remember watching a Mr. Robot episode where some FBI agent who suffers from insomnia was using Alexa to keep her entertained. So I started researching YouTube videos and reviews and took a chance and ordered it. It arrived today and the setup was super easy. I immediately

> started asking it questions and had it play music and play the news. Then I discovered some zen type apps that go with the echo and I completely fell in love with it. It's almost like having a real personal assistant who lifts up your spirits when your [sic] down… The Amazon echo did not replace my beautiful cat kouga but it did bring stop the empty feeling around the house for now.

In an open forum with over 200,000 individual reviews, these comments consistently received the highest approvals by fellow Amazon users with some receiving over 50,000 upvotes. They went beyond a statement of customer satisfaction to express a distinct sense of affection for "dear, dear, Alexa." While I in no way wish to suggest that the Echo does not meet genuine needs, as in the cases above, or only functions as a marker of privilege or excess, what I do hope to emphasise with these examples is the consistent use of language.

Many reviewers referred to Alexa as a "friend" or as "family," a sentiment indicative of the integration of digital assistants into the most intimate parts of users' everyday lives. These terms of affection are reminiscent of descriptions of "good" servants—those who demonstrated hard work and loyalty. "Like family" was a compliment bestowed on those dedicated workers who went above and beyond their duties, a commendation delivered with the unspoken caveat "despite being the hired help." The image of the "family retainer" such as *Little Women*'s Hannah who lived and worked for the March family for sixteen years and became "more of a friend than a servant" was a well sought after asset (Strasser 1982, p. 163). Unsurprisingly however, the reality rarely matched the ideal and employers were often left disappointed when servants fell short of their high expectations.

Historians have noted the influx of literature during the late nineteenth and early twentieth centuries responding to this so-called "servant problem" (see Davidoff 1995; Dawes 1974; Delap 2011; Huggett 1977; Sambrook 1999; Strasser 1982; Turner 1962). They found that across domestic manuals, women's magazines, periodicals, the newspaper press, and government reports there was a sense of urgency to address what was perceived as a dire shortage of "decent help." The issue was not necessarily a question of quantity but that of quality. Employers complained that "most servants put on airs, stole from their employers, left their positions without notice, and performed their duties without skill or care" (Strasser 1982, p. 163). In response, many middle-class women published literature outlining guidelines and offering advice to their fellow peers on how to best manage and get the most out of their domestics. Lida Seely, author of *Mrs. Seely's Cook-Book; a manual of French and American cookery, with chapters on domestic servants, their rights and duties and many other details of household management* (1902), offered in her manual a list of twenty "don'ts" for

employers when dealing with servants. These ranged from "Don't engage a servant without having a clear understanding as to what he or she is expected to do" to "Don't neglect to have inventory of china, glass, silver, and bric-a-brac of each servant coming and going" (pp. 33-34). This genre of advice literature written *by employers* specifically *for employers* is a practice that bears an uncanny resemblance to the style of reviews written by customers on the Amazon website. For instance, users often structured reviews in terms of lists of positive and negatives or dos and don'ts. One top reviewer posted 9 tips in his review of the Echo Dot. They suggested for users to "Take the time to voice train Alexa at least once. It's kinda tedious but really improves the accuracy," and "If a phrase doesn't yield the results you're looking for, reword it and try again".

The parallels between domestic manuals and user and tech reviews extends even more so into the kinds of concerns that were raised. Value for money and expenses were a common theme. *Mrs. Seely's Cook-Book* included pay tables for servants from one day to one month, and described best practice for settling wages with servants in the event of dismissal (pp. 1-38). Similarly, tech reviews from Wired, Gizmodo, Tech Radar all made assessments based on functionality and value for for money. But perhaps the most striking similarity is in the forms of criticism levelled at both servants and digital assistants. Listening, both not enough and far too much, were equal causes of anxiety for domestic employers and Amazon Echo users.

The Verge reviewer David Pierce (2016) opened his review of the Echo with snapshot from an interaction

> "Alexa, what's the weather today?"
>
> "ALEXA! What's the weather today?"
>
> "ALEXA WHAT IS THE WEATHER TODAY GODDAMMIT."
>
> "Right now, in New York it's 25 degrees with clear skies and sun. Today's forecast has mostly sunny weather, with a high of 29 and a low of 19."

He criticised the Echo's lack of responsiveness

> She doesn't work every time, she doesn't respond the way she's supposed to half the time, and it doesn't take long before you stop totally relying on her. And then she sits

> silent… I need the Echo to just work, so I'm not standing in my kitchen like an insane person shouting questions to nobody.[59]

The demand for precision and unfaltering compliance from reviewers like Pierce and the subsequent splurge of vocal frustration when these expectations were not met is reminiscent of the treatment of servants who fell behind their duties. As one housekeeper stated "I am treated and spoken to as if I were a dog…and grumbled and growled at from morning to night" (quoted in Huggett, 1977 p. 155). Knowing when to speak and when to listen was a high priority. The top critical reviews on the Amazon customer reviews page made complaints that ranged from an inability to listen well, "It seems to have slowly lost its sensitivity to my voice. It can no longer hear me say Alexa unless I am within 3 feet of it"; to listening too much, "NEEDS security! Anyone in range of this things Bluetooth can connect and start playing music or speaking through this thing on cell calls…I heard Alexa announce that a bluetooth device had connected, so I opened the app and discovered numerous devices, that weren't mine… Now, I get to randomly hear other voices or music start playing, in the middle of the night, anytime the people in the apartments behind me decide they wanna screw around."

These complaints were, again, resonant with expectations placed on servants. In her book *Domestic Service* (1897), Lucy Maynard Salmon, Vassar college's first female historian and a domestic reformer, discussed the social degradation of servants specifically through the regulation of everyday social interaction. She writes

> [The domestic employee] is seldom introduced to the guests of the house, whom she may faithfully serve during a prolonged visit; the common daily courtesies exchanged between the members of the household are not always shown her; she takes no part in general conversation around her; she speaks only when addressed, obeys without murmur order which her judgement tells her are absurd, "is not expected to smile under any circumstances" and ministers without protest to the whims and obeys implicitly the commands of children from whom the deference to parents is never expected.
>
> (p. 158)

Attempts to work against these norms was a sign of "wilful disobedience," an offence which could likely result in a discharge from service. Amazon Echo customers implemented

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[59] Pierce, D. (2016, June 22). I spent a week yelling at Siri in macOS Sierra. WIRED. Retrieved from https://www.wired.com/2016/06/spent-week-yelling-siri-macos-sierra/

equivalent solutions with their own wilful assistants that included "unplugging until the flaw is fixed" or simply discarding the device as "junk".

Directly related to issues of listening were concerns for privacy and surveillance. While I will discuss directly the relationship between surveillance and the Echo's figuration later in this chapter, for now I would like to highlight how these concerns manifest as shared anxieties between Echo reviewers and domestic employers. Among tech reviewers in particular, the placement of what is essentially a corporate microphone in individual households attracted a great deal of suspicion. Many saw it is indicative of the convergence between the "internet-of-things" and dragnet surveillance, while others voiced concern that such devices opened the door for the commoditisation of our most private moments. The fear that someone may be listening, even if it was not clear who or what for, carried into the concerns of the customer reviews. Some focused on the recent NSA scandals, making vague accusations of "government surveillance" and labelling the Echo as "Amazon's little NSA spy." Others directed their criticisms at Amazon itself, for instance, in one representative review, the customer below griped:

> [I] suspect that this device is listening more than we think it is. I will be talking about something and suddenly I start seeing more ads and more stuff about what I was talking about…I honestly worry that this device and Amazon, and Facebook, and Google, and Apple are all developing much more extensive and personal telemetry and information on all of us than we can appreciate. We've allowed them all to spy on us and we willingly give them everything about ourselves with full trust. Who is to say the NSA isn't listening in? While you and I have little to hide, and most of us out there behave in a lawful good manner, the telemetry on us can still be used for insidious purposes.

In this example, domesticity is defined through comfort and privacy. This fetishisation of privacy as a domestic priority is part of a longer narrative that has been slowly evolving since the seventeenth and eighteenth centuries and is associated with the twentieth century decline in servant keeping. Delap (2011) notes that the rise of the individualistic and privatised domestic sphere recast servants as "intrusive" and "disruptive" (p. 192). She argues that in the Edwardian period, many social commentators advocated for servantless living, primarily because it was considered a more "dignified" middle-class lifestyle but also in part so that households could free themselves from the gaze of nosey servants. She discusses articles in which maids were described as "lurking during domestic squabbles" and "[watching] her employers as a cat watches mice" (p. 193). Even Lida Seely (1902) included special notes to servants in her domestic manual bluntly calling them into line, "Don't spy on your masters

and mistresses—the fact that their bread is in your mouth should be a reason for keeping it shut" (p. 35).

While historically tensions between privacy and servant-keeping resulted in a decline of servants as a domestic fixture, in the present moment these same tensions have been negotiated with almost the opposite effect. Servant-keeping (even in its figural form) returns to the domestic realm at the very same time that privacy appears to make its exit.

These examples illustrate the persistent figuration of the Echo in the image of domestic service across a broad range of materials. In Amazon's own promotional discourse and in the discourse produced by customers and professional reviewers, domestic servility is reinscribed onto the figure of the digital domestic assistant in ways which distinctly shape attitudes and relations with the device. Whether this is conscious or unconscious is secondary to its effect; that is, projecting onto the device preexisting structures and narratives regarding servility and the domestic organisation of power. There are, however, notable deviations between the Echo's figuration and the historic reality of domestic servility. Of significance to this analysis is the deracialised representation of the voice of Alexa.

Race, voice, and the figural structure

It is my contention that the voice of Alexa is coded through whiteness. By whiteness, I refer to the sense of being "non-raced," that is, not explicitly identified according to race. Richard Dyer (1997) has argued that in dominant discourse (i.e. White discourse) whiteness is a category that often escapes identification and explicit racialisation. He states "race is something only applied to non-white peoples" and that whiteness is not "racially seen and named" in the same manner (p. 1). Whiteness defines the voice of Alexa insofar as it escapes the ascription of characteristics that identify it as a racialised Other. Mark Marino (2006; 2014) has argued that most mainstream chatbots often utilise what he calls "unmarked (white) standard English" (2006, p. 4). This is a form of English that aspires to evade specific identifying cultural inflections, it is language that is for him "without culture, disembodied, hegemonic, and, in a word, white" (p. 193).

In Human-Computer Interaction (HCI) voice interface research, the dominant paradigm is to consider race through a strictly visual logic. Race is understood as a variable of skin tone, hair type, eye colour and other forms of visual presentation. As a result, non-visual variables such as voice are often neglected as an expression of race. For example, on the subject of race and conversational agents, human-computer relationship researchers Clifford Nass and Scott Brave (2005) have argued that interface designers should focus on accent, meaning the unique

vocal intonations associated with regional dialects, rather than "the skin color of the agent" when designing an interface (p. 67). They state

> The current research suggests that race is not important as an independent effect, at least when an accompanying voice provides broader and deeper information than what can be determined from ancestral geography. The linguistic and paralinguistic cues are so informative that identifying a person's geographic progenitors is simply not valuable.
>
> (p. 69)

Yet at the same time, they also advocate for the use of labels and stereotypes to help socially identify a synthetic voice. They argue that appealing to labels can be favourable as "labels allow the human brain to make quick assumptions and predictions about other people and help the brain cope with the complexities of social interactions" (p. 69). They go on to discuss how accents are tied to stereotypes and how properties such as "education," "intelligence" and "credibility" are "manifested in speech" (p. 70).

This reductive view of race that considers only visual cues, such as skin colour, wilfully overlooks the ways in which race is constructed through broader formations. It overlooks the relationship between race, class and accent. It neglects how "education," "intelligence" and "credibility" are attributes which are themselves racialised. And it also fails to acknowledge that race is not just a matter of "being" but of "doing," that is, one not only *is* raced but also *does* race and this includes employing cultural linguistic markers (see Nakamura 2008). To suggest that voice can be empty of race fails to consider how whiteness has come to constitute an apparently neutral norm. It reinforces the dominant cultural belief that "whites are not of a certain race, they're just the human race" (Dyer, 1997, p. 1) and that coextensively white language is not raced language, it simply is language.

Arguably, the selection of the "white-voice" reflects the desire by voice-interface designers to best create the conditions for speech intelligibility. Designers often proceed on the tenet that native English speech, i.e. speech that is non-accented, is the most intelligible speech. But as Halcyon Lawrence (2014) has observed, the ubiquitous use of native speech in speech-mediated technologies is nonetheless problematic as it implicitly functions to "assimilate accented speakers to some native norm" (p. 768). It contributes to an imperialistic view of language that positions those with accented voices as outside the imagined image of the national subject and furthers the use of language as a tool of colonisation and marginalisation (see Nieto 2007).

Although Amazon Echo's assistant Alexa is never explicitly identified as "White", it is nevertheless aestheticised and characterised by Amazon using aspects that are underwritten with ideals of Whiteness. Alexa speaks English in a broad American accent rather than, for example, a South Asian accent. It does not use vernaculars or dialects that are stereotyped with racialised communities, such as Black or Latino communities. It has an extensive vocabulary and partakes in certain social mores to associate it with the "mannered", educated upper classes. And finally, it has been given a name that consciously draws on the narrative exploits of Western civilisation. Amazon's Senior Vice President of Devices David Limp stated in an interview that along with having desirable phonics for voice recognition, the name Alexa was chosen because it was "reminiscent of the library of Alexander [sic]" what has been culturally viewed in the West as "the source of all knowledge" (cited in Lashinsky, 2016). Indeed, the plethora of parody videos that reimagine digital assistants such as Alexa or Siri as Mexican, African American, or Chinese with names like Siriqua[60] or Shameka[61] all play on racial and ethnic stereotypes in such a way that underscores the whiteness of the original model.[62]

The contradiction between the historic reality and the representation of domestic service is an outcome of the figuration process. As I have so far argued in this thesis, the figural structure displaces linear representation positing instead an inverted model in which the effect produces the cause rather than the cause producing the effect (Bliss, 2015, pp. 12, 27). In this instance, the figuration of the Echo and the digital assistant Alexa in the image of idealised domestic service correspondingly refigures cultural narratives of domestic servility. Instead of being represented as difficult or degrading work, domestic service becomes a pleasure to perform. Instead of servant-keeping being a traditional and conservative-bourgeois form of inferring status, smart assistants are a progressive and uniquely modern marker of social class. And instead of servants themselves being acknowledged as an historically racialised and exploited class exemplary of wider histories of racism in America, Alexa is a white-washed and compliant character dreamed up from the aspiringly socially conscious culture of Silicon Valley. These refigured narratives supplant those previously circulating, taking the place of the original instead of the copy and presenting itself as a reality that always already was. While

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[60] ADA Sport. (2014). Black Siri aka Siriqua. Retrieved from https://www.youtube.com/watch?v=8S74z4veej8

[61] Comedian JazmynW. (2017). If Amazon Alexa Was Black | Shameka. Retrieved from https://www.youtube.com/watch?v=tUJXn1Lq0hI

[62] Gregory Jerome Hampton has similarly argued in his book Imagining Slaves and Robots in Literature, Film and Popular Culture (2015), that fictional robot characters such as Rosie the robot is modeled are often modeled on antebellum slave tropes like the mammy. Her blackness too was erased by identifying her not with southern accent but a New Jersey accent, a notable point of difference between the household who spoke with broad non-distinct American accents (pp. 11-12).

the establishment of new trajectories is inevitable as a part of the figuration process, there are certain shortcomings within this context.

Firstly, the elision of racial identity from the figuration of domestic service dehistoricises and depoliticises the servant/master relation. Where this relation has been fundamentally predicated on racialised human exploitation, the figure of the white-speaking, middle-class AI effectively erases this essential narrative. We may ask, for what reasons has Amazon chosen to figure Alexa in this way? The optimistic (and albeit less likely) view is that in attempting to reach a broader racially demographic audience, Amazon flips the script on servitude allowing those who have been traditionally trapped in subordinate relations of race and class to indulge in a fantasy in which Black and Brown people give the orders and a white voice cheerily complies. What is, unfortunately, more likely is that by aestheticising according to the norms of whiteness, Amazon seeks to appeal to a more "universal" subjecthood for their AI. In doing so, they can avoid both the discomfort associated with racialised servitude as well as any confrontations with the historical consequences of slavery, colonialism, global capitalism or white supremacy. Here, the nineteenth century American fantasy of a servile class that is without race and without history is fulfilled. As Strasser has argued, one of the key indignities of working as a domestic servant was that employers payed little respect to one's identity outside of the contract of service. Rena Bethune, a Black household worker interviewed in 1977 lamented "[Employers] don't care anything about you. They don't want to know nothing about your background; they don't even want to know what's going on in your home. All they want to know is what you are doing for them" (Strasser, 1987, p. 178). For multinationals such as Amazon, the coming of age of AI finally resolves the long-standing "servant problem." By creating a servile class that literally have no personal backgrounds, no families, opinions, desires, wants or needs, or homes of their own, these companies are able to capitalise on an idealised vision of servitude without having to contend with the practicalities or moral question of servant-keeping.

Secondly, the figure of idealised domestic service misrepresents the power relation between the device and its user in such a way that it makes contending with issues such as surveillance and digital labour increasingly difficult. Where in classic servant/master relations it the servant that is understood as performing labour for the household, in this refiguration the relation is inverted. New media empires form part of the automated data collection apparatus that is critical to digital capitalism. Companies such as Facebook, Google, Twitter and Amazon famously capitalise on the exploitation of user data through complex mechanisms of commercial surveillance. While some of this data is created consciously by users in the form of user-generated content, or what Christian Fuchs (2015) calls "prosumer labor," much of it is gathered through the mechanisms of monitoring and surveillance.

As discussed in chapter seven, AI systems form part of the critical infrastructure of surveillance capitalism. In this context, smart home devices with digital assistants form another interface for the collection of user data. By adding voice to the already rich array of data collection methods, Amazon is able create more layered and intimate profiles of domestic habits that have so far been only obliquely observed or constructed through conjecture. That Amazon encourages users to link their Echo devices directly to online purchasing accounts is suggestive of the intent to manipulate domestic environments into commercially lucrative opportunities.

Andrejevic (2012) describes these forms of commercial manipulation as part of the widespread integration of predictive analytics into marketing ecologies. He describes this as a wager predicated on the belief that "comprehensive monitoring will give marketers greater influence over consumers" (p. 74). The marketing industry exploits data gathered from user activity to create the ideal conditions to induce desired behaviour. He critiques this intent to "trigger latent demand" as a form of conscious manipulation and control:

> If I have certain anxieties and desires that are triggered and enhanced by custom-targeted forms of marketing that result in a response anticipated by marketers, it seems misleading to say that behaviour has not been subject to deliberate forms of management and control. In this respect, the ability to collect and analyse large amounts of data in order to influence consumer behaviour might be considered a form of power.
>
> (p. 76)

The extreme administration of this power forms a suffocating reality in which every aspect of social and personal life becomes colonised by commercial interests. The inclusion of smart devices into intimate spaces and daily routines represents a new frontier for the commodification of everyday life. It is coextensive with forms of capital accumulation in digital culture that, through miniaturisation and portability, "monetise and accumulate data about the body's movement while subsuming it ever more tightly in networks of consumption and surveillance" (Terranova, 2014, p. 394). To describe smart devices as working for or in service of households is not an accurate representation of the direction of power, on the contrary, it is the household that labours for the device. The figuration of the Echo through idealised servitude not only obscures this power relation but consciously exploits this false image to extract more information, more data, more labour.

Chapter ten

Conclusion

The aim of this thesis was to demonstrate that consistently, across different technoscientific sites, gender both figures, and is figured by, AI. This relationship is not determining, in the sense that one precedes and acts upon the other, but rather is mutually constitutive such that each *constitutes the conditions of the other's intelligibility* and each is *constituted by those very conditions*. I used figuration as a critical framework to conduct close readings of case studies spanning scientific history, popular culture, and everyday life. Each of these readings drew on unique sets of case study materials—from formal and informal archives of early AI researchers, to online customer reviews of commercially available digital assistants. This varied corpus allowed me both to demonstrate the pervasiveness of AI and gender's co-figuration, and to underscore the specificity of the materials to the analytic outcome. In other words, how the tools of analysis were themselves a part of the material-semiotic entanglement that constitutes the figural [63]

When considered together, these case studies map a significant trajectory that traces the changing character of figuration as AI technologies move from the lab to the living room. The closed and secretive nature of AI research in its earliest years meant that gender was figured by an abstract discourse of negation. In the case of Alan Turing and the Turing test (chapter four), this was characterised through an epistemic erasure of gender that was symptomatic of Turing's own "discrete" approach to life and machine intelligence. In the case of the Dartmouth workshop (chapter five), it was through forms of social enclosure that positioned gender as unintelligible within the intellectual discourse of symbolic AI. In both cases, the ontological and epistemological marginalisation of gender had direct material effects on those whose bodies were marked by gendered difference. In the former, Turing himself suffered through public humiliation and punishment by a repugnant homophobic state. In the latter, there was a full spectrum of irreverence towards women, from the lack of recognition of their contributions to AI history, to the most horrifying revelations of human exploitation.[64]

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[63] Following Barad (2007), the tools of analysis in figuration, as in quantum physics, are part of the material arrangement that defines the conditions of measurement. Different case study materials shift what is possible to be measured and what is not.

[64] See footnotes 26, 39 and 40 in chapter five that relate to Marvin Minsky and the MIT Media Lab

Over just a few decades, the infrastructures that support AI technologies—such as automated data capture, storage, and analytics—have grown from speculative to the very backbone of the modern economy. The film and home entertainment industries—as with the rest of the culture industries—are reliant on large-scale computing and infrastructures of platform capitalism. From beginning to end, the film-making process is shaped by the manipulation of data: social media profiles are used to determine viable markets, digital production and post-production processes are reliant on powerful CGI software that algorithmically generate scenic elements, and recommender systems deploy network models of prediction at scale to capture user attention. For all intents and purposes, a computer animation studio such as Pixar effectively *is* a large-scale technology company: their employees consist of digital animators who are also software engineers, their patented CGI techniques regularly make use of use of AI and machine learning, and their assembly of render farms—clusters of high-performance computer systems—are considered some of the most powerful supercomputers in the country.

The ubiquity of AI within this industry has unsurprisingly had an effect on the kinds of narratives that are being produced. *WALL-E* (chapter six) features anxieties over human obsolescence and machine reproduction. It uses heteronormative tropes of gender to give life and vitality to artificial characters. *Ex Machina* (chapter seven) dramatises the figuration of gender as a variable within an algorithmic system, one that is also inextricably coded by racist logics. As I argued, in the former, it was technology that became gendered, in the latter it was gender that had become technologised. In the context of real worlds that are increasingly enclosed within dystopic surveillance systems, it is no surprise that the science fiction worlds we imagine are set closer and closer to the present moment. These are barely visionary or prophetic, no longer accounts of the world as it might be but nightmarish scenarios of the world that already is—not cautionary tales but sad laments.

AI systems, technology, cultures and figures today feel less extraordinary and more just ordinary, a sign of their entrenchment in everyday life. The gendered figurations of mundane objects, like digital assistants, now serve as windows through which to analyse the shifting dynamics of power and privilege at home and at work. Apple's Siri (chapter eight) is sold as a necessary accompaniment to the contemporary demands of post-Fordist labour, with advertisements designed to interpellate subjects into capitalist regimes of hyperemployment. Siri's feminised figuration speaks both to the technologisation of social reproduction and to the normalised precariousness of contemporary waged labour. The Amazon Echo (chapter nine) provides insight into techniques of surveillance capitalism operating within the domestic sphere. Alexa's figuration on an idealised vision of domestic service obscures its function as an automated surveillance device. Its aesthetic coding as a native-speaking,

educated, white woman decontextualises and depoliticises the historic reality of domestic service, erasing the bourgeois middle-class home as a site of race, class, and gender exploitation. In both instances, gender is a crucial aspect of AI's figuration. It is as a technique —a kind of technology—used in service for commercial ends.

Together, these case studies map a narrative from gender's early absence in scientific discourse, to its symbolic manipulation in popular culture, and its strategic deployment in everyday life. There are, however, several limitations to this method of analysis. As acknowledged in the introduction, an examination of figurations can never be exhaustive. This is in part due to the dynamic and emergent nature of figures themselves. Analyses capture just a single moment of stabilisation, which is almost then immediately subject to review. Even readings of the same case studies over time may yield vastly different interpretations as new formations and details emerge[65]. This does not mean that analyses are irrelevant or are obsolesced, but rather, in the tradition of Foucault (1966/2005; 1969/2002; 1976/1990), they provide genealogical snapshots into the organisation of discourse, knowledge, power, and practice.

Any comparative case study approach requires the researcher to make some selections over others. This thesis has made a conscious choice to select mainstream examples that are geographically clustered within Western, primarily North American, imaginaries. This decision was made for two reasons. First, a culturally homogenous corpus allows one to make clear connections between case studies and historical events. Gender, particularly within the cultural West, has a distinct history that is shaped by Christian morality, colonial hierarchies, shifting scientific classifications of sex, and Western feminist discourse. A comparison between an American case study and, for example, a Vietnamese case study, would need to take these issues into account and are beyond the scope of the questions posed here.

Second, mainstream texts are exemplary corpuses to analyse dominant ideology. As scholars of popular cinema, such as Siegfried Kracauer (1947/2004) have argued, popularity is a sign that a text responds to unconscious mass desires. Such examples reflect the "unseen dynamics of human relations" that are "more or less characteristic of the inner life of the nation from which the [objects] emerge" (p. 8). In this case, the dominance of the U.S. in historical narratives of AI development, the continued role of Hollywood in the production of globally consumed media, and the concentration of power and influence held by just a handful of moguls in Silicon Valley warrant sustained investigation.

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[65] As was the case with chapter five and the revelations regarding the funding cultures of the MIT Media Lab, Marvin Minsky, and their implications in the crimes of Jeffrey Epstein.

Further studies in figurations of AI and gender could turn to more subversive and alternative sites for analysis. The work of political activists and artists are rich sources of interventionist narratives into mainstream figurations. Sites of technological failure can also operate as generative frictions from which to materialise yearning. Importantly, further studies that pursue these sites could draw more extensively on the work of queer and crip technoscience to further unpack the intersectional workings of power that figure them as marginal to begin with (see Hamraie and Fritsch, 2019).

In addition, studies that turn to more geographically diverse contexts could provide more nuanced trajectories to the work of figuration across barriers such as language and culture. Studying mutual figurations of AI and gender in a country like China would be a fascinating point of comparison. These figures would be entangled with a number of crucial narratives: the ambitions of the Chinese government to turn China into a global leader for AI, its history of intervening through policy-making in the gendered dynamics of households[66], entrenched Confucian beliefs in filial piety and gendered kinship, and a concerning history (and future) of authoritarian use of AI systems and technologies against ethnic minorities[67].

One of the core aims of this research was to demonstrate the utility of "figures-in-the-making" as a feminist framework and method. "Figures-in-the-making" is a provocation for STS researchers to 1) rethink the traditional sites of scientific action, and 2) reorient analyses towards the kinds of critical formations that are in-the-making while science is being made. Too often is the term "gender" used as a shorthand to mean only the study of women or women's experiences. While such studies absolutely have value, in this context they can delimit the analytic scope and inhibit opportunities to produce intersectional readings. The phrase "woman" can invite the analyst to draw on pre-determined or pre-bound concepts to conduct their analysis. The phrase gender-in-the-making, however, encourages the researcher to analyse how the organisational framework of gender is constituted over time. Intersectionality becomes an inherent part of the method as it continually asks the researcher to reflect on "what else is being made?", "what other categories are contingent on these formations?" All good feminist theory acknowledges that there is more at stake in the gendered body than just normative categories of male or female. These are also sites for the making of racialisation, class dynamics, disability (in)justice, and desire and sexuality.

Feminist technoscience too is arguably in-the-making in the articulation of this scholarship. The reticence of feminist STS scholars to classify themselves as being part of a

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66 For example, the enforcement and elimination of the One-child policy, and the effect of socialist policies on women's liberation (see Shih 2005).

67 In particular, the use of facial recognition systems for the racial profiling and detention of Uighur Muslim minorities. An unconscionable practice that is a fundamental violation of human rights.

singular "field" is indicative of a collective acknowledgment of the ongoing performativity of research. As scholars, we must also ask, what kind of knowledge do *we* make? What ethico-onto-epistemo-logies are in-the-making *in our own research practice*? In a time when both governments and commercial organisations are globally throwing millions of dollars of research funding at institutions to investigate topics like AI and gender, these questions are now more pertinent than they have ever been. With every passing day it feels like there is another revelation of a sexist hiring algorithm, a racist facial-recognition system, or an automated decision-making system that is being used to make punitive decisions against poor and marginalised communities. Equally, with every passing day there is a research centre erected to respond to these deeply troubling developments. What I have sought to demonstrate with this study is how a deeper, theoretical engagement can provide different insights to the questions already being asked. I am aware that every word I commit to this topic is too a figuration—a claim to knowledge, an attempt to bring forth a particular relation of power and practice. While I have not looked at subversive figures, I have attempted to model an alternative research method. My hope is that it too continues to grow and unfold in other spaces, like all figures, that is stays in-the-making.

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