Loving Machines: Theorizing Human and Sociable-Technology Interaction

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Abstract. Today, human and sociable-technology interaction is a contested site of inquiry. Some regard social robots as an innovative medium of communication that offer new avenues for expression, communication, and interaction. Other others question the moral veracity of human-robot relationships, suggesting that such associations risk psychological impoverishment. What seems clear is that the emergence of social robots in everyday life will alter the nature of social interaction, bringing with it a need for new theories to understand the shifting terrain between humans and machines. This work provides a historical context for human and sociable robot interaction. Current research related to human-sociable-technology interaction is considered in relation to arguments that confront a humanist view that confine 'technological things' to the nonhuman side of the human/nonhuman binary relation. Finally, it recommends a theoretical approach for the study of human and sociable-technology interaction that accommodates increasingly personal relations between human and nonhuman technologies.

Keywords: automatons, social robots, human robot interaction, actor-network theory.

1 Introduction

This work seeks to accomplish two exploratory objectives. The first objective involves situating emerging human and sociable-technology interaction as a developing site of inquiry relevant to communication studies and cultural studies. To this end it (briefly) overviews the historical and contemporary context of social robots. The second objective involves theorizing increasingly affective human and sociable-technology interaction by drawing on approaches that accommodate increasingly intimate relations between human and nonhuman (sociable) technologies. To this end, current research which interrogates "sociableness" between human and sociable-technology [4, 25, 26, 43, 44] is considered in relation to arguments that confront a humanist view that confine 'technological things' to the nonhuman side of the human/nonhuman binary relation [16, 28]. As intimate machines become increasingly capable of engaging people in affective social relationships, unfamiliar moments emerge as humans and nonhumans comingle in ways that make Western moderns feeling uncomfortable and call for improved frameworks for coming to terms with the shifting relationship between people

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and machines. Today, human and sociable-technology interaction is a contested site of inquiry, with some regarding social robots as an exciting medium of communication that will ultimate shift the way we view ourselves and others. Still, others question the moral veracity of human-robot relationships, suggesting that such associations risk psychological impoverishment [19] or are disconcertingly inauthentic [34, 39] and therefore morally problematic [43]. What seems clear is that the emergence of social robots in everyday life will alter the nature and dynamics of social interaction [48], bringing with it a need for new theories to understand the shifting terrain between humans and machines.

2 Historical Context of Social Technologies

Today, many people are familiar with the technological figure of the social robot which is purposefully designed to engage human users in emotional relationships. Indeed, the quest to (re)create a perfect version of "man" has engaged the imagination of philosophers, inventors, and scientists since Antiquity [7, 8].[1] Less acknowledged however, is the continuity that exists between eighteenth-century automatons and twenty-first century humanoid social robots [35]. For example, from the beginning interaction between humans and automatons was inflected with intense, sometimes conflicting, emotions: from triumphant feelings of technological achievement [14], to erotic passion [33], to disorienting feelings of intellectual uncertainty [17].

This paper regards the mid eighteenth-century as a defining moment in the history of the quest for artificial life. During this period, automata were considered to be the very symbol of the Enlightenment, with Jacques de Vaucanson widely regarded as the "forerunner of the great eighteenth-century builders of automata" ([7], p. 275). The eighteenth-century also represents a critical moment wherein, "…the ambitions of the necromancers were revived in the well-respected name of science…an interest in anatomy, advances in the design of scientific instruments…meant that automata were thought of as glorious feats of engineering, or philosophical toys" ([47], p. xvi).

During this period, mechanicians produced life sized highly sophisticated humanoid automata that played music using fingers, lips and breath; drew detailed portraits of royal subjects; and scribed such intellectual poetry as, "I do not think, therefore am I not?" The human actions mechanicians (automaton builders) selected to simulate with their automata were, at the time, regarded as the very height of human essence (e.g. music, poetry, art). The automatons of Vaucanson and others were presented at courts, fairs, and exhibitions throughout Europe. Parisans crowds were variously delighted and unsettled by these ingenious mechanisms. Yet, in

[1] The first mechanical automata for which there are verifiable records emerged around second or third century BC with the invention of mechanical water-clocks of Ctesibius, Philo the Byzantine, and Hero of Alexandria who collectively represented the Alexandrian School. The sciences of the Alexandrians were preserved through translations authored by Hero of Alexandria into Arabic and Latin at Byzantium and from the sixteenth century onward, authors remained inspired by the science of the Alexandrians, but added personal ideas and inventions to these early inventions applying the art and science of hydraulic automata to the gardens and grottoes of princes and kings during the sixteenth and seventeenth century ([5], p. 31-36).

addition to being wildly popular entertainment artifacts, these automata were boldly engaged with the central debates of their time. "Vaucanson's automata were philosophical experiments, attempts to discern which aspects of living creatures could be reproduced in machinery, and to what degree, and what such reproductions might reveal about their natural subjects" ([31], p. 601). So we can see that the blurring of the boundary between human and machine; the evocation of feelings associated with the uncanny; the ambivalence felt toward the steady march of scientific progress; and the engagement with the central debates of their time are attributes that the eighteenth-century automaton and contemporary artificial life projects seem to share.

With rise of industrial development (1760 onward), Western Europe and North America were transformed and the age of the automata drew to a close and with it the quest to simulate life was abandoned. In 1847, Helmholtz, reflecting on Vaucanson's automata, mused, "nowadays we no longer attempt to construct beings able to perform a thousand human actions, but rather machines able to execute a single action which will replace that of thousands of humans" ([2], p. 41). In the historical record life-like automata are regarded as the "progenitors of the Industrial Revolution" [2, 10]; they were the concrete manifestation of a nation's scientific ability, "[embodying] what was, at the time, the absolute cutting edge of new technology" ([38], p. 2) and provided the technological foundation for the advancing Industrial Revolution. Amusement automata, "capable of self-government and intelligence" ([33], p. 335) assisted the vision of this new factory system.

If the eighteenth century was driven by the desire to know if life could be reproduced mechanically, our contemporary moment is characterized by a resolve that we can and will create intelligent machines (shifting from the idea of human-as-machine to machine-as-human) that will be endowed with artificial intelligence, consciousness, free will, and autonomy [45].

As a site of inquiry relevant to communication and cultural studies, a handful of media scholars are beginning to consider the social robot as a unique medium of communication that may ultimately affect the way that we see ourselves and relate to others and "extend new possibilities for expression, communication and interaction in everyday life" ([29], p. 328, [48]). Within cultural studies, Thrift [39] suggests that social robots represent a site beyond conventional structures and sites of communication and is concerned with issues of authenticity, while Roderick [32] examines representations of agency and automation of Explosive Ordnance Disposal (EOD) robots in mass media. Finally, I note that human-robot interaction (HRI) studies [24] concerned with the practical and theoretical implications for the design of social robots are finding their way into top tier communication journals.

3 Social Robotics: Sociable, Relational and Present

Variously referred to as friendly machines, socially intelligent robots [26], relational artifacts [40, 41, 43], and robotic others [19], the social robot is designed to give the impression "of wanting to be attended to, of wanting to have their 'needs' satisfied, and of being gratified when they are appropriately nurtured" ([43], p. 331). Social robots are technologies designed to engage with humans on an emotional level through play, sometimes therapeutic play, and perhaps even companionship.

Examples of commercially available entertainment robots include, Innvo Lab's robotic dinosaur *Pleo*, Tiger Electronic's hamster-like *Furby* and Sony's puppy-like robot *AIBO*. Japan's National Institute of Advanced Industrial Science and Technology created *Paro*, a harp seal robot, to serve as companions for Japan's growing senior citizen population [18] and as therapeutic playmates for children with autism [9]. Highly advanced social robots include MIT's *Kismet*, *Cog* and *Nexi* as well as Osaka University's *Repliee Q1* and *Repliee Q2*.

According to social robot creator, Cynthia Breazeal, "...a sociable robot is able to communicate and interact with us, understand and even relate to us, in a personal way" ([4], p. 1). Fong, Nourbakhsh, and Dautenhahn [13] envision social robots as "embodied agents" belonging to a heterogeneous group. They would recognize and engage one another in social interaction and possess histories and "perceive and interpret the world in term of their own experience" (p. 144).

Sherry Turkle refers to this category of robot as relational artifacts, defined as "artifacts that present themselves as having 'states of mind' for which an understanding of those states enriches human encounters with them" ([43], p. 347). The term 'relational' also denotes her psychoanalytic orientation and an emphasis upon human-meaning within user-technology interaction.

Hiroshi Ishiguro is a pioneer in researching the significance of the aesthetic appearance of social robots upon human-robot interactions. Ishiguro is interested in the conveyance of *sonzai-kan*, or human presence, and the best way to evoke the sensation of "presence" within the social robot's human social partner. "Simply put, what gives something a social presence? Is it mainly behavior, or is there instead some complex interplay between appearance and behavior?" ([27], p. 1) For Ishiguro appearance *and* behavior are the critical factors in creating sufficiently believable humanoid robots.

The idea that a nonhuman figure, a robot, might possess presence or engage human interactants in emotional relationships highlights the receding boundary between humans and machines. Donna Haraway [16] argues that people in Western society have gradually become biotechnological hybrids, and as such are all cyborg like beings, a fact that destabilizes dualisms underpinning much of Western thinking. Consequently, dichotomies which bind and separate the world, like the mind/body split, human/machine, Self/Other, male/female are rendered meaningless and irrelevant.

Propelled by the radical ideas of Descartes,' eighteenth century mechanicians (automata builders) were early problemitizers of Western dualism, as they sought to simulate as closely as possible both the external and internal mechanisms of life. Jessica Riskin [31] argues that the *age of the automaton* differs from periods immediately preceding and following it in that this period was concerned with collapsing the perceived differences between humans and machines rather than maintaining distance.

4 Tensions: Authenticity and New Technological Genres

"Our culture [has] clearly come to a new place" muses Sherry Turkle after reflecting on yet another threshold crossed in ongoing cultural-technical imaginary suggested in

the release of David Levy's *Love and Sex With Robots* [25]. As the relationship between humans and social robotics become increasing diverse and complex uncomfortable questions begin to emerge relating to what it means to engage in authentic social relationships [11, 43], what it means to love [25], what it means to be human (and machine) [20] as well as all the attendant ethical concerns [1, 34, 36, 37] related to these apprehensions. Anxiety about authenticity and deception as well as the emergence of novel ontological categories of 'being' are briefly outlined below and where ever possible connected to similar concerns of the eighteenth century period of mechanistic simulation.

Authenticity & Deception. A study by Turkle [44] examined the interaction between senior citizens and Paro (a robotic baby harp seal) and found that Paro successfully elicited feelings of admiration, loving behavior, and curiosity but felt that these interactions raised thorny "questions about what kind of authenticity we require of our technology. Do we want robots saying things that they could not possibly 'mean'? What kinds of relationships do we think are most appropriate for our children and our elders to have with relational artifacts?" ([44], p. 360). Sharkey and Sharkey [34] raise parallel concerns when they consider the natural human tendency to anthropomorphize and suggest we question the ethical appropriateness of deceiving people into believing that a machine is capable of mental states and emotional understanding. Kahn et al. [19] question a sociable robot's ontological status as 'social' and their ability to engage in truly social behavior, doubting that intelligent machines can ever really interpret the world around them in terms of their own experience.

On the other hand, Duffy [12] points out that from the point of view of social robotics, it doesn't really matter whether or not a particular robot *genuinely* possesses a sense of personal agency, intention, or self awareness. What matters most is our perception of their emotionality and intelligence. Further, as Nass and Moon's [30] research has shown, in spite of the fact that most technology-users consciously view machines as non-persons, they persistently engage in behavior that may best be described as ethopeoia, involving "a *direct* response to an entity as human while knowing that the entity not warrant human treatment or attribution" ([30], p. 94). Turkle suggests that relational artifacts are so successful at engaging humans in emotional relationships because they successfully press our Darwinian buttons through eye contact, gesture, vocalization, and so on [42].

Contemporary thinkers' concerns about authenticity and deceit in relation to social robots resonate with eighteenth century concerns over similar mechanistic simulations of life. For example, when eighteenth century automata builder Jacque de Vaucanson first revealed his *Flute Player* and *Tabor-and-Tambourine Player* to the Academie des Sciences in Paris in 1738, spectators were profoundly suspicious of his mechanisms, "At first many people would not believe that the sounds were produced by the flute which the automaton was holding" ([7], p. 274). However, after thorough inspection Voltaire declared the inventor: "bold Vaucanson, rival of Prometheus!" ([38], p. 11) Vaucanson's work provides a dramatic representation of a philosophical preoccupation engaging laymen, philosophers, and royalty throughout this period: the problem of whether or not human processes and functions were essentially mechanical.

Technological Beings & New Ontological Categories. Kahn et al. [20] posit nine characteristics that social robot designers might strive towards to achieve successful social acceptance. Similarly, Duffy [10] suggests eight criteria for successful human-social robot interaction. Yet even without fully attaining all of these dimensions, the affect of minimal social cues from consumer robots (e.g. Tamagotchi, Furbies, My Real Baby, AIBO, Pleo) have shifted our acceptance and perception of social robots dramatically over the past decade and a half.

Sherry Turkle [43, 44] speaks of an emerging category of "being" expressed by young children engaging with very rudimentary and very advanced social robots, discovering a tendency to ascribe social robots to an emergent category of *being*, referred to as "sort of alive," situated between alive and not alive (Kahn et al. [14] call this a 'new technological genre').[2] Further, Turkle notes that the child of today still feels compelled to classify social robots (as they did twenty years ago) when first encountering intelligent machines. However, today this urge to classify is now increasingly entangled with a desire to nurture and be nurtured by relational artifacts [43].

Even designers form enduring emotional connections to their projects. Breazeal admits to being quite attached and never tiring of her interaction with, Kismet, an engaging social robot. "To me Kismet is very special because when you interact with Kismet, you feel like you're interacting with Kismet. You know, there's someone home so to speak [laughs]. There's someone behind those eyes that you're interacting with." This capacity of social robots to provide a good 'fake' [12] or 'cheat' [11] leads some critics to conclude that the use of social robots with our most vulnerable (children and elderly) is potentially unethical, "as it is akin to deception" ([37], p. 148).

That Kuhn and colleagues [19, 20] favor the term robotic *other* foregrounds their view that there is a need for new language and words that accurately capture the shifting ontological status of machines and the new social relationships arising from our increasing interaction with robotic others. For Turkle, and Donna Haraway as well [16], this intermediate category is illustrative of a culture in which the boundary between the inanimate and animate has significantly eroded. It also signals a moment in which children, adults, and seniors comfortably engage emotionally and intellectually with increasingly social technologies.

Ronald Arkin states, that "Robotics researchers make a tacit assumption that the creation of this new technology is wholly appropriate and can only enrich the lives of those on the receiving end. It is important that we as scientists re-examine this assumption" ([1], p. 3). What approaches might assist roboticists, engineers, and computer scientists respond to such complex questions and concerns as the appropriateness of human and robotic love? How do we begin to assess authenticity and fully understand and manage anthropomorphism in social robots? What seems clear is that in the context of robo-nannies, therapeutic seals, military bots, and domestic and surgical robotics there is need for methodological and theoretical perspectives that enable us to think through techno-cultural hybrid configurations of people and machines. In short, what is needed is a "theory of machines" [23].

[2] The tendency to anthropomorphize and attribute life like essences to social robots is not limited to children [14, 23].

5 Actor Network Theory: 'A Theory of Machines'

I suggest that a theory from the field of science and technology studies, actor-network theory, may prove to be a useful theoretical orientation for research related to human-social robotic interaction. In particular because many of its central tenets accommodate and presume non human artifacts, especially the machine, are a constitutive aspect of the social world. Actor-network theory is derived from the sociology science and was pioneered by Michael Callon [5] and Bruno Latour [21]. Later works focused on technology and is therefore sometimes regarded as a branch of the social construction of technology school of thought [3].

Actor-network theory rejects the assumption that society is constructed through human action and meaning alone. Rather, it regards social life as being performed or created by actors, some human, some non human, all of which may be 'enrolled' in the creation of *knowledge* that always takes some material form (e.g. patents, scientific papers, agents, social institutions, machines, technologies, and organizations) [6]. This approach argues that human agents as well as machines are all *effects* of networks of diverse (not simply human) materials. In short, the social is not viewed as a strictly human domain but rather, a "patterned network of heterogeneous material" ([23], p. 381) which includes people, machines, text, institutions and more.

In this regard, actor-network theory is radical because "it treads on a set of ethical, epistemological and ontological toes" ([23], p. 383). Specifically, it does not categorize and privilege humans on one hand, and cordon off non human objects on the other. Indeed, actor-network theory contends that the social and the technical are inseparable. Actor-network theory sets out to study the motivations and actions of actors (human and non human artifacts) "who form elements, linked by associations, of heterogeneous networks of aligned interests" ([46], p. 468). In this way actor-network theory is concerned with the mechanics of power.

A major focus of actor-network theory is to strive to reveal and describe the development of stable networks of allied interests and how these networks come to be created and maintained, and conversely, to study those instances where a network has failed to become established. Micro level moments of creation, maintenance, and failure reveal instances of controversy and uncertainty and expose the occasions where "science and technology [is] in the making" [21]. Thus, Latour proposes investigating at least five sites of major uncertainties including: the contradictory identity of actors within an institutional groups (nature of groups); the competing goals for each course of action (nature of action); the open and varied nature of agencies involved (nature of objects); the ongoing dispute between society and the natural sciences (nature of facts); and the types of scientific studies undertaken (nature of the social study of technology) [22].

The term actor-network theory references both a theoretical and methodological approach. It provides the concepts (e.g. actor, actor-network, enrolment, translation, delegates, irreversibility, black box, etc.) through which to view the socio-technical world as well as the elements which need to be revealed in empirical work. Thus, the researcher is encouraged to document network elements including the human and the non human, processes of translation and inscription, the creation of black boxes or immutable mobiles, and the degree of stability and irreversibility of networks and their elements [46].

To follow the theoretical orientation set up by Latour and Callon we must consider concurrently all of the members, organizations, concepts, places and objects that contribute to a particular scientific outcome. What actor-network theorists propose is that we consider all of these dimensions simultaneously as well as their internal relatedness in order to understand how science operates. "We cannot, for example talk about how Pasteur discovers the cause of anthrax without aligning his biological laboratory in Paris, the anthrax bacillus, the rural farms, the cattle, Pasteur, his ideological framework, the hygienists who supported his work, etc." ([15], p. 43)

Similarly, if we want to apply an actor-network approach to social robotics we might find our entry point through the identification of a problem or controversy with which the field is presently grappling ([21], p. 4), perhaps social presence in robots or conceptions of authenticity. From here we turn our attention to the micro-level work of scientists, engineers, and computer scientists. But also in our analytic frame are all of the other members of the heterogeneous network [23] that make up the social robotics field: robots, humans interactants, ideological assumptions, emerging robot-ethics, codes of conduct, representation (design) choices, corporate entrepreneurs, state policy, scientific publications and more.

In closing, I return to a point that I raised earlier in this essay. That is to say, the current push to fashion life-like creatures through science and technology is by no means a new development. Indeed, this project is at least 250 years old and has at least two distinct periods in which the conceptual boundary between human and machine was sufficiently malleable to be subject to negotiation and change. If we want to understand what happened at the start of the industrial revolution that ultimately coincided with the (re)solidification of the conceptual boundary between man and machine as well as the abandoning of the pursuit to simulate life through mechanism we might consider broadening our analytic frame to include an investigation of all the "bit and pieces" from the socio-technical world that make up our heterogeneous technological products.

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