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Representing Robots: The Appearance of Artificial Humans in Cinematic Media

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ABSTRACT

Immediately recognizable, culturally ubiquitous, androids, cyborgs, and robots, need no introduction. Yet their very familiarity obscures their participation in culture and media, and our perennial fascination with such artificial human devices when seen on the screen. This paper attempts to unpack how humans see these artificial humans and how we interpret their representation in cinema. In the context of cinema, appearance, as well as the interaction modality of a humanoid robot can play a crucial role in the perception of robots before and after short-term interactions. Although speech is the most common mode of communication in film, and is an intuitive way to interact with robots, the research reported in this paper also suggests that tactile interaction is important to the way people perceive and interact with robots. People cannot escape their own social identity, which heavily impacts their work and decisions: people themselves, and all their interactions, are embodied within and therefore fundamentally impacted by their body and identity. This paper proposes that even with better representation in cinema, improved sensitivity to gender and racial issues will still be important to promote fairness in the bold new future of cyborg cinema.

Keywords: Android, Appearance, Cinema, Cyborg, Gender, Representation, Robot.

1. Introduction

An artificial consciousness permeates globalized societies; technology is all around us, in science, in science fiction, in daily life. This relationship continues to be processual, technologies continue to move forward, assisting or, perhaps, encroaching on the human body. In modern society, we are increasingly becoming merged with the technology around us, wearing it and implanting it. This allows us to contemplate the merging of the organic and the inorganic. Bodies are being remapped by technology and rigid notions of subjectivity are reconfigured and societal norms are disrupted and shifted. Questions and issues regarding ability, identity, and a struggle for embedded agency in relation to technologies are principal concerns of the late twentieth and early twenty-first centuries (Parker-Starbuck, 2011). Humans

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are bombarded by visual media and one often feels as if there is a fundamental invasion of body integrity (Braidotti, 2002).

Cinema is often described as a cultural construct and the 'liveness' and 'realism' debate is well documented (Barthes, 1977; Dixon, 2007; Glesekam, 2007 and Reinalt and Roach, 2007) . Introducing robots as actors can be seen as removing the human agency which in turn can undermine the idea that performance is a specifically human activity and it may cast into doubt the existential significance attributed to performance. Auslander (1997, 1999) claims that the concept of the 'live' emerges only as a result of mediatization and 'live' is, in the contemporary moment of globalized technology, already to some extent mediatized.

Morse (1998) makes a case for machine subjects (such as, the television or computer screen) and the cyberized machine-human interactions that increasingly take on the 'I' and 'you' of subjective construction (we talk to the television, to our phones, etc). Socially constructed and based on what she calls virtualities the embodied, intelligent machine emerges as a partner in discourse.

A number of commentators have also noted that there have been noticeable changes in the styles of acting seen in film in recent years. Many mention a move towards a more mechanic, flattened, and intentionally 'non-acting' style, as humans sit alongside the technological on the screen (Parker-Starbuck, 2011 and Bay-Cheng, 2007). The introduction of new forms of technology into cinema, has challenged many notions of existing theory and practice and form complex alternatives. The introduction of robot thespians also highlights the fixed notions of what being human means in our modern world relative to the embodied and pervasive technologies that surround us.

However one sees the use of technology in cinema, there is no doubt that the cinema of the late twentieth and into the twenty-first centuries has been shaped by cultural processes. As the representational, visible bodies on the screen merge into the technology, Phelan proposes a new 'inclusive representational framework'—suggesting that the technology may efface their 'representational visibility' but in the process they are re-marked as something new, entering a cyborg sensitivity (Phelan, 1993).

The concept of robot cinema raises a number of questions regarding the representation of the human body on the screen, providing an innovative site for exploring and experimenting with these ideas. If robot cinema is to progress, and to be used to help understand the impact of technology on human bodies, then the complex relationships between physical spaces, human bodies and technology needs to be examined. Removing humans from a film perhaps moves us closer to an understanding of a post-human condition (Isherwood, 2010). A new, radically inclusive notion of 'universal subject' becomes necessary and a new critical language and way of thinking about film and performance becomes necessary.

Cinema featuring robots, cyborgs, androids, or automata often contain scenes that depict opening the artificial body; someone ejects a face plate, pulls back artificial skin, removes a skull covering, reveals a chest panel, lifts clothing, or pushes a button, thereby rendering visible the insides of the fascinating human-like machine. The interior space may include flashing computer lights, elaborate wiring, metal surfaces, old-fashioned cogs and wheels, or sophisticated electronic equipment. Sometimes the inside is stark in its dean modem efficiency, a gleaming metal box, but it can also be gooey, shocking, or opaque, display a minimalist emptiness, or reveal incongruous skeletal structures that seem unlikely as weight-bearing supports (Kakoudaki, 2014). Interpreting these anatomical structures provide an act of revelation suggesting new meanings, that the technology inside might explain the human form on the outside. Perhaps the robot's interior will be understandable, logical, or orderly in contrast to the organic body on the outside. This technological revelation promises clarity or understanding, even when it unveils a confusing interface behind the removable face. The mechanical efficiency can inspire a human desire for replaceable body parts and the absence of pain, the transposition of the materiality of the human.

Technology itself, can call the materiality of the body into question. Human bodies are increasingly abstracted, adjected, objectified through distance, media, commodification and technology (Parker-Starbuck, 2011). A number of academics and researchers have asked if we should we lament the loss of the organic body (Cartwright, 1995). In reality, technology development is often led by technological determinism, which feels that human bodies can naturally co-exist with technology as long as humans remain in control.

This paper considers the relationship between twenty-first-century research in robotics and the fantasy of the ideal robot, as this fantasy was honed in fictions, plays, and films of the twentieth century. It can be seen that that new versions of the artificial person in science fiction literature and film cannot escape many of the representational patterns of older texts. Cinema containing artificial people often returns to the same arsenal of tropes and plotlines decade after decade (Kakoudaki, 2014).

While a wide range of theoretical and cultural domains, popular fantasies, technological debates, and scientific research may refer to fictional artificial people, the literary and cinematic tradition that informs their cultural meanings has not been fully codified. Despite, or indeed because of, its cultural ubiquity, the discourse of the artificial person is often used to rehash stereotypes of these figures; this tendency will be examined and analyzed in this paper.

This paper also discusses media which has been designed to push the boundaries of what is traditionally described as film; providing a sterile environment where machines perform on a screen, robots reciting lines. Film is often defined as a form of literature which incorporates acting and stagecraft elements combined with a narrative script. The effectiveness of the film medium (which when conducted may be considered a play or drama, according to actual type) is based on the delivery of text through the actors and how the audience observing the performance responds. The introduction of robot thespians has the potential to create a form of cyborg cinema that challenges and re-examines the 'sensually different atmosphere' of cinema that we are used to (Glasser, 1955).

2. Artificial humans: Robots, androids and cyborgs

In this section, we briefly survey events and work that have made modern robot technology possible. Although most robot technology was primarily developed in the mid and late 20th century, it is important to note that the notion of robot-like behavior and its implications for humans have been around for centuries in religion, mythology, philosophy, and fiction (Goodrich and Shultz, 2007).

There are reports of automata and mechanical creatures from ancient Egypt, Greece, and China. The Iliad refers to golden maids that behave like real people (Homer, 800BC). The idea of golem, an "artificial being of Hebrew folklore endowed with life" has been around for centuries (Webster, 1996 and Weiner, 1996). Ancient Chinese legends and compilations mention robot-like creations, such as the story from the West Zhou Dynasty (1066BC–771BC) that describes how the craftsman Yanshi presented a humanoid. The creation looked and moved so much like a human that, when it winked at the concubines, it was necessary to dismantle it to prove that it was an artificial creation (Youkou, 500BC). During the Tang Dynasty, a craftsman, Yang Wullian made a humanoid robot which resembled a monk. It could beg for alms with a copper cup, put it in place after collecting and even bow down to the person who gave alms to the robot. All these movements were mechanically actuated and were either in a fixed sequence or under manual control (Denny, 2016). Similar robotic devices, such as a wooden ox and floating horse, were believed to have been invented by the Chinese strategist Zhuge Liang (Goodrich and Shultz, 2007), and a famous Chinese carpenter was reported to have created a wooden/bamboo magpie that could stay aloft for up to three days (Tzu, 400BC).

In the 15th century, Leonardo da Vinci drew up schematics for a mechanical robot knight. It consisted of a knight's armor, which was fitted with gears, wheels and pulleys. Controlled using cables and pulleys, this robotic knight could lift its visor, sit or stand and could move its head. Using the plans of the robotic knight made by Leonardo da Vinci, robotist Mark Rosheim built a prototype of the knight in 2002. He further modified the design and made it more advanced by introducing the ability to walk (Rosheim, 2006).

Early robot implementations were remotely operated devices with minimal autonomy. In 1898, Nicola Tesla demonstrated a radio-controlled boat, which he described as incorporating "a borrowed mind." In fact, Tesla controlled the boat remotely. Tesla hypothesized, ". . . you see there the first of a race of robots, mechanical men which will do the laborious work of the human race." He even envisioned one or more operators simultaneously directing 50 or 100 vehicles (Goodrich and Shultz, 2007).

In the 20th century we entered the era of robotics. An early example includes the Naval Research Laboratory's "Electric Dog" robot from 1923. Robots were created for many different purposes in multiple industries, including attempts to remotely pilot bombers during World War II, the creation of remotely piloted vehicles, and mechanical creatures designed to give the appearance of life (Fong and Thorpe, 2001). In 1940, the first humanoid robot named Elektro (Televox, 1983) was created by

Westinghouse Electric Corporation. It could only move its arms and head, move around on a wheel in its base, and it could play recorded speech. It consisted of photoelectric eyes and could distinguish between red and green light (Denny et al, 2016).

Complementing the advances in robot mechanics, research in artificial intelligence has attempted to develop fully autonomous robots. The most commonly cited example of an early autonomous robot was Shakey, which was capable of navigating through a block world under carefully controlled lighting conditions at the glacially slow speed of approximately 2 meters per hour (Bainbridge, 1983). Many agree that these early works laid a foundation for much that goes on in robot hybrid control architectures today (Parker, 1994 and Murphy, 2000).

The real challenge in production of autonomous humanoid robot is not just the designing but also programming and developing human functionality. It is important to design a humanoid robot as closely as possible to the design characteristics of a human being. The robot should also be able to communicate easily with the others and also should be able to take decisions on its own. The design was a difficult part to execute, since the extra ordinary balancing capability of the human being was not an easy task to understand and imply on a humanoid robot (Denny et al, 2016).

In 1973, Wabot-1, the first humanoid robot which could walk on two legs, communicate with a human and transport objects was created by Waseda University (Takanishi, 2002). Although it could walk on two legs, the robot could only walk on flat surfaces.

A further breakthrough in autonomous robot technology occurred in the mid-1980s with work in behavior-based robotics (Arkin, 1998 and Brooks, 1986). Indeed, it could be argued that this work is a foundation for many current robotic applications. Behavior-based robotics breaks with the monolithic senseplan-act loop of a centralized system, and instead uses distributed sense-response loops to generate appropriate responses to external stimuli. The combination of these distributed responses produces "emergent" behavior that can produce very sophisticated responses that are robust to changes in the environment.

Robot behaviors initially focused on mobility, but more recent contributions seek to develop lifelike anthropomorphic behaviors (Yamaoka et al, 2005), acceptable behaviors of household robots (Kim, 2007), and desirable behaviors for robots that follow, pass, or approach humans (Pacchierotti et al, 2006; Gockley et al, 2007 and Walters et al, 2007).

Robots have also factored in multiple works of fiction, such as the mechanical-like birds that were present in the 1933 poem Byzantium by W. B. Yeats (1933). Robots have always had a large presence in science fiction literature, most notably the works of Isaac Asimov (1938). Many state that Asimov's Laws of Robotics acted as forerunners to the first design guidelines for human-robot interaction metaphors.

2.1 Definitions

The word "robot" originates from the Czechoslovakian word robota which means (Denny et al, 2016). "Robot" appears to have first been used in Karel Chapek's 1920's play Rossum's Universal Robots—the character was a servant robot, which resembled the structure of a human being—though this was by no means the earliest example of a human-like machine (Capek and Capek, 1961).

The term cyborg was first used in 1960 to describe human-machine interfaces—cybernetic organisms—which could adapt to new environments, specifically space travel (Clynes and Kline, 1995). These cyborgs were intended to taken care of tasks automatically and unconsciously, leaving their creators free to explore, to create, to think, and to feel. A summary of accepted definitions is given in Table 1 (Garreau, 2005).

Table 1: Technology definitions

Android	A robot designed to mimic human behavior and/or appearance.
Bionic	Any organism which has mechanical or robotic hardware designed to augment or enhance the body.
Cyborg	An organism with synthetic hardware which interacts directly with the brain, and alters the way it functions.
Robot	A machine designed to perform a task. A digitally driven creature that can sense and move.
Sentient	Responsive to or conscious of some impression and context; aware.

The words ‘robot’, ‘android’ and ‘cyborg’ permeate modern culture, demonstrating a need for a radical rethinking about human positioning in the world. Our human subjectivity, seen in relation here to the digital technologies that surround us, becomes a shifting, difficult concept. Some argue that we are already cyborgs and therefore there is no need to question the shift; that humans are slipping into the technology world, appearing only as projections as we are becoming fully immersed in the technology (Caygill, 1997 and MacKenzie, 2001).

McLuhan and Moos (1997) describe how we often see technology as an extension of our bodies, perhaps a response to existential and spiritual uncertainties, as we try to leave our fallible mortal bodies behind. A range of modern technologies are able to reconfigure our bodies as “dynamic fields of action in need of regulation and control” (Cartwright, 1995). The terms robot and cyborg can be viewed in both a literal and metaphoric sense, asking questions regarding what it means to have a body, to share a body, and what it means to lose physical control of your own body (Parker-Starbuck, 2011).

Artificial people may be mechanical, but they may also be engineered through chemical or biotechnological means, cloned, altered, or reconstructed. While such modes of production reference technological realities, actual artificial people are truly imaginary, creatures of fiction, the imagination, and the magic of representational media. And yet despite their unreality they seem to inform a host of cultural domains and debates, participating in a dense web of interactions between fiction and reality in contemporary culture (Kakoudaki, 2014).

2.2 Applications

There are millions of robots in day-to-day use all around the world, and the rate of take-up of these systems is increasing rapidly (IFR, 2016). Over time, it has been the goal for creators and manufacturers to expand the definition of what a robot is; in other words, the tasks robots are able to perform are continually expanding with manufacturing, hospitals and space exploration seen as common areas of interest for robotics (Behnke, 2008 and Presher, 2010). It is generally felt that robots have emerged into an era of ‘weak’ Artificial Intelligence (A.I.) where currently they can imitate humans without being independent (Beck, 2010). Either through autonomous means, or extensive exhaustive programming, robots have the potential to better everyday life.

This is perhaps nowhere more evident than in the very successful application of unmanned underwater vehicles that have been used to explore the ocean’s surface to find lost ships, explore underwater life, assist in underwater construction, and study geothermal activity (Whitcomb, 2000). The development of robust robot platforms and communications technologies for extreme environments has also been successfully used by NASA and other international space agencies. Space agencies have had several high profile robotic projects, designed with an eye toward safely exploring remote planets and moons. Examples include, early successes of the Soviet Lunokhods (Fong et al, 1999) and NASA’s more recent success of exploring the surface of Mars (Wilcox and Nguyen, 1998 and Leger et al, 2005).

Another of the major fields where humanoid robots have brought significant help is medical. For example, statistics have shown an epidemic increase since 1960’s in cases of Autistic Spectrum Disorders (ASD). In recent years, robots have been increasingly used in autism diagnosis and treatment (Taheri et al, 2015). Humanoid robots have also been used for the treatment for cerebral palsy disabilities present in children that cause impairment in movement and posture (Rahman, 2015). Socially Assistive Robotics (SAR) is an example of a high end technology that assists humans in rehabilitation treatment of CP and ASD. Using human like responses from humanoid robots it has been possible to develop motor skills in CP patients and to Improving social and imitation skills in autistic children (Taheri et al, 2015 and Rahman, 2015).

Robot technology continues to develop, ever moving in the direction of increasing autonomy. Robot developers are working toward building robots that can act on their own, independent of specific direction from users. This type of “smart technology”, as it is sometimes called, has begun to make its way into the everyday life of humans (Bernstein and Crowley, 2008).

Robot technology developers have started developing physical robots that interact with humans in everyday settings. These robots—known as social robots—hold a variety of different functions, including aiding the elderly, acting as tour guides, and even tutoring (Fior et al, 2010). The robots can also have emotional roles, acting as companions, allowing people to cope with negative states such as depression, loneliness, and disability (Libin and Libin, 2004). The use of robots in these areas has begun to open up a whole range of other areas of human endeavor to mechanical devices, including challenging areas of the arts and humanities that were traditionally the exclusive domain of humans (Hatano et al, 1993 and Barakova, and Laourens, 2010).

There are many different examples of autonomous robots: mechanical—or physical—robots, and software agents (softbots) which are now an everyday part of our internet experience in cyberspace (Zhao, 2006). This paper primarily focuses on physical robots, particularly those aspects that involve human interaction and communication. The paper also particularly focuses on the potential for robothespians to entertain in the emerging medium of cyborg cinema.

3. Robots in cinema

Although theatre has been around for thousands of years, robots have inhabited the earth for only a couple of decades. However, there exists a long and rich history of technology being integrated with theatre, acting and performance dating back to the ancient Greeks. These have ranged from tools used in the mechanics of theatre (winches and revolves, for example), the integration of complex props into performances, the use of realistic mannequins and puppets, to the use of technological themes within the narratives themselves. Historically, following Aristotle's elements of drama; theatrical forms that rely on technological effects are named as a 'spectacle', and are often considered as entertainment rather than serious drama (Laurel, 2013).

There is a long history of film practitioners investigating and trying out computer technology; however the late 20th century showed an increased amount of experimentation with technology. During this period, the rapid pace of technological development was reflected and mirrored in performance contexts in films all over the world (Dixon, 2007). This upsurge in multimedia performance demanded of scholars and reviewers a new critical language to accurately describe and analyze the work of this nature.

The majority of film productions utilizing digital technology have focused on computer generated special effects and characters (Youngblood and Fuller, 1970; Manovich, 2001; Ohta and Tamura, 2014; Schofield, 2016a and Schofield, 2016b). Modern cinema creates multiple fantastic worlds and 'spectacles' that constantly clamor for our attention. However, the acceptance of Computer generated technology in film has not been universally positive and many push back against the changes (Catmull, 1978; Magnenat-Thalmann and Thalmann, 1987 and Clark, 2014).

As modern consumers we all live tied to our own personal, ubiquitous, interactive digital devices. New technologies are developed and subsequently introduced and experimented with in media contexts. Artists and film pioneers continue to push the boundaries of old and new media in their efforts to explore the ongoing relationship between technology and human bodies. Traditionally, technologies have had a tendency to contain and limit bodies, fixing them on screen, as if viewed through lenses. In a cinema context, the appropriation of these technologies has sometimes reiterated or exposed these restraining boundaries (Parker-Starbuck, 2011).

Although there have been many examples of entertainment robotics, including the use of robots as robotic story tellers (Montemayor, 2000), robotic dance partners (Kosuge et al, 2003), robotic plants that give users information such as incoming email (Jacobs, 2003), and robotic (Shibata et al, 1999 and Fong et al, 2003). However, from a research perspective, not much has been published in the literature. Early entertainment robotics centered on animatronics, where the robot generally plays prerecorded sounds that are synchronized with the robots motion. These types of robots can often be found in old movies and theme parks; however, the interaction is mostly in one direction, that of the robot presenting information, although the robot's performance may be triggered by the presence of the human. However, the 2005 AICHI Expo demonstrated several robots designed to entertain, including the use of robots as actors and dance partners (Goodrich and Shultz, 2007); similar work on the relationship between acting, drama, and artificial agents is presented in recent work using robots as improvisational performers. However, here again, the role of the human is as an observer, and the interaction is minimal and more implicit (Bruce et al, 2000).

Recently, we have also started to see artificial 'physical' characters on theater stages, such as the one introduced in Richard Maxwell's play, Joe (Maxwell, 2002). Although the robot does not literally merge or interact with other live bodies in this piece, the very introduction of such technology on stage introduces the concept of a whole new era of cyborg theatre and cinema. The first dedicated robotic theatre has recently opened at the Copernicus Science Centre in Warsaw, Poland (Poynton, 2016).

Although this playhouse is relatively new, robotic acting has been occurring in other countries for many years. For example, in 2008, it was reported by BBC that Mitsubishi had created a robot named Wakamaru which spoke lines of script in Japanese. Wakamaru, a humanoid robot, performs in plays which emphasize the relationship between "humanity and technology" (Ogawa, 2014).

When human actors are replaced in cyborg cinema, is there a need to represent differing genders and races that remain distinct among human actors on the material stage or do we meld all the stereotypes together into a single cohesive entity represented by the robot actor? Cyborg cinema is an extension of the tension and attention exhibited by the audience, it allows us to deeply investigate technology and the audience's reactions to it. Cyborg theatre also pushes the boundaries of 'posts' into new territories: post-private, post-identity, post species, post organic (Parker-Starbuck, 2011 and Schofield and Young, 2016).

Many feminist theorists have already extensively discussed the ideas proposed by cyborg cinema, particularly the way the technology challenges existing notions of subjectivity in our modern world (Haraway, 1991; Phelan, 1993; Grosz, 1994; Albright, 1997; Thompson, 1997; Hayles, 1999; Braidotti, 2002 and Parker-Starbuck, 2011). Parker-Starbuck (2011) claims that when considering cyborg subjectivity gender still matters, that individual bodies—human or robotic—however abled, raced, sexed, all matter in the formation of a subjectivity that opens out to encourage a composite position.

Ultimately, the robot actors are bodies on the stage. The cyborg actors form links and connections with the audience through technologies in a presumed cyborg consciousness (Parker-Starbuck, 2011). These robot actors are often immersed within technology, but resist being absorbed by it; there is a smooth acceptance by most audiences that evades gender, sexuality, age, race, class, ability.

4. Robot gender

This section of the paper addresses the relation between gender, technology, embodiment and possible futures. More specifically, it focusses on two questions:

(1) How are the epistemological approaches adopted in the fields of artificial intelligence, cyborg technologies and robotics, going to impact the futures of gender?

(2) And how, and to what extent, do gender and the intersectional differences characterizing the human species inform such developments?

Feminist studies have widely exposed the racist and sexist frame within which the discourse on technology has been formulated. Wajcman (1991) noted how only specifically gendered types of technologies are referred as such:

> "The very definition of technology, in other words, has a male bias. This emphasis on technologies dominated by men conspires in turn to diminish the significance of women's technologies, such as horticulture, cooking and childcare".

Research has shown that cyborg cinema places a clear emphasis on male characters: while the cyborg was thought of as neutral or male by the large majority, out of more than one hundred interviewees, no-one thought of robots in feminine terms (Ferrando, 2014). Some of the reasons given by respondents as to why are: "More males seem interested in AI" and "Robots made by females will probably look nicer".

Layne (2010) presents a specific example to make this point: when some manufacturers realized that they had designed their phones for men, and not for people, they simply thought about altering the design. This is referred to as the "shrink it and pink it" approach: when it comes to include gender in new technology, the first input is simply to change the color to more vivid ones (Bell and Brand, 2008). On one side, such an attitude can be perceived as a reduction and assimilation; on the other, it is important to notice that design is crucial in the reception of technology by users, and that the color change is not a neutral passage when accessed in the frame of psychological and socio-symbolic dynamics.

As another example, many Japanese roboticists have a picture or a figurine of Tetsuwan Atomu (Astro Boy) in their laboratory, and most acknowledge the boy robot as a childhood inspiration—the reason for their interest in building sociable robots. Atomu played a key role in fostering among postwar Japanese an image of robots as cute, friendly and human-like, characteristics that currently inform the thriving humanoid robotics industry. Both real and fantasy robots embody ideas and notions of the relationship in humans between sex, gender and sexuality; and the—mostly male—roboticists design the gender of humanoid robots (Roberson, 2010). The gendering of humanoid robots draws from domains of gendering practices contingent upon shape, color, function and sociolinguistic convention. Most of the humanoid robots developed over the past two decades are gendered, if sometimes ambiguously, and the trend is toward distinctly feminine/female and masculine/male robots (Robertson, 2007).

4.1 Visions of robots

Humans form impressions of each other in as little as 100 ms (Vernon et al, 2014). It is believed that quick impressions of robots are formed in a similar way, depending solely on the robot's appearance (Kidd and Breazeal, 2004; Haring et al, 2013 and Kim et al, 2014). The Expectation Confirmation Theory, furthermore, states that people form initial expectations towards technology (including robots) based on appearance alone (Oliver, 1980), which is then confirmed after observing its performance. Although based on this theory it is believed that a mismatch between people's expectations of a robot based on its appearance and the real experience based on the robot's performance plays a significant role in how people perceive and interact with a robot (Haring et al, 2014), it is unclear to what extent each of these factors influence short and long-term interaction.

There is a body of research which has experimentally investigated the effects of visual gender cues on the perception of anthropomorphic robots (Campbell et al, 1997 and Lohse et al, 2008).

One particular experiment examined whether hair length of a target biased the ascriptions of stereotypically male versus female traits and applications to two gendered robot types. The manipulation of robot "gender" by varying hair length was successful and confirmed that the short-haired robot was perceived as more masculine than was the long-haired robot (Eyssel and Hegel, 2012). Thus, obviously, in line with findings on the effects of human hairstyle on judgments and behavior, the robots' hair cues activated participants' knowledge structures about males and females, and gender stereotypes subsequently biased the evaluations of the robots. Once gender was effectively assigned by the participants in the study, it colored their choices of what the robot should do. The participants thought that "male" robots were considered better choices for technical jobs—like repairing devices—and "female" robots were thought to be "better" at stereotypical household chores.

Gender-stereotypic perceptions were assessed using traits indicative of prototypically "male" agency and "female" communion. This draws on classic research (Bem, 1974; Bem, 1981; Schneider-Duker and Kohler, 1988) which identified stereotypically male and female personality traits and their role in gender-schematic information processing. In this experiment, the female robot was perceived as more communal than the male robot. Hence, the findings show that basic dimensions of human social cognition, namely, agency and communion, are equally applied to nonhuman objects (Abele, 2003 and Cuddy et al, 2008).

4.2 Voices of robots

Robotic natural language capabilities and voices substantively affect human interactions. Consider Siri today, iPhones—and other mobile devices—give users the option of choosing a male or female voice. Apple have provided no reasons for why prior versions of Siri were female in the U.S., but male in the U.K. Having voice options may sound like a step toward gender equality, allowing people to think of assistants as either male or female. However, Siri's purported sexism was not only a matter of voice selection, but of content. It seemed as though sexist biases were embedded in the functionality. Answers were markedly skewed in favor of meeting the needs of straight, male users. Siri couldn't answer basic questions about female-centered contraception and health (Chemaly, 2016).

In human-human social cognition, not only ethnicity, but also gender represents a core category, which is heuristically used in impression formation. In human–robot interaction, however, gendering processes based on visual and vocal cues are still under researched. Existing work on gender has primarily focused on the machine's synthetic voice as the main cue to trigger gender stereotyping of machines.

For example, in their research on the effects of gender-stereotypic responses toward computers, Nass et al (1997) demonstrated that participants attributed gender to computers that communicated in a low or a high pitched synthetic voice. Subsequently, the low versus high frequency of the synthetic computer voice triggered gender-schematic judgments of the "male" versus the "female" computer.

Specifically, the female-voiced computer in a dominant role was perceived more negatively than was the male voiced dominant computer. Furthermore, evaluations provided by the male computer were taken more seriously than when praise was given by the female computer.

Eyssel and Hagel (2012) studied the way a gendered robot conveys common ground and how that common ground influences users' speech. They showed that a robot that speaks with a feminine—high frequency—voice or that has feminine appearance will be associated with the female gender, thus will take on the persona of a female. As such, the robot will be estimated to have knowledge that many women have, such as knowledge of women's clothing sizes and women's sports celebrities.

By contrast, a robot that speaks with a masculine—low frequency—voice and looks masculine will be estimated to have knowledge that many men have, such as knowledge of men's clothing sizes and men's sports celebrities. In our experiment, we chose to focus on the topic of romantic dating practices. In human populations, women are more knowledgeable about dating norms and social practices, and they have more social skill than men do (Eyssel and Hagel, 2012).

Research has shown that if a robot's task is stereotypically associated with different social groups, then we may want to design the robot's interface to fit or to violate the stereotype. For example, a "nursebot" robot, if stereotypical, would be female. To have minimal and efficient conversation with users about their medications, health, and so forth, then the nursebot robot should be female. If, however, there was a need to provide users to provide more information, to explain themselves, to "talk down" to the robot, then the nursebot robot should be male. One reason to implement an anti-stereotypic robot would be if the robot's speech understanding were poor. In that case, it is speculated that people will be more redundant in their conversation with the robot if it does not fit the stereotypic persona for that topic (e.g., a female mechanic, a male nurse). More generally, we can use the principle that people adapt their speech to the perceived needs of the other. So, just as adults speak more clearly to three-year olds than they speak to their peers, users will speak more clearly to an ignorant robot than they will to the smart one (Powers et al, 2005).

4.3 Agency of robots

One of the most gendered stereotypes concerns agency, an important concept in considerations of humanity. Implicit bias means that many, if not most people, associate agency with masculinity, not femininity. This idea is informing the design of elegantly anthropomorphized robots. As mentioned above, in order to make robots socially acceptable they need to be human like. Which means, most likely, they will have gender. Researchers have shown that human users thought of "male" robots as having agency, being able to exercise control over their environments (Eyssel and Hagel, 2012). On the other hand, female robots were perceived as having communal personality traits, being more focused on others than on themselves. Believing that male robots have agency could turn into a belief that, when we employ them, they should have agency and autonomy. Female robots not so much. In essence, male robots are Misters, female robots are Mrs. and Misses (Chemaly, 2016).

Eyssel and Hagel (2012) also demonstrated, with regard to perceived suitability for sex-typed tasks, that the male robot was perceived as more suitable for typically male tasks (e.g., repairing technical devices, guarding a house) than was the female robot. The female robot was perceived as more suitable for gender-stereotypically female tasks (e.g., tasks related to household and care services).

These stereotypes also affected participants' choice of team task to be completed with the robots. That is, with regard to the male robot as a potential interaction partner, participants were significantly more likely to choose a task that required mathematical ability than verbal ability. On the other hand, participants did not differentiate between task types for the female robot. Because of social desirability concerns, participants might have refrained from openly "discriminating against" the female robot by choosing it as team partner for tasks that require stereotypically female verbal ability (Eyssel and Hagel, 2012).

4.4 Removing gender

In humans, gender is both a concept and a performance embodied by females and males—a corporeal technology produced dialectically. The process of gendering robots makes especially clear that gender belongs both to the order of the material body and the social and discursive or semiotic systems within which bodies are embedded (Balsamo, 1997). The construction of gender goes on through the various technologies of gender (such as robotics) and institutional discourses (such as, nationalism and pronatalism) with ‘power to control the field of social meaning’ (value, prestige, kinship location, status, etc.) and thus ‘produce, promote, and “implant” representations of gender’ (de Laurentis, 1987). If gender representations are social positions which carry differential meanings, then for someone or something (such as a humanoid robot) to be represented as female or male implies the assumption of the whole of those ‘meaning effects’ (de Laurentis, 1987). However, the assumption of those ‘meaning effects’ is not necessarily conceived as part of a bigger picture.

A major challenge of gender studies is that a person’s gender identity, a social construct, cannot be adequately described by simple terms such as male and female (Wang and Young, 2014). In fact, a person’s gender may not necessarily correlate with their biological sex. Instead of attempting to address the complexities of gender, studies, sex is generally used as a straightforward way to categorize people, as it serves as a coarse-grained sampling method which provides a metric of analysis roughly along the gender lines (Wajcman, 2009). We highlight, however, that this is a serious simplification which does not address the true diversity and range of people, and rigidly categorizes people into bins in precisely the way we are arguing to avoid; future work will need to address the complexities of gender more deeply (Rode, 2011). Robots lack actual physical genitals and these play no role in their initial gender assignment. The relationship between cultural genitals and gender attribution is reflexive. The reality of a gender is ‘proved’ by the genital which is attributed, and, at the same time, the attributed genital only has meaning through the socially shared construction of the gender attribution process (Kessler and McKenna, 1985).

Gender is not simply a feature or characteristic of a given female body or a given male body. Examining the processes whereby Japanese roboticists assign gender to humanoids necessarily involves looking closely at the socio-historical particularities of the sex/gender system in Japan. In Japan past and present, for example, femininity and masculinity have been enacted or lived by both female and male bodies as epitomized by the 400-year-old all-male Kabuki theater and all-female Takarazuka Revue founded in 1913. Nevertheless, both theaters continue to reproduce not alternative but dominant stereotypes of femininity and masculinity. Moreover, there is a qualitative, socially reinforced—and socially sanctioned—difference between the kind of femininity performed and lived by male bodies and the kind of masculinity performed and lived by female bodies whether on or off stage (Robertson, 1991 and Robertson, 2001). In short, the kind of body matters in the meaning and function of gender that emerges in practice. The point to remember here is that the relationship between human bodies and genders is contingent [81]. Whereas human female and male bodies are distinguished by a great deal of variability, humanoid robot bodies are effectively used as platforms for reducing the relationship between bodies and genders from a contingent relationship to a fixed and necessary one.

Tomotaka Takahashi, a leading robot designer and founder of Robo Garage predicts that over half all future humanoids will be female. Technical difficulties aside, Takahashi—who seems to represent Japanese roboticists in general—invokes, in no uncertain terms, his common-sense view that an attribution of female gender requires an interiorized, slender body, and male gender an exteriorized, stocky body. Takahashi has not been consistent in equating the interiorization of body parts per se with a female-gendered body as his very first robot, the Atomu-inspired Neon, was specifically assembled so as ‘not to have any of its mechanical components visible’ (Takahashi, 2006). Thus, in order to feminize the robot over and beyond her interiorized body, Takahashi consulted with a number of professional fashion models in developing an algorithm enabling the diva-bot to perform a graceful catwalk with all the twists, turns and poses of a supermodel.

5. Race and ethnicity

There is no gender separated from race, ethnicity, age, sexual orientation, and many other social and individual differential categories, as the intersectional approach has pointed out (Crenshaw, 1989). When formulating questions on the subject of race and ethnicity, a problem that arises is scientific terminology. In Europe the term “race” has not been reappropriated the way it has been within the US academic debates of the last decades, where the social construction of the term is a given which does not have to be remarked each and every time. Considering the notions of “race” and “ethnicity”—the latter term is often employed in the European political discourse to avoid racist connotations, thus risking, on the other side, to silence the issue of racism itself. When considering robot technology within a post-humanist frame, race and its intersections with gender, class, and other categories, have yet to be fully addressed (Ferrando, 2014).

As the existing body of HRI research has shown, the robot's voice, demeanor, or its appearance function as social cues that provide information about the robot's persona and subsequently guide social perception (Denny et al, 2016). Thus, such cues facilitate HRI in that users infer certain traits and functions from the physical design of the robot. This is in line with Powers et al. (2005), who proposed that people do not "approach the robot tabula rasa but rather develop a default model of the robot's knowledge."

In September of the same year, a video showing an automatic soap dispenser refusing to respond to a black hand went viral. One may dismiss these examples as harmless bugs or honest mistakes, but they still tell us a lot about the way the technology industry tests its products—and therefore, which customers it values. But then it got worse. This year alone, the first beauty contest judged by AI had only one dark-skinned winner out of over forty, Princeton academics discovered that a popular language-processing algorithm found "black" names unpleasant, and an American software used to predict future criminals rated black people as higher risk (Tait, 2016).

A research project at Carnegie Mellon University has tried to determine human responses and attitudes towards robot ethnicity (Makatchev, 2013). The research showed that human's generally believe that any advanced robot) will need to have some degree of culture associated with ethnicity. Humans relate to technology through human knowledge, which is structured through categories and beliefs, race is perceived as significant in its hermeneutical role. Race, perhaps becomes 'common sense'; a way of comprehending, explaining, and acting in the world.

The results from Carnegie Mellon also showed that most people believe that humanoid robots will look like the country in which they have been created; for example, in Japan the robots look and speak Japanese. This infers that intelligence may be defined and seen differently depending on race and culture, hence as robots are developed, the way of understanding them in different cultures will be very different. As Makatchev (2013) stated in his thesis:

> "If you have a robot that's interactive, there's reason to expect that a person will want to bond with the robot subconsciously. If a robot makes bonding easier, the interaction will potentially be more successful, and expressing social cues makes it easier to bond with the robot."

In another similar study, the appearance and language of a robot was shown to affect the perceived knowledge of the robot when it was described in terms of its ethnicity, either stemming from China versus the United States. In that study, the Chinese-speaking robot of "Asian ethnicity" was assumed to know more about landmarks in China, compared to an "American" robot that had been developed in the U.S. (lee et al, 2005).

A further Carnegie Mellon study, hypothesized that if humans can relate to a robot on the basis of culture, they'll respond more positively to the robot and recall interactions more thoroughly and accurately. Perhaps surprisingly, this study provided virtually no support for the cultural-bonding hypothesis. Few combinations of behaviors and faces showed differences in perception between the American and Arabic participant populations; both groups viewed American robots as more animated, and both rated the least humanoid robot as the most likeable (Tvetan, 2016).

6. Conclusions

Industrial robot technology has replaced human power in many high-speed, high-accuracy and repeating works at various advanced factory production lines. Since the beginning of 21st century, rapid development in related technologies for intelligent robots has built a solid foundation to new advantageous robotic applications in the future. Different from industrial robotic technology, intelligent robotics technology involves many new technologies in various categories. By uniting more powerful artificial intelligence, many faster and smaller multi-functional sensors, more efficient communication technology, and faster, economical computer calculation, intelligent, humanoid robots in new age can provide numerous new potential utilities beyond our imagination. Bill Gates' declaration that "By 2025, there will be robots in every family," has been backed-up the real-world development of humanoid robots (Lin et al, 2009).

The amount of robot actors in films will only continue to grow. Since the characters in most films are reflexive of human traits and behaviors, humans can relate to these characters. By relating with these characters, audiences are also anthropomorphizing them. This is a fundamental framework for the idea of transhumanism to continue to develop in audiences. In return, audiences will also be able to give these characters' human traits such as gender. This allows for the idea of the presence of artificial humans. to become more normalized in society. The work referenced in this paper demonstrates that the more audiences view robots in film, the more comfortable they will be with future robots playing roles in films.

A number of issues have been identified by the audience members and viewers of cyborg cinema, mainly relating to movement of the robots (Schofield, 2018). The larger research question is the efficacy of using robots as actors to perform in films such as this and their effect upon an audience. It is apparent that when an audience compares cyborg and human cinema, they will probably compare what the robotic actors lack to (what they believe are) perfected, human actors. Therefore, this comparison is biased since currently robots still lack autonomy, human motion and advanced language processing. However, cyborg thespians offer a degree of control and precision not available in human actors. As in the human cinema, the success of the cyborg cinema will primarily depend on the response of the audience.

This paper has outlined the ways in which cyborg cinema involving robot thespians has already provided a deeper understanding of how intentional or coincidental robot actions might impact human perception. While it is acknowledged that cinematic contexts are often distinct from natural sociability, robotic interaction schemas generally place humans at the center of overall task goals, thus there are many overlapping lessons we can glean from the construct of an actor and audience.

This paper has also shown that in the context of cinema, appearance, as well as the interaction modality of a humanoid robot can play a crucial role in the perception of robots before and after short-term interactions. Although speech is the most common mode of communication in film, and is an intuitive way to interact with robots, the research reported in this paper also suggests that tactile interaction is important to the way people perceive and interact with robots.

Humans relate with robot technology through human categories of comprehension, but these same categories may differ, depending on cultures, nationalities, social, political and religious backgrounds. For instance, Japan has recently hosted the first wedding conducted by a robot priest. This associates such an open-mindedness about the spiritual relevance of robots, to the animist component of Shintoism (Kitano, 2007). As early as the 1970s, Masahiro Mori, one of the Japanese pioneers of robotics, presented robots as spiritual beings eligible for attaining enlightenment (Mori, 1970).

Cultural beliefs play a crucial role in the reception and development of advanced robots on our cinema screens, so that, while in the West robots are portrayed as the new "other" which might rebel and try to take over the world—like the golem in Jewish folklore or Frankenstein—in Japan they often partake of a spiritual quest. This cultural difference, illustrates the point that race, and ethnicity are not fixed notions, but are always changing, resonating with a popular view of race as a fluid and dynamic social construct (Omi and Winant, 2014). At the same time, cinematic media often presents gender in a more static way, while the concepts of "female" and "male" are constantly performed and re-enacted (Wang and Young, 2014). Such conclusions highlight the need for a deeper investigation in the topic of race, ethnicity and their intersectional significations in the development of technological futures, and the way these futures are presented on our cinema screens.

If ethnic attribution in robots is inevitable, there are many reasons to be concerned. Perhaps the largest issue is one of multicultural presence within the science and technology communities themselves. Gender and diversity problems still looms large in most environments in which technology is developed. It's potentially dangerous to create culturally representative technology in demographically homogeneous circles, where engineers might not enjoy the awareness provided by a gender balance and a broad multicultural scope (Makatchev, 2013).

Some may feel that humanoid robots, and the underlying technology and algorithms, are gender neutral, or that astute practitioners can stay objective and do not need to consider gender when designing and building robots. However, people cannot escape their own gender identity, which heavily impacts their work and decisions: people themselves, and all their interactions, are embodied within and therefore fundamentally impacted by their body and social identity (which, in science and technology, is usually male).

The so called "god trick" of staying perfectly objective—seeing the world untainted by, or from outside of, one's own existence—is impossible, and practitioners thus must consider how gender relates to their decisions (Haraway, 1991). This perspective highlights how HRI, robotics and filmic representations of robots are already gendered, and it is important to consider how to move forward to re-gender the field in a more balanced way (Wang and Young, 2014).

Raising the profile of gender studies in the representation of robots in cinema is not a substitute for more women involvement in technology development and in film making. Raising awareness alone has the danger of simply trusting—primarily male—practitioners' sense. Even with better representation in cinema, improved sensitivity to gender and racial issues will still be important to promote fairness in the bold new future of cyborg cinema.

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