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Kathleen Richardson

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In loving memory of my brother Mark

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Introduction
Annihilation Anxiety and Machines

> In an extreme view, the world can be seen as only connections, nothing else.
>
> Tim Berners-Lee, *Weaving the Web*, 1999, p. 14.

The Terminator movies (1984–2003) show examples of robots that are super-advanced intelligent machines intent on destroying humanity to assure their supremacy. *The Terminator* is significant to begin this narrative, as it is one of the most popular fictions of a robot and it carries a central theme about human destruction. Whether you look to the past of robots or the present, this enduring theme of destruction returns. I respect that there are many other kinds of robots to consider such as robot companions, robot lovers, therapeutic robots, domestic robots and others, and we will explore these different imaginings of the robot in what follows, but for now, we will focus on the theme of human annihilation by robots.

The Terminator film caused something of a stir when first released in 1984 and was seen by millions of people around the world in the first year of broadcast.[1] It features a high-profile Hollywood action actor, Arnold Schwarzenegger, who has a very unique stature; he is known for his toned muscled physique and stands at 1.88 meters or over 6 feet 2". Schwarzenegger's speech is marked by his strong Austrian-intoned English, and his speech and language are jokingly referred to as mechanical and formalistic. Some have rudely suggested he makes the "perfect" robot! While this is not the case, it is true that we take our cultural and technological models of robots from fictions. Multiple tides flow from fictions to living practices of technoscience.

A quick summary of the plot of the first *Terminator* is necessary. Set in the future of 2029 (not far away now), a super-advanced cyborg is sent to 1984 to kill Sarah O'Connor. In this dystopian future of 2029, super-intelligent machines rule the Earth, and authority over the remaining humans is maintained by killer robots. The Terminator T-800 Model 101 is sent back in time and must destroy Sarah O'Connor. Sarah is the mother of the future leader of the human rebellion. The machines figure if they can stop her child from being born, they can save themselves problems later. In this tale that twists and turns, and folds together the future, present and past, human and nonhuman into its narrative texture, the film represents an iconic Euro-American portrayal of robots as destroyers.

This popular fiction of robots has something important to tell us about the cultural theme of destruction, and more frightening themes followed in each subsequent film: *Terminator 2: Judgment Day* (1991), *Terminator 3: Rise of the Machines* (2003), and *Terminator Salvation* (2004). And the *Terminator* story is not over yet: in July 2015, *Terminator: Genesis* is scheduled for release, and speculating from the title, involves a hint at a rebirth. Only time will tell what the next installment of this robot saga has in store!

Hollywood filmmakers may receive some reward for shaping the cultural imagination of robots, but it was not them, but another more esoteric and radical avant-garde playwright to whom we must make our first tribute in recognizing the robot as a cultural entity, and a destructive one.

The first robots emerged as characters 1920s play, *R.U.R.* (Rossum's Universal Robots), written by Czech playwright Karel Čapek. The play is unique. It is the first to coin the term "robot" and features the first cultural representations of robots. *R.U.R.* is the first play of modern fiction to bring about the end of humanity as a narrative plot of complete human annihilation (Reilly 2011). This being the first work of modern fiction to do this is significant, as prior to this, only in religious tales such as the New Testament's Book of Revelation is human annihilation a central feature when the apocalypse comes.

The robot—as first given life in a text and through theatrical performance by its creator Čapek in *R.U.R.*—is a device to explore the fears of terminus in human existence brought about by mechanization, political ideologies and high modernism, and it speaks to the theme of humanity's end. Set in the tumultuous political era of the 1920s, Čapek took the idea of the factory worker one step further by inventing the robot. He created a laboring entity to work with limited subjectivity, a functionally competent laboring device. The term robot is from the Slavic term for work ("robota"), but Čapek, inspired by his artist brother Josef, drew on another meaning of the term relating to the "robota economy", an agricultural system where peasants work extra, providing for their landowners needs before their own. Robot is Czech for 'compulsory service', akin to Slav "robota", meaning 'servitude, hardship' (Merriam-Webster 1971, p. 1964).

As we reflect back on the robot in the 1920s play and the contemporary fiction of it, there is a recurring message:

BEWARE YOUR END, HUMANITY!

In which case, we must take seriously the fear of the end of the human that is circulated in robot narratives.

In this book, I will preface and interlace each chapter with tales from robotic fictions because I want to argue that robotic fictions are taken into the lived realities of robotic practices and transferred into the making of robots, returning back into those fictions. This book is a reading and appreciation of these fictions by observing the making of robots in labs at the Massachusetts Institute of Technology (MIT). MIT is a world-renowned science and technological institution, repeatedly in the top three of the world's top research institutions (QS World Rankings 2014). MIT has a presence in popular culture that has formalized its mystique. In the 1950s classic, *The Day the Earth Stood Still* (1951), an alien spacecraft lands in Washington, guarded by a robotic life form. In the panic that ensues, it is MIT scientists that the US government calls on to help "rationalize" the situation, decipher the mystery of the alien visitor and calm the American public. In American culture at least, MIT scientists stand for impersonal rationality and arguably masculine authority in the fields of science and technology.

By the time I began thinking of my fieldwork in the early 2000s, humanoid robot labs only numbered a few around the world, notably in cities in Japan, such as Tokyo and Waseda. MIT's robot lab was one of the first in the US to begin a program of making humanoid robots, funded by a generous Defense Advanced Research Projects Agency (DARPA) grant. Robots and violence are frequent bedfellows, even when the robots produced by military funding seem to have no direct application for a military purpose, such as building a robot child.

What is in a name anyway? In labs at MIT, I realized lab titles were fragile, coming and going depending on the grant or new focus of the research director. As a visiting researcher to robot labs in the US and the UK, the lab name is really an umbrella term, often for a multitude of research activities, some humanoid in focus and others not. The MIT robotics lab was set in the Artificial Intelligence Laboratory but shared the same physical space as MIT Computer Science. In 2003 these two departments merged to become The Computer Science and Artificial Intelligence Laboratory (CSAIL). All the CSAIL researchers were relocated to a new campus building, designed by architect Frank Gehry, known for his radical, geometrically distorted designs (Gilbert-Rolfe and Gehry 2002).

In keeping with issues of anthropological commitments to confidentiality, I have given the people and the robots in the lab pseudonyms. Some of these pseudonyms I have playfully taken from Čapek's play, *R.U.R.* As the robotic scientists I work with produce artifacts such as memos, scholarly dissertations, books, papers and robots, I have only referred to public material if such activities do not conflict with my initial commitment to honor the relationships with my interlocutors, many of whom are still my friends. I experienced considerable generosity from the lab group and researchers at MIT. I found their work and their lifeworlds extraordinary, and I hope some of that uniqueness is reflected in this book.

The robotics lab had taken a humanoid turn in early 2000s after its group director had been inspired to build humanlike robots after watching the film *2001: A Space Odyssey,* made in 1968 but set in the year 2001.

The lab pioneered the first sociable robot (an oxymoronic term no doubt): A robot designed for social interaction with the intended aim of developing to such an extent that its future kin would be sophisticated enough to be a companion to humans.

This book then is about the theories and technologies that go into the making of robots, as well the people who make them and how their stories and narratives feed into the machines they create.

Haraway's observation that the boundary between fiction and reality is thoroughly breached by technoscience is, of course, accurate (1991). But what I will attempt to show in these pages is that the Real is continually asserting itself in the making of robots, and there is a sphere outside cultural constructions that has its own separate properties. The Real is the boundary. Robotics in its own ways is confronted by its own realities. When constructing models of the mechanical human, theory and practice become intertwined in distinctive, sometimes unpredictable ways. In these labs, the robotic scientists continually referenced robotic fictions when producing robots, and the robots were repeatedly meeting the constraints of the Real: the physical, social and cultural environments that acted as containers. The Real and the fictional played off against each other in unusual ways, most notably in how the theme of robot destruction was addressed by these researchers. The cultural image of the threatening robot informed the making of the robots in the lab. The following information was provided on a robotics lab website at MIT:

> Q: Are you ever worried that your robot might get 'too intelligent' or 'too powerful'?
>
> A: No—we have programmed the robot to spare our lives in the event that it ever attempts to organize its brethren in a bloody revolution against the human race.
>
> (MIT Humanoid Robotics Group n.d.)

Here the theme of destruction is taken up and diffused in a light-hearted way, but robots and artificial intelligence (AI) threats are present and receive more than a passing dismissal as will become apparent in the pages that follow.

ANNIHILATION ANXIETY: TO REDUCE TO NOTHING

The last few decades of anthropological theorizing have been beset by a number of theoretical problems that have resisted the dualistic analytical consequence of Cartesian dualisms and the ways these constructions have played themselves out in the construction of what life is (Latour 1993, Haraway 1991). One may say that anthropology as a discipline has suffered (and overcome) a kind of separation anxiety—about how to describe, resolve and

explain dichotomous relations including those between: persons and things (Gell 1998; Strathern 1988), humans and machines (Haraway 1991; Haraway 2003; Suchman 2006; Hicks 2002; Rabinow 2011), humans and animals (Haraway 2003; Haraway 1991; Ingold 2012), the body and the mind (Csordas 1999; Featherston & Burrows 1995), humans and nonhumans (Latour 1993; Latour 2005), fact and fiction (Haraway 1991; Graham 2002), and public and private spaces (Buchli and Lucas 2001; Buchli 1997).

If anthropology is said to have dealt with and overcome separation anxiety, why is the theme of human terminus brought about by machines a persistent and recurring theme in contemporary Euro-American cultural life? Latour (1993) takes this one step further and proposes that underscoring the fear of machines is a result of asymmetrical humanism (separation anxiety):

> How could the anthropos be threatened by machines? It has them, it has put itself into them, it has divided up its own members among their members, it has built its own body with them. How could it be threatened by objects? They have all been quasi-subjects circulating within the collective they traced. It is made of them as much as they are made of it.
>
> (1993, p. 138)

For Latour, the fear of the machine is an outcome of artificially separated categories, and this is reflected in the fear of objects (robots, viruses, supercomputers or meteors) that possess autonomy and can come back and haunt humanity as detached other.

Could the fear of the machines really be an outcome of 'asymmetrical humanism', as Latour proposes? I want to suggest that fear of robots and machines is the outcome of symmetrical anti-humanism, where humans and nonhumans are placed on a par, and the human is ascribed no distinctive quality over other agents—where human agents are reduced to nothing. This is presented as an anthropological emphasis on process in the absence of ontological difference. The robot has historically been a way to talk about dehumanization and the elevation of the nonhuman. The first meanings of the robot were primarily about dehumanization, and hence Čapek's robots were human, made of flesh, blood, bones and veins, but assembled on a mechanical production line with a scientific formula (2004, p. 13). It was other artists in the 1920s that took the robot character from the play and turned it into a machine. We can look to the robot in its historical sense and its contemporary manifestations in labs and in fictions to explore these points further. I frame this recurring fear, in contrast to separation anxiety as annihilation anxiety.

Annihilation anxieties are produced by an analytical position that rejects ontological separations, combined with radical anti-essentialism—when humans and nonhumans become comparable. The dystopian horror presented in *R.U.R.* and *The Terminator* films relate to a fear of terminus, but the fear of the robot uprising is an existential fear about the end of the human (though with $8 billion in forecasted funding for military robots by 2016 (ABIResearch 2011), the physical threat of destruction is not so fictional). The robot is a way to reflect on the violence of World War I and the unprecedented destruction of human life mediated by machines. The end of the human then is intimately related to violence: death is the ultimate end of the human.

What does annihilation mean? Annihilation is one of those terms encompassing multiple meanings, and I call upon all of those meanings in proposing an analytical framework to make sense of robots and AI systems. On the one hand, annihilation means the 'act of annihilating' or 'state of being annihilated' (Webster's Third New International 1971, p. 87). We are already familiar with Euro-American narratives of technological revenge—in the form of Frankenstein's monster from the nineteenth-century classic tale by Mary Shelly (1969), or *The Matrix* Trilogy (1999–2003), where humans are imagined as batteries for AI systems. Annihilation also means 'cessation of being: NOTHINGNESS' (Webster's Third New International 1971, p. 87). Annihilation is derived from the verb "annihilate" ('ending'), and the Latin "annihilates", past participle of "annihilare": 1. 'to cause to be of no effect', 2. 'to look upon as nothing', 3. 'to reduce to nothing' (Webster's Third New International 1971, p. 87). These meanings open up another way of reflecting on endings and nothingness. Central to this discourse on robots is to highlight the reduction of the human to nothing, as a nondistinct agent in anthropological theorizing. 'To reduce to nothing' is also about the erasing of differences between humans and nonhumans. As anthropological theorizing takes an 'ontological turn' shaped by 'actor-networks', 'assemblages', 'meshwork', and 'companion species', so too are the human and nonhuman interconnected, even enmeshed with each other (Latour 2005, Rabinow 2011, Ingold 2012, Haraway 2003). Aside from the meanings the term annihilation possesses in popular language, it has meanings in physics, too, which are worth considering: '. . . the process whereby an electron and a positron unite and consequently lose their identity as particles transforming themselves into short gamma rays' (Webster's Third New International 1971, p. 87). In this sense, annihilation means something more than the mere disappearance and end of phenomena: a stage of merging occurs before one thing is created from these two forms. Out of nothing does come something—at least in theoretical physics.

In Buddhist philosophies too, annihilation of the ego is the highest state of being a human can attain. Japanese roboticist Masahiro Mori, theorist of the uncanny valley, writes, 'human beings have self or ego, but machines have none at all. Does this lack cause machines to do crazy, irresponsible things? Not at all. It is people, with their *egos* who are constantly being led by selfish desires to commit unspeakable deeds. The root of man's lack of freedom (insofar as he actually lacks it) is his *egocentrism*. In this sense, the *ego-less* machine leads a less hampered existence' (Mori 1999, p. 49; my emphasis). In the *Buddha and the Robot*, Mori writes of his Buddhist vision of science, technology and robots. In Buddhist philosophies, the relations between different kinds of things are seen as interrelated. 'As I consider questions of this sort, I am reminded of the Buddhist axiom that "nothing has an ego". This means that nothing exists in isolation; everything is linked with everything else' (Mori 1999, p. 28).

Cartesian dualism, which proposed the mind as transcendent and the body as immanent, did capture something about the nature of ontological difference. In rejecting Cartesian dualism, anti-dualist categories have emerged ('cyborgs', 'meshworks', 'actor-networks', and 'assemblages'), but such styles propose a multiplicity without proposing any ontological difference of the different entities. Cartesian dualism has not been resolved—it has been side-stepped into a form of merging. In rejecting the ontological difference that was captured in the theorizing of dualism, a form of the "I/ego" is also threatened: the "I" as a human subject and different from other entities. Robotic scientists and AI theorists bring these issues to the fore in the way they create artificial beings (Helmriech 1998).

EVERYTHING IS CONNECTED

"Everything is connected" is a phrase we hear repeatedly: from chaos theory, when a butterfly flaps its wings, creating havoc elsewhere (Gleick 1994), to globalization (Erikson 2003) that emphasizes global flows of markets, labor, goods, services and capital. Let us consider Marilyn Strathern's (2014) points in relation to this statement:

> Indeed, the more so-called 'bounded' notions of society and culture are held up to criticism, along with the systems and structures that were once their scaffold, the more relations, relationships, the relational, relationality, are evoked as prime movers (of sociality) in themselves. Quite aside from identifying relations in structures, systems of classification, co-variation, and so forth, the concept is equally forcefully applied to any new object of knowledge, emergent configuration, or co-construction, and not only in a passive sense (*everything is connected*), *but in the active sense of the observer making phenomena appear, illuminating them, by the concept.*
>
> (p. 5; my emphasis)

In the 'active sense of making phenomena appear', Strathern highlights the construction of connections between everything. Strathern (2014, p. 10) takes up these points and develops philosopher John Locke's ideas of association when what becomes connected to something else is dependent on the types of associations that are crafted. Locke's theory of associations was also a theme that interested cybernetics pioneer Norbert Weiner. In Weiner's classic text

Cybernetics: or, Control and Communication in the Animal and the Machine, he outlines a theory of cybernetic systems as organic, mechanical and tied together by control and communication systems (1961). Wiener draws on Locke's themes, exploring 'the possibility of assigning a neural mechanism to Locke's theory of the association of ideas'(Wiener 1961, p. 156). Weiner uses the example of recognition of the face of a man to explore this issue: 'how do we recognize the identity of the features of a man, whether we see him in profile, in three-quarters face, or in full face? (1961, p. 156). Weiner, like Strathern, was interested in the parts of the person, and how ever-diminishing parts could still stand in for the whole of the person (Strathern 1988).

The feminist model of the cyborg developed by Donna Haraway needs to be honored in this history of humans and machines, and though written over 20 years ago, the cyborg reveals something distinctive when contrasted with different cultural imaginations of robots. The cyborg is an analytical device with which to assess the breakdown of organism and machine as distinctive categories:

> Although the cyborg image originated in space and science fiction to refer to forms of life that are part human and part machine, it is by no means confined to the world of technology. Rather, cyborg anthropology calls attention more generally to the cultural production of human distinctiveness by examining ethnographically the boundaries between humans and machines and our vision of the differences that constitute those boundaries.
>
> (Downey, William & Dumit 1995, pp. 264–265)

The cyborg was appropriated by Haraway as a polemical tool to critique social relations, and in this sense, it is similar to the robot. Whereas the robot as imagined by its creator Čapek expressed the fear of boundary transgressions between human and nonhuman, Haraway's cyborg takes them as given, and she pushes the boundary transgressions further in her political work:

> I want to signal three crucial boundary breakdowns that make the following political-fiction (political-scientific) analysis possible. By the late twentieth century in United States scientific culture, the boundary between human and animal is thoroughly breached. . . . The second distinction is between animal-human (organism) and machine. . . . The third distinction is a sub-set of the second: the boundary between physical and non-physical is very imprecise for us'.
>
> (1991, pp. 151–153)

For Haraway, the cosmologies that constitute modernism have been called into question via new technologies and feminist theorizing. The cyborg is a symbol of the breach of boundaries and their playful dissolution. The cyborg may have had its heyday in the 1980s, but it is an important analogical (and digital) symbol for theorizing about the robot. The cyborg is an anti-dualistic and anti-essentialist symbolic construct, in the sense that Haraway in her essay critically attacks patriarchy, colonialism, and capitalism, drawing the lines between these positions and social theorizing of lived realities (1991). The robot, too, once served the same purpose as an object critical of modernism and Enlightenment, but Čapek's robots were a nightmare, not an ironical celebration as our latter day cyborg.

Tim Ingold (2012) proposes an alternative framework to Haraways' cyborg of leaky machine-organism configurations, noting the situated aspects of becoming between person and environment that he calls "meshwork", as he explains: 'Together, these entangled lines, of bodily movement and material flow, compose what I have elsewhere called the meshwork, as opposed to the network of connected entities. And this *meshwork* . . . is nothing other than the web of life itself' (p. 435; my emphasis). Ingold is distinguishing himself from the networked model of associations proposed by Latour (2005), but in the meshwork, there is no distinctive agent. In my reading, the meshwork is another kind of network. Whereas the coordinates are set in different configurations, the essentialist aspect of the human actor is still lost. Meshwork echoes the term "enmeshment", a condition of being unable to separate that speaks to being trapped, as in a net—a mesh. These lines of enquiry in anthropological theorizing reduce the human to nothing, speaking instead of a multiplicity made up of many parts.

Latour (2005) and Rabinow (2011) prefer to use the term 'assemblages' to describe these complex multiplicities of humans and nonhumans. Strathern takes up Rabinow's themes, and in *Reading Relations Backwards* she writes:

> Assemblages are composed of preexisting things that, when brought into relations with other preexisting things, open up different capacities not inherent in the original things but only come into existence in the relations established in the assemblage.
>
> (Rabinow cited by Strathern 2014, p. 4)

What does it mean when human and nonhumans are 'assemblages', 'networks' or 'meshworks'? What does it mean when 'preexisting things, when brought into relations with preexisting things, open up different capacities not inherent in the original'? To say that the original is continually emerging as original is an intriguing position. Is creativity really an outcome of endless assemblages of different things? This is what the architectural team at MIT thought when they were building the Frank Gehry building—they called this design framework 'communicative sociality', which accounted for the extensive open-planned design of the building's interior. A year after arriving at MIT, I, along with the entire research group, moved into the Ray and Maria Stata Center in 2004. The building is famous on the MIT campus as it is designed by architect Frank Gehry. The building was unfinished and furiously disliked by the new occupants. One of their architect team explained to me this philosophy of 'communicative sociality':

> When someone is walking through one space and they can see something on a board, then they walk through another space and see something else, they can be creative because they can put together different parts.
>
> (Personal communication 2004)

The Gehry architect team was creating a version of Rabinow's 'assemblage' in the built environment. The irony was that the Gehry building was built on the old ruins of Building 20, a prefabricated building that was only meant to last a few years but was kept on for nearly 40, until it was demolished to make way for the Gehry building. Building 20 was known for the innovative development of radar in a building that cost a few dozen thousand dollars with no such design philosophy as opposed to the Gehry building, which cost $300 million (Dey 2007).

As in the design of the Gehry building or in relation to Rabinow's concept of the assemblage, we must ask: is any part of the assemblage any different from the other? There is an apt analogy in computing that is a kind of assemblage device: the compiler. Compliers are computer programs used by robotic scientists to bring different mechanical and electrical systems together.

Computer analogies are of primary importance in shaping the idea of a "network", a theory developed by Latour to describe a multiplicity of parts with no central actor. Tim Berners-Lee, founder of the World Wide Web, initially designed a software program called Enquire, which stood for 'Enquire Within upon Everything' (1999, p. 1). Berners-Lee was driven by his interest in connections between different entities while a researcher at CERN in Switzerland.

In the chapter entitled "Tangles, Links and Webs", Berners-Lee explains his interests that foregrounded his research into web systems:

> In an extreme view, the world can be seen only as connections and nothing else. . . . There really is little else to meaning. The structure is everything. There are billions of neurons in our brains, but what are neurons? Just cells. The brain has no knowledge until connections are made between neurons. All that we know, all that we are, comes from the way our neurons are connected.
>
> (2007, p. 14)

The flat ontological model of interconnected nodes, assemblages, cyborgs, meshworks and actor-networks show resemblances between anthropological theorizing, and robotic and AI models of information systems. As an anthropologist using theoretical models developed in my field to help me explain the ethnographic data I found while at MIT, I found the point of resemblances worthy of note.

I want to assert that there are many similarities in the frameworks developed by anthropological theorists, particularly their focus on the flat ontological and decentralized anti-hierarchical systems that make up human-machine modalities and computer scientists, AI scientists and roboticists. Robotic scientists and AI researchers at MIT are involved in creating new kinds of artificial entities and using these entities as a way to reflect back on the human.

I will show how the fields of robotic science and AI share an underlying openness about human-nonhuman relations, and this is accompanied by the radical redefinition of the social. In this book I call this mechanical sociality.

MECHANICAL SOCIALITY

Over the last few decades, the meaning of the social as a distinctively human quality has been disputed (Appadurai 1986; Latour 1993; Latour 2001; Latour 2005). The "social" is so thoroughly detached from human subjects that it can be found everywhere and focused on the effects of agents (Latour 2001). In robot labs the emergence of the social robot in the early 2000s showed a new way of reflecting on human-robot relations. Artificial intelligence, developed as a sub-field of computing in the 1950s, focused on simulating human intelligence in machines; the human subjectivity was within a computer system, and the body of a machine was irrelevant to these functions. Robots by contrast offered a way to write the social on the body of the machine by focusing on the way that it acted with humans. Robotic scientists called this 'situated learning', 'situated action', or 'behavior-based robotics'. All these different configurations focused on the present aspects of the machine *in situ*. For roboticists, the social is based on a socially interactive ritual. If the robot acted in a "social" way and could entice people in an interaction, this was a testament to its success as a social machine. Therefore the social in robotics is located in the interpersonal space between present actors: it is in the micro-exchange of human and robot. Digital online social networking by contrast carries its social meanings through networks. Whereas digital social action is important, I will confine my discussion of the social to how it is configured by robotic scientists, adjusting and reflecting on these practices as they emerged in the making of robots at MIT.

To speak of mechanical sociality is not possible without reference to Durkheim, who in different words described traditional society as 'mechanical' and industrial society as 'organic'—he did not refer to sociality, but to solidarity (1965). These terms are important. For Durkheim, a sociologist and witness to the cultural transformations of modernity, solidarity is the bind and bonds between people, featured as the glue that connected person to what constitutes agents: 'Action is simply not the property of humans but of an association of actants . . .' (1999, p. 182). What are the consequences of action when it is not simply a property of humans? Latour's concept of hybrids constitutes the interrelationships between humans and nonhumans. The 'work of purification' is what Latour assigns to the moderns, while actor-network theorists explore 'translation' and the formation of 'hybrid networks' (1993, p. 11). The project for moderns is to purify the hybrids; otherwise the hybrids represent 'the horror that must be avoided at all costs by a ceaseless, even maniacal purification' (Latour 1993, p. 112). What is sacrificed in this approach? Latour's theorizing reformulates social relations between distinctive categories of humans and nonhumans in favor of hybrid networks: 'we have to turn away from an exclusive concern with social relations and weave them into a fabric that includes non-human actants, actants that offer the possibility of holding a society together as a durable whole' (Latour 1991, p. 103).

Ultimately, Latour rejects ontological, essential differences, writing 'I have simply re-established symmetry between the two branches of government, that of things—called science and technology—and that of human beings' (1993, p. 138). In re-establishing symmetry between different kinds of things, the consequential analytical process does two opposing analytical things: it makes things appear radically separate and distinct, detached and chaotic, but on the other hand, it merges them into one.

Is there another route out of Latour's model—is defending human subjectivity always an act of purification? In what follows, I want to show how the making of robots calls into question these positions by focusing on those technologies that comfortably embrace the hybrids, that model and develop the hybrids in new ways. Robots and AI systems show the limits of hybrid systems. Artificial intelligence and social robots try to create new hybrid forms where human-nonhuman attachments are reconfigured.

HOW TO ATTACH A HUMAN TO A MACHINE

In exploring the applied aspects of social robotics and social machines, the links between attachment and detachment will come to the fore.

In *Love and Sex with Robots: The Evolution of Human-robot Relationships* (2009), computer programmer David Levy makes the case for human-robot relationships, but he premises this possibility on observing human-human relationships that presently exist and exhibit a state of detachment. Levy writes about the widespread use of sex-workers and proposes that robots could fill these roles. Levy's case for robots is that human relationships are too messy and complicated; there would be no misunderstanding between a robot programmed to do what the human wanted. Levy further speculates that if the robot becomes too predictable and submissive, you could alter its program so it could demonstrate more resistance

to you. Levy's book is an argument for why sex and love with machines is possible—because men and women both seek sexual pleasure in the absence of a full person (with a substitute sex simulator such as a vibrator, or via sex-work). He explains:

> More obvious reasons why the robot experience will be more appealing than visiting a prostitute include the utterly convincing manner in which robots will express affection and other emotions, simply because their emotions will be programmed into them, to be part of them, instead of being make-believe affections acted out by a prostitute with little genuine enthusiasm for the need to convince.
>
> (Levy 2009, p. 206)

This theme of lack of empathy is taken up by autism expert Baron-Cohen (2011), and he argues in *Zero-Degrees of Empathy* that violence, abuse and murder are only possible because individuals lack empathy, namely men. Baron-Cohen proposes that autism is a state of 'zero-degrees' of empathy and is an extreme form of the male condition. Robots come to the rescue in helping to support those children and adults where attachments are broken or disordered, and autism spectrum disorder is a case in point. There is a narrative about human relationships presently seen as confusing, unsatisfying and conducted without empathy and attachment. If humans already relate to each other in these ways and a machine can act as the human might in the same circumstances, then it could become a viable alternative. Robots are proposed to fill these roles.

Robotic scientists at MIT by contrast are tying to cultivate affectionate bonds between humans and robots, but the social is reworked as performative and scripted, a set of acts that are predictable. Robotic scientists did not design their robots to resemble sex-workers as Levy hopes, but instead, robots in labs at MIT (and beyond) are crafted in the image of children. The philosophy of these robotic scientists is to create robots as relational companions to humans. It was among robotic scientists in labs at MIT that I first heard the term "companions" to refer to extending the companion range of "significant otherness" to nonhumans. Donna Haraway took up these themes in *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (2003), proposing a lifeworld of natureculture mixtures of humans and dogs. Underscoring such positions is a model of sociality for anthropologists interested in multispecies ethnographies (Kirksey & Helmreich 2010) and otherness (Haraway 2003). For robotic scientists, it was also about extending the relational possibilities to robotic machines.

Robots are imagined to help fill the gaps in human social relations and are imagined to become friends and companions to a growing elderly population (Robertson 2007), therapeutically support children with autism and to be sexual companions (Levy 2009, Robertson 2010). In *Alone Together: Why We Expect More from Technology and Less from Each Other,* sociologist of technology Sherry Turkle (2011) warns that human social relationships are under threat by the artificial, a topic she has researched extensively since the publication of *The Second Self* (1984), where Turkle explored how children were attaching to newly computerized technologies.

Why are robotic machines emerging to help human relationships? While the social may not be exclusively human, as seen in other living creatures living in social collectives (Latour 2001; Haraway 1991; Enfield & Levinson 2006), the extension of the social to machines is unique to the contemporary age. The corporate message from Silicon Valley is the "social"—social computing, social networking, social machines, and alongside this, social robots. At the interpersonal level, the social is the mutual dialogical space between one person and another (Buber 1937; Stawarska 2009). The social is made up of gestures, vocalizations, speech, behavior, shared attention, cognition and affective exchange (Enfield & Levinson 2006). If there is an impairment in reading these cues, it can result in difficulty for children and adults. Children and adults with autism have difficulty reading the cues of another person and making sense of their behaviors (Baron-Cohen 1995). As autism is a social interaction difficulty, it may come as no surprise that robotic scientists at MIT began to imagine a robotic machine as a kind of person with autism, an entity that lacks the capacity to read social cues and respond appropriately (Scasselati 2001). We find that analogies between people with disabilities and machines recur as aspects of the making of robots.

In technology circles, the social is valorized, given a meaning and a life of its own. We can attribute some of this to Marx, who in *Capital* wrote: '. . . the relations connecting the labour of one individual with that of the rest appear, not as direct social relations between individuals at work, but as what they really are, material relations between persons and social relations between things' (1974, p. 78). Particular kinds of persons have been identified by robotic scientists as potentially able to benefit from their technologies: older populations (Robertson 2007), children with autism (Dautenhahn & Werry 2004)and (perhaps one day when the technology is sufficient), adults, some who have difficulty forming emotional attachments and desire a sexual relationship (Turkle 2011; Levy 2009). These different populations suffer from severe attachment issues.

Robots are created to help humans in all these areas of their existence. I call all these different types of attachment difficulties "attachment wounds". The machines are imagined to save us from modern attachment wounds. The machines can act in place of another person—as a lover, a friend or as a therapeutic agent.

Durkheim's concept of "anomy" is described as a state of detachment from lived existence in modernity (Durkheim 1952). Anomy referenced a state of despair felt at the level of the individual in society. While Durkheim described attachment and detachment through the discourse of solidarity and anomy respectively, it was not until the early twentieth century that theorists began to think about how attachments are made between humans.

Robotic scientists propose that humans can assist and help the robot to develop, which then returns us to the primary questions: How do humans actually form bonds with one another? How do humans make one another? What happens when there is disruption in the bond?

In his seminal work *Attachment and Loss* (1981), John Bowlby outlines his attachment theory, emphasizing the importance of a loving and stable bond for children to grow in prosperity. Bowlby identified three important stages in the attachment process. The child would exhibit neurotic disruption expressed as protest, despair and detachment if the attachment process was disrupted by the death of a parent, war or other crises that may disturb the secure relationships of the child with a primary caregiver or givers. The new science of attachment that Bowlby created was an outcome of his work for the World Health Organization (WHO) in the 1950s, where he prepared a report on the adjustment of children's mental health, writing 'What is believed to be essential for mental health is that the infant and young child should experience a warm, intimate and continuous relationship with his mother (or permanent mother-substitute) in which both find satisfaction and enjoyment' (1981, p. 12). It was not only Marxist feminists who resisted the motherly attachment logic of Bowlby; psychoanalyst Melanie Klein (mentor of Bowlby) wrote 'Dr. Bowlby, we are not concerned with reality, we are concerned only with the fantasy' (Kagan cited in van der Horst 2011, p. 21). Bowlby's work was focused on the mother-child relationship and separations between them, as well as the mother's treatment of the child (unconscious attitudes), and illness and death in the family (Bowlby 1981, pp. 21–22). The importance of a loving attachment for the development of a child was paramount. For Bowlby, the 'development processes' of attachment were vital to making humans distinctive. He wrote: 'The truth is that the least-studied phase of human development remains the phase during which a child is acquiring all that makes him most distinctively human' (Bowlby 1981, p. 423).

Sigmund Freud was arguably the first to take seriously childhood experiences as important in shaping the lifeworlds of adults, and for connecting the patterns of childhood experience with adult neurosis (Freud 2003; Bowlby 1981, p. 424). In *Leonardo da Vinci and A Memory of His Childhood*, published in 1910, Freud proposed that da Vinci's subject matter in his art could be traced back to his childhood. Freud used biographical accounts of da Vinci, alongside analysis of his paintings, such as *The Virgin and Child with St. Anne*. The virgin with St. Anne, Freud believed, was really da Vinci's own relation to his early experiences, having two mothers, a birth mother (Caterina, a peasant woman) and a stepmother. Da Vinci's father married another woman Albiera, and da Vinci was conceived out of wedlock (Freud 2003).

The robotic scientists also channeled their psychical-physical sufferings into the robots they created, and their machines mirrored parts of themselves. Robots were modeled on the unconscious psychic sufferings of their makers, as physical and social limitations and models of post-traumatic stress disorder were imported into the machines. While Freud arguably is the first to acknowledge the importance of childhood in the development of adult neurosis, he famously discounted his patients' reports of sexual abuse as mere fantasies (Hacking 1991, p. 267). Freud was more interested in proving his Oedipus theory and using material given by his patients to illustrate his theory that children want to sexually possess the opposite gender parent. This is illustrated in his analysis in *Screen Memories*, where the life history of his patient is forced into his Oedipal frame (2003). It was up to later psychoanalysts such as Klein and Bowlby to develop perspectives on childhood experience and later adult neurosis, but Bowlby moved on from the focus of Klein's 'object-relations'.

For Bowlby, love between parent and child was essential, and he challenged the widely held belief that the most important aspect of the parent-child relationship was subsistence. He drew on the work of Harry Harlow, who conducted experiments on rhesus monkeys and found that clinging to something soft was more important for the monkeys than food (Kagan 2011, p. xiii). These awfully cruel experiments on primates showed that younger primates required comfort as well as food. Bowlby's theory of attachment brought together multiple strands from psychoanalysis and experimental psychology, ethnology, primatology and the influence of environment on biology (1981).

Attachment ideas were enthusiastically taken up by Bowlby's colleague Mary Ainsworth, who conducted studies on parent-child relationships in Uganda, the US and England. In Uganda (1954–1955), she spent a period observing 28 Ganda infants, and from here she proposed three patterns of attachment: secure attachment, insecure attachment, and non-attachment (Ainsworth 1967). Ainsworth and colleagues (1978) went on to explore the important of attachment in the *Strange Situation Experiment*, and argued these attachment models shape the child's psychology and ability to form relationships with others.

In the 1940s another field of childhood psychiatry emerged, studying a pattern of detachment in children that would be termed autism (Kanner 1943). Autism, "first" identified by psychiatrist Leo Kanner in children, was marked by an absence of relating, repetitive behaviors, and speech, language and communication difficulties (Kanner 1943). Kanner wrote of children with autism:

> The Children's *relation to people* is altogether different. Every one of the children, upon entering the office, immediately went after blocks, toys or other objects, without paying the least attention to the persons present. It would be wrong to say that they were unaware of the presence of persons. But the people, so long as they left the child alone figured in about the same manner as did the bookshelf or the filing cabinet.
>
> (1943, p. 242)

In Switzerland in 1944, another psychiatrist, Hans Asperger, also published reports of children he described as exhibiting severe social-interaction

difficulties (Asperger 1991). Prominent autism expert Uta Frith had this to say about Kanner and Asperger: 'By a remarkable coincidence, Asperger and Kanner independently described exactly the same type of disturbed child to whom nobody had paid much attention before and both use the label autistic (Frith 1991, p. 6). Autism and attachment theories arose almost simultaneously from the 1940s. Autism was marked in the biomedical framework as an outcome of biology and genes, and more recently neuroscience rather than "nurture" (Baron-Cohen 2005). Bruno Bettleheim is controversial in this respect, and he argued that autism was a survival response to cold and detached mothering sometimes coined 'refrigerator parenting' (1967). Bettleheim's controversial position is rejected by autism experts, who instead focus on the neurodevelopmental aspects of autism (Baron-Cohen 2011, Frith 2008).

Attachment theory is a description of how humans (caregivers) make other humans (infants), and turn these children into particular kinds of persons. Bowlby, Ainsworth and Bettleheim propose the social is the mutual and dialogical interaction between parent/caregiver/mother and infant/child. Melanie Klein proposed an alternative theory—'object-relations', that was focused not on the human-human interaction, but how feelings, thoughts and experiences about those relationships were projected onto things (Gomez 1997). Klein's thing-focused view of social relations was arguably extended by Appadurai in his famously titled edited volume *The Social Life of Things* (1986) that focused on commodities, and extended this view that "commodities" (nonhumans) can have a social life.

Robotic science extends and reframes the social through its activities. By designing robots like children, robotic scientists attempt to cultivate affective exchanges between adults and machines. The bond is no longer exclusively human. Computer scientist Josef Weizenbaum (1984) warned against human attachments to machines after he discovered his computer program ELIZA (the first chatbot) became a close confident of his colleagues, causing Weizenbaum to begin to worry about the future of humanity. For robotic scientists, the social is located in micro behavioral exchanges between human and robot. The narrative of attachment and detachment plays out in multiple ways in anthropological theorizing, and in robotic and AI research.

In what follows, I hope to unfold these issues addressed above in different ways.

In chapter 1 I explore the origin of the robot as a cultural outcome of the cultural milieu of the 1920s. Drawing on themes in the play and connecting these theme to actual events occurring in the early twentieth century, I show how the robot was a critical response to what Čapek believed was a obsession with labor and production by right and left political philosophies. I explore the role of revolution and the fear that humans were losing their individuality.

In chapter 2 I take the robot over from its fictional and political imaginings and bring it into the fold of artificial intelligence, a technological field focused on simulating human intelligence in machines. I continue the theme of distorted attachments by showing how much of the efforts of AI were devoted to developing war machines. I focus on the personal biography of Alan Turing and show how his biographical story was connected with his theorizing of thinking machines. If AI focused on the development of Cartesian rationalistic disembodied minds, the rise of embodied robotics and behavior-based robotics were anti-Cartesian in orientation, rejecting the notion of a centralizing consciousness or "mind". Instead, these researchers proposed that consciousness resides in bodies, behaviors and movements that allow others to interpret them.

In chapter 3 I then explore the philosophy around social robots and social machines. These robots were developed in labs at MIT and beyond, and signaled new ways of reflecting on what it means to be social and how sociality between humans and machines can develop.

In chapter 4 I take these themes of the social and asocial by exploring the kinds of gendered persons that are involved in making robots and AI systems. These types of persons, stereotypically labeled "nerds" or "geeks", show the paradoxes at play with asocial researcher scientists developing social systems. The asymmetries and symmetries between humans and machines offset each other frequently.

In chapter 5 I explore how the robot creation represents a 'figure of human suffering and breakdown, and show how robotic scientists used their machines as an unconscious dialogue sounding board for their own existential anxieties and difficulties. Robot and robot scientist seemed to mirror each other in unusual ways.

In chapter 6 I explore the role of fantasy and the Real in the making of robots. These robots were premised on a philosophy of the Real—they were robots designed to act in the Real world, but, as my ethnography shows, there were ongoing tensions between the robot and the Real world, the two reflecting on each other in unique ways.

NOTE

1. In January 1985, less than one year after released in 1984, *Terminator* had grossed $38,371,200 in the US alone.

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