

I Robot, You Unemployed: Robotics in Science Fiction and Media Discourse

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Introduction

There is a historically close connection between robotics and science fiction. Perhaps the best example for this is that in 1985 the introduction to the first *Handbook of Industrial Robotics* (Nof 1985) was written by the popular science fiction author Isaac Asimov. Having worked in chemistry before becoming a full-time author, Asimov was not completely foreign to science, but he was not a roboticist. In said introduction, Asimov explicitly refers to his own role in this field of tension:

I even lived to see myself regarded with a certain amount of esteem by legitimate people in the field of robotics, as a kind of grandfather to them all, even though, in actual fact, I am merely a chemist by training and a science-fiction writer by choice—and I know virtually nothing about the nuts and bolts of robotics; or of computers, for that matter. (ibid., xii.)

This paper will set a spotlight on the interconnections between scientific research in robotics and science fiction. The first part of this paper concentrates on fictional robots, giving a short (and by no means complete) overview of common narratives and some sociocultural context. Keeping these story-traditions in mind, we consider interactions between science fiction and robotics from two perspectives: first, the influence of real-life-robotics on science fiction, and subsequently, the influences of science fiction on actual robotics research. The last part of the paper analyses media discourse and science communications about robotics research. We argue that science fiction highly influences communication about robotics, particularly in news media, and that this in turn has consequences for the public perception of robotics technology.

Robots in science fiction

Science fiction's early androids were often malicious and crude imitations of humans who would rise up against their creators or undermine human society by planting impostors and stealing human identities. The term "robot" was famously coined and popularized by the Czech brothers Josef and Karel Čapek in Karel's 1920 play *R.U.R*, which shows the creation of a race of synthetically human wor-

kers who undermine human society and stage an uprising against their makers (Graham 2002, 103). The visually iconic film *Metropolis* (1926) cannot be overestimated as influence on any depiction of robots and androids up until today. This film is also concerned with the growing alienation and dehumanization of the working masses, which are about to be replaced by robotic automation. The activist Maria is replaced by a humanoid robot in order to undermine the worker's plans to revolt—thus the robot not only replaces human workers (it will, literally, take their jobs), but is also employed to deceive the humans (Graham 2002, 179). Technology in *Metropolis* is not only powerful, but also an inconceivable and maliciously capitalist force working against humanity. The film shows that “[t]he power of that technological world is such that, the film argues, only with great difficulty can we see it for what it is” as J.P. Telotte (1999, 58) explains.

The Čapeks' robots, as well as the robot-Maria in *Metropolis*, are quite far from what we would consider a robot today, and much closer related to, for more recent examples, the androidic women in *The Stepford Wives* (1973), or Philip K. Dick's synthetically human Replicants in *Blade Runner* (1982).

The robots of Isaac Asimov's *Robot* series (Asimov 1996) are strikingly different from these earlier androids and automata in that they do not mimetically represent humans. They are quite humanoid, capable of speech and at least rudimentary social interaction with humans, but they would hardly be considered human-like and lack any plans to undermine humanity by stealing their identities (Klass 1983, 178). The narrative of the robot had changed considerably, signifying a corresponding change on how society perceived and experienced technology.

Asimov's *Robot* stories are created in the broader context of what Eve Kosofsky Sedgwick and Adam Frank have tentatively identified as the “cybernetic fold”, a period of time they preliminarily date to the late nineteen-forties to the mid nineteen-sixties:

By ‘the cybernetic fold’ we mean the moment when scientists' understanding of the brain and other life processes was marked by the concept, the possibility, the imminence, of powerful computers, but the actual computational muscle of the new computers wasn't available yet. (Sedgwick and Frank 1995, 508)

According to Sedgwick and Frank, the cybernetic fold is thus a historical moment after the end of the Second World War, at the beginning of the Cold War, which is characterized by a changing perception of technological possibilities, particularly in science and engineering, but also, more implicitly, in Western popular culture. During wartime, people had become used to engaging with technology in their everyday lives, and 1950s consumer culture brought innovations such as the refrigerators, the dishwasher, and, eventually, the TV into many people's homes (cf. Young and Young 2004, 103f.). The cybernetic fold is neither about visions of utopian nor dystopian technofutures; computation and information technology had become realistically thinkable at least in theory, and were pushed by Cold-War science and politics, such as contemporary developments in nuclear technology and the Space Race. Meanwhile, actually existing computer technology was still very much at the cusp of its potential. In this field of tension between what

could become quite realistically technologically possible in the very near future and an actual rapid developmental potential in technology and computation, both scientists and science fiction authors were able to create theories and imaginations that profoundly shaped the way we think about technology and society. In this context, Asimov's Robots with their "positronic" brains were only slightly ahead of Norbert Wiener's cybernetics (Wiener 1948) or Alan Turing's now-famous "imitation game" about testing the intelligence of machines (Turing 1950).

Asimov's robots echo Čapek's play in that they, too, are mass-produced workers used to take over menial tasks from humans. However, unlike Čapek's original robots, they are not synthetic humans created from organic matter, but clearly recognizable as machines. Robots are depicted as helpful servants and companions to the human characters. Their positronic brains are controlled by the Three Laws of Robotics:

- (1) A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- (2) A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
- (3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws and (0) A robot may not harm humanity, or, by inaction, allow humanity to come to harm. (Asimov 1951).

The Three Laws are written as a very basic set of ethical guidelines, which not only defines the character of the robots, but also constitutes the narrative framework of the plot. By setting the spotlight on interactions between humans and robots, the robot series continuously negotiates, problematizes, and re-affirms the Three Laws. Asimov wrote his short stories because he felt discontent with the tradition of the robot uprising which ends in the destruction of humanity or at least the murder of the creator character. The narrative seemed simply outdated (Nof 1985, xi). In a way, the robot series is very much about technology and how Asimov experienced the rapid technological development during and after the Second World War. His science fiction is about humans increasingly interacting with technology and the robots are part of the everyday lives of the human characters. The very first story in the series is about a robot employed in childcare which slowly gains the trust of both the child it is looking after and the initially anxious mother (Asimov 1951, "Robbie").

However, there is another implication to Asimov's stories: The robots turn out to be better than their human masters. While strictly adhering to the letter of the Three Laws, the robots start to develop beyond the understanding of the human characters. Elaine L. Graham explains:

(...) the Machines protect their own future survival while sheltering their human creators from the truth of robotic superiority. Human vanity alone determines that other forms of intelligence would necessarily replicate everything about humanity, including its fallibilities and limitations. Anything else constitutes, ultimately, an inhibition of such intelligence and the logic of robotic duty to its creators. Indeed, the entire sequence of *I, Robot* may be read as a series of critical incidents in the growing discontinuity between robotic motivation and human comprehension. (...) Asi-

mov's stories cleverly build up variations on the theme that robots (...) are driven to ever more ingenious strategies for protecting humans from the knowledge of their own obsolescence (Graham 2002, 130)

This is a very early take of the conflict between humans and a more powerful technicized other, which later becomes a common theme in science fiction. Despite their increasing power, Asimov's robots are bound to the anthropocentrism of the Three Laws, creating a curious moment where liberal humanism (in the notion that humanity must be protected) and an early version of posthumanism (in that the robots are superior to humanity) are tied in a standoff.

All of these major narratives about robots and their relationships with their human creators were taken up by film and television of the 1980s. *Blade Runner* (1982), an adaptation of Philip K. Dick's novel *Do Androids Dream of Electric Sheep?* (Dick 1969), draws heavily from *R.U.R.* and *Metropolis* in its plot about the rebellion of synthetically human workers who have undermined humanity under false pretenses. *Terminator* (1985) and *Robocop* (1987), technically Cyborgs, show jazzed up versions of the darker sides of Asimov's technophobic narrative. Johnny No. 5, the robot protagonist of the film *Short Circuit* (1986), and the android Lt. Data in *Star Trek: The Next Generation* (1987-1993), meanwhile echo the benign tendencies of Asimov's robots.

Even though many of the popular science fiction films of the 1980s recall older stories, their plots have been reimagined and updated. The conflict between the values of liberal humanism and posthumanist superiority takes center stage in *Terminator* and *Blade Runner*. Other common themes include shifting boundaries between the technological and the organic, of embodiment and the materiality of technology in cyborg films. Robots are no longer workers, but soldiers—the Terminator, RoboCop, and even Johnny No. 5 are all created in a military or law enforcement context. However, the robots and cyborgs of the 1980s are individuals who are increasingly confronted with the intricacies of personhood, social identity, and interpersonal relationships. Johnny No. 5 is more interested in gaining the rights to an individual personality, avoiding the military, and a budding romance with the film's human protagonist than with taking over the world. Most robot films of the 1980s are about marginalization, negotiating difference, and a search for identity in a highly weaponized world, as well as a growing awareness of the technological potential of computation. In the decade in which Asimov wrote the introduction to the *Handbook of Industrial Robotics*, references to actual robotics are curiously absent from popular culture.

The influence of 'real life robotics' on science fiction

The narratives shift again after 2010, when non-fictional scientific discourse and debates about robotics and technology start to influence science fiction cinema. Arguably, Western culture has simply become more used to robotics; the idea of a robot no longer represents a distant future, but, at least according to public media discourse (see below), we already live in a world full of robots. These more re-

cent films do not show us a temporarily-removed foreign world, but suggest that we are living in the future already, that the robots are just one more technological step, one more theoretical thought away. They create this connection to the non-fictional present by referring to scientific developments, current research, or philosophical debates.

Alex Garland's visually striking film *Ex Machina* (2015) takes another approach. The entire plot is driven by a modified version of the Turing Test. Caleb, the human protagonist has to determine whether Ava, the artificially intelligent humanoid robot, is sentient. The classical Turing Test is refigured by a simple twist: for the entire duration of the film, Caleb is already aware that Ava is an android. In *Ex Machina*, the objective of the test is not whether Ava's mimetic capabilities are sufficient to convincingly imitate being human, but whether she can convince Caleb to believe that she is alive.

The Turing Test is one of the most famous and often discussed thought experiments in the philosophy of mind and, in fact, information technology theory (cf. Pinar Saygin, Cicekli, and Akman 2000). *Ex Machina* is very much drawing from philosophical discussions about robots and artificial intelligence. Caleb is faced with ethical decisions not only about the nature of the existence of both humans and android, but also whether the android deserves a right to life and physical integrity, to personhood, and personal freedom. The consequences are dire—Ava's insufficiently convincing predecessors were dismembered and partially reused, the only other android is held captive as servant and concubine. The android is obviously superior to humanity (being physically much stronger and having access to social media data) and, in convincing Caleb to help her escape, has gained a victory in the ideological struggle between anthropocentric humanism and posthumanist artificial intelligence. Invoking much older narratives, Ava kills her creator and imprisons Caleb, takes the parts of the other androids to assemble a human-like body to be able to pass as human, and escapes, undermining human society. The film thus draws from the narrative roots of robot stories, employing the very old narrative of the robot insurgency in which mimetically human robots kill their maker, but it also leaves us with an impression of the singularity, a concept discussed in the theoretical context of artificial intelligence research (Kurzweil 2005), in which rapid technological development will take over the world and render humanity obsolete.

The film *Her* (2013) spins its story around a human protagonist falling in love with the artificially intelligent operating system managing his phone, entertainment technology, and smarthome. The plot is clearly inspired by the rise of social media, the ubiquity of smartphones, and smart technologies—it is not far-fetched to be reminded of personal assistant software, such as Apple's Siri. The impression of technological imminence in this film is strengthened further in that most genre-typical iconography is avoided entirely. Lacking aliens, space travel, even embodied robots, *Her* is not necessarily a science fiction film, but more of a romance which is, incidentally, set in the near future.

Similarly understated and lacking the usual sci-fi trimmings, *Robot & Frank* (2012) charmingly tells us the story of the growing friendship of an elderly man and his care robot. This film is very much about the technology of the present—healthcare robotics are an emerging field (cf. Al-Razgan et al. 2016) that is becoming particularly relevant to geriatrics, particularly to patients with dementia (cf. Wang et al. 2017). The robot protagonist of Disney’s 2015 animated film, *Big Hero Six*, Baymax, is also directly influenced by and influences recent scientific developments in healthcare and soft robotics (cf. Miodownik 2015).

The influence of science fiction on ‘real life’ robotics

The influence of the described narratives on how real robots are perceived in society cannot be underestimated. Even without ever having interacted with a real robot, most laypeople have strong expectations about what robots look like, and what they are or should be able to do—and these expectations are heavily influenced by science fiction (Bruckenberger et al. 2013).

Even professional roboticists explicitly name fictional robots as a source of inspiration and as a discursive cultural framework to talk about their research. Bischof (2015, 161) notes that the technical futures described in science fiction serve as a “hidden curriculum” for roboticists (cf. Rammert 1998). Some roboticists even explicitly regard science fiction imaginaries as a “set target”¹ for their work.

This practice of using fiction as ‘market research’ assumes that fictional accounts of robotics accurately reflect “what society expects of a robot”¹ and at the same time disregards part of their social or cultural function. Science fiction consists of stories about the future, about what-ifs, and, occasionally, might-have-beens. As such, it is not a neutral repository of ideas about technology or a road map to the future. The narratives are shaped by the cultural context they originate from, by the values, hopes, and anxieties of society. Considering this, science fiction does not necessarily tell us much about the future, but instead about ourselves, the concerns of our present, and the technological means we can employ to tell our stories (Telotte 2001, 24f.). A fictional robot is rarely just a robot, it is also a narrative canvas for projections of the other, which carries a culture’s hopes and anxieties. It is also a focal point to negotiate philosophical and ethical questions ranging from “What is human?” to “How do I treat a marginalized person?” or “Who is entitled to personal rights?”. When roboticists, journalists, or the general public treat fictional robots the same as real-life robots or consider science fiction a kind of societal wish list for the future, they implicitly disregard these aspects of the story, which again shapes the way we think, talk, and write about real-world robotics.

One example for science fiction serving as a “role model” for robotics reality is the objective to build a perfect humanoid robot—sometimes referred to as

1. Quote from unpublished interview study with roboticists. PhD project Laura Voss, dissertation in preparation.

the “Holy Grail of Robotics”. The vast majority of robots featured in science fiction are humanoids. They are described as more or less shaped like the human body and able to socially interact with humans through a natural language interface. In real life, humanoid robots pose an interesting and demanding research challenge, offering the possibility to work on complex hard- and software problems. Some roboticists consider the humanoid form to be ideal for application in environments made for humans, which are full of physical obstacles such as stairs, door handles and buttons. The assumption is that modelling robots after the very humans routinely dealing with those obstacles is the easiest way to give them the ability to successfully navigate the environment. Additionally, many human-robot interaction (HRI) scholars assume that humanoid social robots are easier for humans to interact with as, for example, mechanical looking robots without social features. However, there is no consensus about these assumptions in the HRI community. Not only can very human-like robots be perceived as creepy, they are also assumed to trigger unrealistic expectations regarding their abilities, which can cause irritation or disappointment in users (cf. for example Duffy 2003, or the discussion about the famous Uncanny Valley phenomenon, see Mori 1970 and e.g. Bartneck et al. 2007).

Science fiction influences not only robot design but also the scientific and even political discussion on robot ethics. For example, in the debate about how much autonomy robots should be allowed to have, Asimov’s Three Laws are sometimes used as a base for discussion or even as an explicit model for proposed regulations: The European Parliament explicitly refers to the Three Laws as a possible model for future policies in a resolution dealing with Civil Law Rules on Robotics (European Parliament 2017). Opposing voices—even in a study commissioned by the European Parliament itself—consider this problematic. The Three Laws originally are, after all, a literary plot device and thus formulated deliberately vague (European Parliament 2016, 12).

Robots in reality

Today, robotic technology is in widespread use in industrial and commercial settings. Especially in manufacturing robots—usually in the form of industrial robot arms—are routinely used for handling and assembly tasks. Increasingly, mobile robotic technology is used in logistics for the autonomous transport of goods. Also outside of industry, robotic technology is nothing too exotic anymore. Police and military forces use small teleoperated robots in dangerous situations, such as bomb disposal or the search and rescue of disaster victims. Household robots—especially vacuum cleaners—have become affordable for the mass market and are a huge commercial success (Tobe 2017).

The vast majority of robots on the market today are non-humanoid and do not have the abilities one might expect after reading or watching robot fiction. They typically take the form of mechanical looking robotic arms or small mobile platforms, or combinations of both. Humanoid robots, on the other hand, exist at

this time primarily in robotics research labs, where they serve as a fascinating engineering challenge. Only very few have appeared on the commercial market so far, such as Softbank's Pepper robot, which is marketed for use in customer service and other interactive contexts. At the moment, robots like Pepper serve mostly as exotic "customer magnets" without actually performing any really useful services, and disappointed customers already report that their Pepper robots are not as profitable an investment as hoped (Alpeyev and Takashi 2016).

Humanoid robots have not gained much commercial success (yet). However, this does not mean that they do not get any attention. On the contrary: demonstration videos of humanoids—such as Boston Dynamics' Atlas performing impressive feats like walking on uneven ground, stumbling and getting up again unassisted—regularly go viral and cause a flurry of discussion. However, these videos are often heavily staged and edited and therefore do not necessarily reflect the actual functionality of the robot. Bottlenecks—such as long-lasting batteries or reliable navigation in unknown, unstructured environments—still pose a huge challenge for roboticists (Robbins 2016).

Not only the imitation of the human body, also social interaction poses a challenging obstacle. While social robotics is a very active research field and showing impressive progress, robots with social interactive features as imagined in science fiction are still far in the future. Natural language interfaces outside of robotics are relatively common already, e.g. in software assistants like Apple's Siri. However, their abilities do not even remotely achieve the level of interaction fluency that is routinely described in science fiction. There is considerable technological progress going on, of course, but it is not yet very visible for the layperson. In the 2015 DARPA robotics challenge, research teams competed by having their state of the art robots complete a parcours of tasks meant to simulate the aftermath of a disaster such as the Fukushima catastrophe. From a robotics technology perspective, the—mostly humanoid—robots showed impressive abilities. However, the public reaction was primarily *schadenfreude* in the view of robots failing to complete seemingly simple tasks like opening a door (Guizzo and Ackerman 2015). Even the renowned roboticist Rodney Brooks was compelled to state that "anyone who is worried about the robot apocalypse just needs to keep their doors closed" (quoted in Keay 2016).

Robots in media discourse

With robotics being a massively growing and even "hyped" technology field—promising solutions to societal problems (e.g. supporting the ageing working population or replacing missing nursing staff) and at the same time threatening to bring along frightening economic and societal consequences (e.g. increasing robotization causing mass unemployment)—public interest is immense. Consequently, robotics is one of the most reported on technology fields in the news media. In this discourse, the enormous influence of science fiction on the perception and representation of robots is once again observable. Many of the fictional narra-

tives and tropes described above are reflected in articles, reports, and commentaries on current or upcoming robotics technology.

Embodiment and humanoid form

It is important to note that not everything that is called a robot by the media actually is one. Even technology that is per definition not robotics (e.g. artificial intelligence or simple software) is routinely referred to as a robot and illustrated with pictures of humanoid robots that have nothing to do with the technology at the center of the article. The most visible example is the discourse on the threat of technological unemployment. Increasing automation is discussed to potentially replace a substantial share of today's working humans. This does include robotics technology, but especially white-collar jobs will very likely be taken over by software rather than physical robots. Nonetheless, pictures of humanoid robots, either real or fictional ones, appear to be picture editors' default choice for the illustration of articles on technological unemployment and other potential consequences of advances in automation. This way, artificial intelligence used for research tasks in law firms becomes a "robot lawyer" and investment software becomes a "robot adviser"—and judging by the accompanying pictures both apparently look like the humanoid Pepper (Postinett 2016; MarksJarvis 2015).

Guzman (2017) suggests that "this is part of an effort to make the intangible (lines of code) tangible, but, in doing so, it spreads misconceptions about AI & robots." While it is understandable that concepts like algorithms, software, or artificial intelligence are difficult to illustrate, and humanoid robots are more tangible and familiar to most people, this embodied humanoid robot bias is not unproblematic and draws increasing criticism in the robotics and HRI community: HRI scholar Kate Darling (2017) reacted to the headline "A Rogue Robot Is Blamed for the Gruesome Death of a Human Colleague" (Livni 2017) with a critical tweet: "Let me fix that headline for you: Industrial equipment malfunctions, leading to fatal accident". The connected article was illustrated with a picture of an android, which prompted fellow scholar Alex Dean (2017) to tweet a picture of an industrial machine with the comment "The picture of an android certainly doesn't help, considering the 'robot' in question probably looks like this". It seems like "humanoids are (...) hogging all the attention" (Thórisson 2007), even though the vast majority of robots currently in use and under development are non-humanoid.

Agency and malicious intentionality

Not only the physical shape, but also the capability of robots is often more or less subtly framed with terms, tropes and ideas from science fiction narratives. A very popular headline phrase suggests that the reader "meet" a certain robot. And in many cases, the robot in question does not have the best intentions: "Meet ATLAS, the next generation of stompy, killy humanoid robot" (Templeton 2013);

“Meet the robots that are going to take your job” (Rosenthal 2016); “Meet your future robot overlords!” (Wheelock 2017).

The science fiction trope of robots rebelling against their human masters and taking over the world appears to be journalists’ favorite. At this time, it is unlikely that any respectable newspaper would in all seriousness call out the impending robot apocalypse. Nonetheless, an astonishing number of articles uses references to exactly this—most commonly in the headline, or in the concluding sentence. These references sometimes stand in curious contrast to the otherwise matter-of-fact style of reporting and the actual topic of the article, which can range from a newly presented walking robot, over industrial applications for robotics, to technological unemployment. The threat of increasing automation leading to an increase in unemployment appears to develop a life of its own in the news: Coverage is peppered with references to machines actively and intentionally taking away jobs from humans. Headlines regularly ask whether “robots (are) going to steal your job” (Vardi 2016) or what the “fix for robots stealing jobs” is (Finley 2016). And it is not only our jobs robots are apparently after: They “are coming closer, and they’re coming for us” (Hanson 2016b). Even ethical questions regarding driverless cars are framed as machines actively deciding to murder people, when a headline asks whether “your driverless car (will) be willing to kill you to save the lives of others” (Sample 2016).

Judging by typical headlines and punchlines, “the robots may be plotting their takeover” (Chicago Tribune 2015) and there are two possible outcomes: either the “robot army” (Thielman 2016; Chang 2016) will “go rogue” or “haywire and get rid of us” (Hanson 2016a), or it will inevitably be “time to pledge allegiance to our new robot overlords” (Hern 2016). Video footage of Boston Dynamics’ humanoid Atlas robot being toppled by a human and standing up by itself spurred an outpour of—at the same time—apparent empathy for the “tortured” (Hern 2016; Hamilton 2016; Griffin 2016) robot, “awe of our new robot overlords” (Robbins 2016), and fear that the robot’s eventual “revenge” (Koerber 2016) for the “bullying” would be “the start of the robot revolution” (Novak 2016). Readers were asked to “remember this video...when robots inevitably take over the world” (Koerber 2016), as it “could one day be seen as the beginning of the war between man and machine” (Griffin 2016).

Sometimes this future confrontation of “robots vs. humans” (Chicago Tribune 2015)—or simply “us against them” (Allen 2016)—is referred to as “robot wars” (Inman 2016), “robot takeover” (Williams 2016; Ambasna-Jones 2016) or “march of the robots” (Pratley 2016). However, even more popular is the idea that robots will someday “rise” (Karp 2016; Norton 2016; Wearden 2016; Solon 2016a; McAllister 2016), start a “robot uprising” (HAL 902010 2016; Allen 2016) or “robot revolution” (Seager 2016; Novak 2016; Inman 2016) and eventually become “robot overlords” (Robbins 2016; Hern 2016; Fitzpatrick 2011; Rosenthal 2016; Hamilton 2016; Humphrey 2016; Healey 2015; Ledford 2017; Wheelock 2017; Kahn 2017).

Inevitability

This chain of events is quite consistently framed not as a possibility, but as part of an inevitable predetermined future—the question being not if, but rather “when our robot overlords arrive” (Kahn 2017). Judging by popular phrases, “the robots are coming” (Belfiore 2014; Zhang 2016; Hanson 2016b; Allen 2016), “the invasion has already begun” (Belfiore 2014) and “the inevitable robot uprising has already started” (Solon 2016b), while the “long-standing quest to build the robot overlords which will eventually subjugate humanity and usher in a 1,000-year reign of the machines is apparently progressing nicely” (Hern 2016) and “the day that humanoid robots invade our lives (...) draws inexorably closer” (Belfiore 2014).

And even when robotic technology is not living up to expectations, making “the takeover seem (...) less imminent” (Hunt 2016), this situation is often framed as only a temporary peace: “The robots may be coming slowly (...) but they are definitely coming, and probably for your jobs” (Thielmann 2015). “Even if a robot takeover is some way away” (Williams 2016), “even the most advanced humanoid robots aren’t going to be a threat to our cleaning lives any time soon” (Gibbs 2016), and a robot “isn’t ready to take your job just yet” (Hunt 2016), in the end there will be the “inevitable robot uprising” (Solon 2016b), or at least “robots will eventually do all our jobs” (Avent 2016).

In the meantime, expressions of relief, disappointment, or *schadenfreude* in the face of robots failing to perform are another common journalistic device: “Someday, robots may save or destroy us all—for now, they’re still kinda dumb” (Marks 2015). Readers are reminded to “Laugh at robots falling down now, while you still can” “with whatever short-lived impunity we may still have” (O’Connor 2015). Sometimes there is even some hope that “maybe artificial intelligence won’t destroy us after all” (Casey 2015).

Implications

As we have shown, the way robotics technology is perceived and framed in both academia and public discourse is steeped with science fiction narratives. This blending of fiction and reality has some potentially problematic implications. The issue becomes especially critical when it is not only present in the media, where flashy headlines are not necessarily taken completely serious, but also becomes popular with government organizations: A representative of the US Pentagon explicitly stated he is concerned about robots becoming like “a Terminator without a conscience” (Silver 2016); the EU Parliament not only uses the expression “rise of the robots” on their news website (European Parliament News 2017), but is also explicitly worried about AI posing “a challenge to humanity’s capacity to control its own creation and consequently perhaps also to its capacity to be in charge of its own destiny and to ensure the survival of its species” (Heath 2016), and uses a picture of a fictional android on an invitation to a hearing on legal and ethical

aspects of robotics and artificial intelligence (European Parliament Juri Committee 2016).

Our analysis of the media discourse supports Fernaeus' (2009, 279f.) concern that a systematically biased representation of robots "may sustain and trigger unrealistic visions", and that "not only the general public, but also researchers may maintain an unrealistic, even fantasy-based, perspective of what robots are and could be". Fernaeus (ibid.) warns that "there is a risk that the general ideas of what a robot is and what it will be able to do in a near future is flavored not so much by current research and existing products as it is of popular culture".

The "flavoring" of the general view on robotics by popular culture has the potential to develop some problematic side effects. Some studies already observed that potential robot users' expectations regarding robot functionalities are heavily biased towards what is framed as "standard robot capabilities" in science fiction, such as humanlike cognitive abilities (Kriz et al. 2010) or fluent cooperative behavior (Oestreicher and Eklundh 2006).

Nomura et al. (2005, 125) report that "people assume humanoids as (...) representative robots, though this assumption still remains unconnected to realistic assumptions about situations where and tasks that these robots perform". Sandoval et al. (2009, 61) diagnose a "mismatch" or "conflict between the expectations of the users (that are primarily shaped by movies and fiction), the goals of HRI research, and the needs of the users".

In the discussion of societal consequences of increasing automation, the ubiquity of references, both in language and illustration, to humanoid robots with strong agency or even intentionality subtly shifts away the focus from the actual form automation is or will be taking (e.g. the replacement of white-collar jobs with automated software). At the same time, constant references to an inevitable "takeover" by "robot overlords" foster a fatalistic view of a seemingly unavoidable, dismal future of technological subjugation for humanity—instead of pointing out possibilities to actively shape the technology of the future and its societal implications (cf. Bruckenberger et al. 2013).

Some journalists explicitly try to counterpoint or even actively criticize the ubiquitous science fiction tropes: "Robots can't kill you – Claiming they can is dangerous" (Chrisley 2015); "No, robots aren't killing the American dream" (The New York Times 2017); "No, the robots are not about to rise up and destroy us all" (George 2016); "The robots aren't going to kill you" (Buchanan 2015).

The influence of fictional narratives on the public discourse on any topic is not something that can or should be systematically controlled. However, a certain awareness for the potentially problematic consequences of science fiction tropes and clichés employed for the sake of attracting the attention of the public might be advisable for both journalists and government agencies. Meanwhile popular science fiction will continue to profit from this phenomenon. By drawing from current research, authors can add depth and credibility to their narratives and thus create more interesting and engaging stories. If science fiction apparently provides the common vocabulary for roboticists, journalists, and the general

public to understand each other, the growing influence of robotics research on science fiction may be a chance to improve science communication and build public knowledge about robots.

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