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Artificial intelligence and the future of work – Lessons from the sociology of expectations

Abstract

Purpose
What is the future of work going to look like? The aim of this paper is to show how the sociology of expectations (SE) – which deals with the power of visions – can make important contributions in terms of thinking about this issue by critically evaluating the dominant expert positions related to the future-of-employment- and artificial intelligence (AI) debate.

Design/methodology/approach
After providing a literature review regarding SE, an approach based on the latter is applied to interpret the dominant ideal-type expert positions in the future of work debate to illustrate the value of this perspective.

Findings
Dominant future scripts can be characterized by a focus on the effects of AI technology that give agency to technology and to the future, involve the hype of expectations with polarized frames, and obscure uncertainty. It is argued that these expectations can have significant consequences. They contribute to the closing off of alternative pathways to the future by making some conversations possible, while hindering others. In order to advance understanding, more sophisticated theorizing is needed which goes beyond these positions and which takes uncertainty and the mutual shaping of technology and society into account – including the role expectations play.

Research implications
The study asserts that the dominant positions contain problematic assumptions. It makes suggestions for helping move beyond these current framings of the debate theoretically. It also argues that scenario building and backcasting are two tools that could help move forward thinking about the future of work – especially if this is done in a way so as to build strongly on SE.

Practical implications
The arguments presented herein enhance sense-making in relation to the future-of-work debate, and can contribute to policy development.

Originality/value
There is a lack of adequate exploration of the role of visions related to AI and their consequences. This paper attempts to address this gap by applying an SE approach and emphasizing the performative force of visions.

Viewpoint article

"The future is what matters in the present." (Menéndez and Cabello, 2017, p. 229)

1. Introduction

Anticipation concerning AI and work is part of public discussion in a wide range of societies today, while the future of work and AI has been a hot topic in the news (Brennen *et al.*, 2018). There are internet sites that estimate the probability that robots will take over one's job. A great number of academic publications and popular scientific books have been written about the issue. Major international organizations such as the OECD (2016) and ILO (Ernst *et al.*, 2018), etc. have published studies engaging with the topic. A key question in these mainstream discussions in the West is what the effect of AI and robotics on employment is going to be (Dyer-Witherford *et al.*, 2019). A number of governments and think tanks have engaged with how to deal with the potential impact of employment issues linked to automation, AI, and robotics (Bailey and Barley, 2019).

This article argues that sociology and the interdisciplinary field of science and technology studies, (STS) – which focuses on the relationships of science and technology to society, culture and politics – can make an important contribution in relation to addressing the future of artificial intelligence and work. I argue that the strong focus within the expert debate about the likely effects of AI on the future of employment is itself problematic in several respects, and leaves out important issues. I critically evaluate the dominant expert positions about the topic.

Questions about the future are troublesome for sociologists since sociological theory has fundamentally concentrated on the past and present (Mische, 2009), and has less to say theorywise about the future. I thus argue that, in order to be able to enrich the debate fruitfully, sociologists need to take the future more seriously. One approach to this involves building on the sociology of expectations (SE). The sociology of expectations is an area within sociology and STS that deals with the constitutive role of future visions with a focus on innovation and technology. I argue for an increase in the role of this area in understanding socio-technological change connected with AI.

The perspective of the sociology of expectations puts at the center of study future visions and their consequences: i.e. the work that future projections "do" in the present and the influence they have on what happens. In the article I provide a fresh review of SE and some sociological work which builds on it – especially that of economic sociologist Beckert (2016). SE can provide important insight into how expectations about the future might foreclose certain future trajectories, and help create a deeper understanding of views about the future. It does this through applying a lens of sensitivity to uncertainty, inequality, discrimination, and power issues. As the evidence shows, studying visions in their own right can substantially advance our understanding of the social implications of imagining futures in certain ways (Brown *et al.*, 2017).

AI has been defined in a variety of ways. For the purposes of this study, the definition of Elliott (2019, p. 3) is adopted: this regards the latter as "any computational system which can sense its environment, think, learn and react in response (and cope with surprises) to such data-sensing. AI-related technologies may include both robots and purely digital systems that employ learning methods."

The essay proceeds as follows. First, I briefly describe the two most popular expert positions in the future-of-work debate. Next, I introduce SE and discuss its main assumptions. I go on to discuss what some of the characteristics of future expectations are according to SE. As an important contribution of the paper, I then connect the previous parts of the article by bringing SE and the future of work debate into conversation. I interpret the two widespread positions in the debate from the perspective of SE, considering their characteristics and the potential consequences of these particular formulations of expectations. By linking SE and the topic of the future of work, this article has three main goals. First, it aims to show that an SE perspective can increase understanding the key features of the future-of-work debate. Second, it demonstrates what the implications of the current framings of the debate may be. Third, the analysis also points to the need to consider reevaluating the main positions that have been taken in this debate. I argue for a more nuanced view that looks beyond the hype and goes beyond currently popular polarized positions. I argue that positions are needed which take into account the uncertainty and the mutual and complex shaping that occurs between society and technology – of which one element is the shaping that occurs in relation to expectations about the future. I emphasize how the main question in the debate – what the effect of AI on the future of work will be – is in itself problematic because it closes down some conversations which do not deal with the effect, but rather with how AI is developed. Finally, the conclusion reflects on the relevance of the arguments for experts as well as policymakers and makes additional suggestions that help move beyond the current framings of the debate, both theorywise and with respect to methodology. The arguments put forward in this article can benefit sense making concerning the future-of-work debate, and may prove useful in policy development.

2. The future-of-work debate

Experts from a wide variety of backgrounds have voiced their viewpoints about what may be expected for the future of work in connection with AI and robotics, including economists, policy makers, computer engineers, and those who work at think tanks (Autor, 2015; Bessen, 2016, 2019; Ford, 2015; Frey & Osborne, 2013; Harari, 2018; Miller and Atkinson, 2013; Peters, 2017; Pulkka 2019; Schwab, 2017; Tegmark, 2017). In this part of the article I briefly touch upon the "ideal types" of the two major circulating visions of the future of work that dominate this debate by experts in the West. Other ideal types could be constructed as well, but the positions I base the latter two on cover a large proportion of the expert debate according to numerous authors (Boyd and Holton, 2018; Dyer-Witherford *et al.*, 2019). Similarly to the approach described in Pulkka (2019, p. 24), ideal types are used in this article to help understand the "foremost divisions" in the debate, building on Weber's concept of ideal types. The ideal types are abstract models, in which certain characteristics are accentuated to help in the interpretation of social reality. Not all of the characteristics I identify as components of the ideal types are present in individual expert projections in exactly the same way.

The key question in much of the debate about the future of work is what the effect of AI and robotics on work is going to be, with polarized positive and negative interpretations about what this will mean for employment and poverty (Dyer-Witherford *et al.*, 2019). I label the former "Positive Effects ideal type" and the latter "Negative Effects ideal type" to draw attention to the fact that they center on impact.

Both major ideal-type visions start with high expectations for technological development; fast diffusion of the technology, and as a consequence, predict great change. Expectations that perceive less dramatic change are less popular among experts nowadays (Boyd and Holton, 2018). Moore's law is recurrently brought up to support claims that development is occurring more rapidly. Moore's law states

that computer chip performance doubles every two years (Van Lente, 2012), thus AI is assumed to develop exponentially as well.

Advocates of the Negative Effects ideal type expect huge changes in the labor market, with robots taking over the human workforce that is now employed in many current jobs (Ford, 2015; Frey & Osborne, 2013; Harari, 2018; Tegmark, 2017). The former warn of a dystopian state, emphasize the dire consequences of changes to the labor market, and warn of a huge increase in permanent unemployment and poverty for a large proportion of the population.

Proponents of the Positive Effects ideal type position are more optimistic in terms of what will happen, and do not expect dystopia. They argue that new kinds of jobs will be created, thus unemployment will not be so massive, and may not even be a problem at all (although there might be a period of transition), or that AI will assist humans in their work in many cases but not take over whole jobs (Autor, 2015; Bessen, 2016, 2019; Miller and Atkinson, 2013; Peters, 2017). Some also argue that the jobs that will be done by humans will be more pleasant and creative, and that productivity increases will create greater wealth for societies and workers, even if unemployment increases (Miller and Atkinson, 2013). In the positive views about the future, analogies are recurrently drawn with the industrial revolution – it is argued that "this time it will be the same": as earlier technological disruptions did not result in job losses in the long term, the same can be expected now of AI.

In contrast to this claim, pessimists argue that "this time it is different": people will not be able to reeducate themselves at the speed that technological development will require, and new kinds of work for individuals will simply not exist this time, as cognitive tasks are at risk of automation (Harari, 2018).

These two ideal types are not just present in scientific and pop-scientific work, but appear in media coverage as well (Brennen *et al.,* 2018; Chuan *et al.*, 2019). It is argued that the related writings have influenced the understanding of a number of governments and think tanks regarding future policies (Bailey and Barley, 2019).

3. Assumptions of the sociology of expectations
In the previous section, visions about the future of work were considered. What is the relevance of these projections? To answer this question, the first step is to look at how SE looks at technological visions in general. Then, in a later section, I concretize this to the field of AI and work.

Scholars of SE argue that it is important to study how the future is viewed by actors, as such perspectives can play a relevant part in what happens in the present and future (Brown *et al.*, 2017). SE contributes by discussing how different projections of the future work rhetorically, and what the consequences of particular formulations of the future are.

Within SE, the focus is on fundamental uncertainty and openness towards the future on the one hand, and the mechanisms that foreclose certain alternative routes – thus may work in reverse to lessen uncertainty – on the other (Brown *et al.*, 2017).

Uncertainty, openness to the future, and complexity are regarded as important aspects of modern dynamic capitalist societies (Brown and Michael, 2003). Beckert and Bronk (2019, p.3), who build on many ideas of SE, stress that uncertainty and indeterminacy are indeed key characteristics of modern economies because "relentless innovation" and novelty characterize the latter, while modern society is comprised of a complexity of systems that can change radically and tip, sometimes even if only small changes are made.

Building on arguments concerning uncertainty, Beckert (2016) calls future projections "fictional expectations" to refer to the fundamental uncertainty that exists precisely when future events are

prophesied. As he explains, "under conditions of uncertainty, assessments of how the future will look share important characteristics with literary fiction; most importantly, they create a reality of their own by making assertions that go beyond the reporting of empirical facts" (Beckert, 2016, p. 61). Grasping the implications of this recognition, this paper stresses the importance of fictional expectations, which it suggests are made the focus of inquiry.

Expectations can on the one hand involve novelties and increase indeterminacy about the future, but on the other, when powerful, can result in the shaping of the future by influencing actions and values. Exclusionary and forceful narratives about the future can marginalize alternative discourses and developments.

SE-related studies have addressed how some actors try to make other actors believe in certain story lines rather than others, and how these future projections can influence behavior, thus calling projections "constitutive" (Beckert, 2016; Borup *et al.*, 2006; Van Lente and Rip, 1998). It is argued that expectations can legitimize, show direction, and coordinate the actions of diverse actors (Van Lente, 2012). Not all expectations have the same status, however: some narrative accounts might exert more force than others. In this context, it is relevant who has the power to make their projections count (Brown *et al.*, 2017), and which narratives take the status of prominent imaginaries. Powerful groups, social institutions, ideas, and policies can influence future expectations and thus shape the future by trying to marginalize alternative channels of future development, resulting in roles being increasingly locked-in. Collective imaginaries can take the status of taken-for-granted futures that no longer have to be justified, resulting in closure and a lack of consideration of alternatives (Konrad, 2006). This can result in blind spots where important emerging phenomena, trends, and problems are disregarded (Beckert and Brock, 2019). However, it should be noted that there is always the possibility that unforeseen and unpredicted developments will happen (Mische, 2009), even when powerful actors seek to "orchestrate" the future.

SE authors assert that future projections are important specifically with respect to science and technology: anticipation about technologies is an important aspect of modern capitalism (Borup *et al.*, 2006; Brown and Michael, 2003). Uncertainty is considered to be more extreme in those sectors that are very innovative. As visions can influence the construction of technologies and what receives funding and support, economic competition in capitalist societies can be regarded as a fight to establish narratives of future technologies as credible (Beckert, 2016).

4. Characteristics of fictional expectations and their consequences

Fictional expectations can have different attributes (Michael, 2017; Mische, 2009). Identifying distinct characteristics of future visions can help create a less "thin" interpretation of the future (Mische, 2009, p. 702). SE discusses how analyzing future expectations can help to uncover the hidden assumptions that guide them, and how they might shape social processes: for example, what blind spots they have, and what trajectories they hinder by making certain conversations more difficult (Michael, 2017). In the following, I choose three dimensions from the many that have been discussed in the SE literature (see for example, Brown *et al.*, 2017; Michael, 2017; Mische, 2009 for more dimensions). I concentrate on agency, hype/disappointment rhetoric, and level of uncertainty, as these are recurrently discussed within SE and are factors that I believe can be fruitfully investigated to advance understanding of the future-of-work debate. However, in future studies, it might prove useful to look at other dimensions as well.

4.1. Attribution of agency and determinism

Who or what is attributed agency – the capacity to act and influence – within fictional expectations is a key issue in the SE literature. Specifically, the question is whether the technological or the social is

attributed agency, and what characterizes the relationship between the two in projections (Brown *et al.*, 2017). Fictional expectations can present technological development as a means of furthering the defined goals of societies. One example of this is the branch of literature about the use of technology within the field of sustainability, where it is discussed how technology can be used to promote a sustainable society (Kerschner and Ehlers, 2016). In this case, more agency is given to humans and the social. In other types of fictional expectations, technology is seen to be the driver, and humans are seen to suffer the consequences. An example of this are the debates that focus on the impact of different technologies on society. In these accounts, human agency is often imagined in a limited way as agency is primarily attributed to technology itself. Technological elements and their "capacity to bend humans to their character" are seen as stronger than the social element in future developments (Urry, 2016, p. 15).

Taken to the extreme, if the social is seen as autonomous and having an omnipotent effect on the technological, we can talk of strong social determinism; vice-versa, then we may talk of strong technological determinism (Mackenzie and Wajcman, 1999).

Technological determinism has often been shown to be a popular characteristic of narratives about the future of technologies (Mackenzie and Wajcman, 1999). In technologically deterministic stories about the future, the further development of technologies is often presented as inevitable, taken-for-granted, the logical next step (Beckert, 2016). This approach obscures the role of many influential actors and contingencies: it is blind to power, to culture, to how values can change over time, to path-dependence related to earlier technologies, and to the role of visions that shape the future. A range of STS scholars, both within the field of SE and outside of it, have criticized this kind of discourse for neglecting how human agency can shape technology and how human-technology interactions can create new configurations that developers were not previously aware of (Brown *et al.* 2017). Many argue for a perspective that takes into account the dynamic co-evolution of technology and society instead (Geels and Smit, 2017). Geels and Smit (2017, p. 146) in their analysis have shown how technologically deterministic interpretations of the future are wrong in many cases: the authors present historical examples of "failed futures" which had technologically deterministic underpinnings and did not take social and cultural factors into account appropriately. Expectations concerning the diffusion of a technology often neglect the fact that cultural change can take place, whilst the expectations themselves often reflect current cultural beliefs. Often, the "pool of existing social practices is assumed to remain constant in spite of the introduction of a new technology," and practical difficulties related to how fast a technology can become embedded in society are underestimated (Geels and Smit, 2017, p. 146).

4.2. Hype or disappointment rhetoric

One difference between fictional expectations is whether they are discussed in terms of hype or disappointment rhetoric. SE research has demonstrated that visions of technological development often involve "temporal patterning," with interchanging cycles of hype and disappointment which can influence innovation activity (Borup *et al.*, 2006, p. 290). In the understanding of SE, hype is not regarded in the more general sense of the term (i.e. as faulty predictions about the future), but rather as very strong positive expectations that gain a high level of exposure and attention that may have the performative role of attracting resources, alliances, and coordinating and legitimizing action (Van Lente *et al.*, 2013). Fictional expectations are not necessarily created to be accurate: technological development may be strategically and favorably inflated by innovating actors with the aim of securing investment and support (Geels and Smit, 2017). Technological hype may obscure limitations and problems associated with the potential further development of a technology.

A rhetoric of revolution, breakthrough, and superlatives can be regarded as indications of hype in this approach. Hyped expectations can be deterministic and the perceived time to commercialization viewed as short. High expectations during a period of hype can contribute to something constituting a promise developing into a requirement that many actors need to fulfil in order to stay competitive, or for other reasons (Van Lente *et al.*, 2013).

Hyped projections can be present at several levels: in how defined technological projects progress, in how whole fields of technology progress, and at a third, macro level – labeled frames by Ruef and Markard (2010) – which locates the technological in the wider context of social problems and solutions.

A rhetoric of disappointment often follows hype if technology is interpreted as not being able to live up to such high expectations. This can lead to a lessening of innovative activity.

Some authors who build on SE have also emphasized in connection with hype and disappointment that the relationship between imagination and materiality needs to be taken into account. Whether a certain technological solution fulfills expectations is to a degree a matter of interpretation, and different groups can have different interpretations. Moreover, the potential resistance associated with material conditions needs to be considered. Some expectations cannot be fulfilled even if human alliances are strong, because success requires the alignment of human and non-human actors and elements (Tutton 2017).

4.3. Level of uncertainty and number of alternatives
A fictional expectation can have different attributes with respect to contingency: projective narratives can envision future developments as pre-fixed and dependent, or flexible and uncertain (Mische 2009). SE scholars have pointed out that there is often variability with regard to how indeterminacy appears in expectations between communities and sites of communication. Uncertainty regarding future development is often communicated more in fictional expectations within the internal research community, especially within the same research labs, whereas when visions are sold to decision-makers or investors, or are presented in the public sphere and in the media, uncertainty may be downplayed (Beckert, 2016; Van Lente, 2012). This way, communication can contribute to creating a protected space (Van Lente and Rip 1998) in which technology can be developed, and where disappointments regarding technology do not cause setbacks – as fictional expectations are strong that the latter will ultimately turn out well.

Many predictions try to hide the uncertain nature of projections and disregard the fact that expectations are often unmet and that the past is littered with projections that have not materialized in the way they were expected to (Geels and Smit, 2017).

One kind of fictional expectation involves the use of calculative technologies employed by experts, often associated with numbers and statistics, which seem to meet the requirements of precision and calculability and exude a sense of professionalism and scientific expertise. However, it should not be forgotten that even if the future is not a completely open book, there is still some indeterminacy that such processes often fail to incorporate (Beckert and Bronk, 2019).

Another issue is what range of alternatives are considered within a fictional expectation (Mische, 2009), or, more broadly within societal discourse, what number of alternatives are available. Is there a homogenization of expectations – and one dominant fictional expectation? Polarization of expectations within Utopian and anti-Utopian genres wherein arguments are built to be coherent with the genre? Or a whole spectrum of alternative routes? Negative and positive expectations regarding technologies can exist simultaneously in societies (Beckert, 2016; Borup *et al.*, 2006), although there can be cases when negative technological imaginaries are so strong that some forms of technological development are seen as undesirable (Beckert, 2016) and technological investment may be blocked.

5. Lessons for the future-of-work debate from a sociology-of-expectations perspective
In this section, I connect the sociology of expectations with the topic of the future of work. I use examples to demonstrate the usefulness of looking at the future-of-employment debate with concepts from SE. In this approach, the two major ideal-type imaginings of the future of work are treated as fictional expectations that can influence what happens, and thus are important phenomena that should be studied. My method involves interpreting what is implied by ideal-type expectations, and what is left out of them. I also discuss what the consequences of such formulations and omissions may be. I focus on the three characteristics of fictional expectations that are presented in the prior part of this paper: agency/determinism, hype, and level of uncertainty/number of alternatives.

5.1. Attribution of agency and determinism
As previously discussed, an important analytical component of fictional expectations is agency. As both ideal-type expert positions concentrate on the effects of technology, agency is awarded to AI technology from both a Positive Effects and Negative Effects perspective, whilst reduced agency is often only attributed to humans, governments, or other organizations (in relation to getting ready for and responding to changes caused by technology). Other elements of technological deterministic framing are often also present in the writings of experts, with technology portrayed as an inevitably disruptive force with strong effects (Ford, 2015).

Within technology specifically, agency is often attributed to robots – especially from the Negative Effects perspective. A popular question is "will robots take our jobs?", while there are now web sites that calculate the probability of specific jobs being taken over, such as willrobotstakemyjob.com. What may the consequences of this imaginary of actors be? One interpretation is that, seen this way, it is hard to imagine that AI can augment or help the work of humans. Looking at the issue from this perspective shifts the focus from software to robots, often with a focus on how humans might be substituted by the latter. It leaves the issue of software, programs, and algorithms in the background. Z. Karvalics (2015) argues that robots as actors evoke more fear than (the somewhat neutral connotations of) software, which is why they are referred to more by those who see the future negatively. Taddeo – Floridi (2018) claim that many aspects of AI cause problems precisely because they are often invisible, and people might not be aware that they are dealing with AI – the discourse about robots leaves these issues in the background. Frequent use of the term robots also draws attention to the potential importance of images and visual imagination. In relation to future work, one often meets with images that involve the anthropoformization of robots, sometimes in stereotypical gender roles.

What alternative questions remain hidden in a technologically deterministic discourse that primarily awards agency to technology? Here are some that contain a different view of agency: If we take the perspective that society and technology mutually shape each other, and that "the complex ways in which people interact with new technologies fundamentally reshapes the further development of those very technologies" (Elliott, 2019, p. 9), what can be expected in the future regarding AI and work? Also, how are current processes, business, and social arrangements and choices influencing the development of AI?

Or, more normative questions: How could technology be developed in a way so as to contribute to the creation of a desirable situation with respect to work? What kind of social and business configurations should be in place now to contribute to obtaining desirable results from technology in relation to the labor market? Who should have a say in how AI is developed, how it is implemented, and in what ways?

These alternative questions are concealed in the two technologically deterministic perspectives that concentrate on effects and lead to the grounding assumptions of the debate that make some conversations possible (such as what should governments do to help with reskilling, or how can individuals prepare for the future), while hindering others (such as what could/should governments do to influence under what arrangements and in what directions AI is developed: for example, is it the role of governments to fund research that develops AI technologies that lessen inequality?). As the discourse hides these alternative trajectories, for some people it may not register that alternative routes are possible. Issues of co-shaping and the fact that the development of AI itself is embedded in social structures and the choices involved in this are missing from the understanding of the ideal types, in contrast to the alternative questions that I have presented above.

The inevitability of technological development is sometimes supported by economic reasoning: the claim is often that the former lowers costs, thereby increasing competitiveness. Technological change is thus viewed to be "market-driven" (in this sense, markets are also attributed agency). Market forces in this understanding are almost seen as natural laws, and how social relations influence markets and how economic reasoning is social remains hidden in this kind of understanding (Mackenzie and Wajcman, 1999, p. 25).

In both Positive Effects and Negative Effects fictional expectations, agency is attributed to the future: the latter becomes seen as an agent that impacts our present; it is because of what will happen in the future that we should be doing certain things today (e.g. the claims that the present education system should prepare students for a future in which a technological shift has taken place). Following Facer (2013), I argue that it can also be fruitful to remain aware that this is just one way to think of the present-future relationship, and that one should keep in mind that other metaphors can be used in relation to our future orientation, as well in the debate about technological change. "Rather than envisaging ourselves walking forwards into a future in which choices are laid out before us and from which we must choose, carefully selecting paths to avoid risks and fears. Instead, we might imagine ourselves walking backwards into an unknowable future, in which possibilities flow out behind us from our actions" (Facer, 2013, p. 140). Taking this argumentation further, Facer posits that mobilizing creative solutions that few people currently know of but which exist in the present can be an option for education systems as well, rather than just instrumentally attempting to meet the demands of a future in which technological disruption is predicted to take place.

As both Positive Effects and Negative Effects fictional expectations focus on the future, they both leave issues of the present in the background. For example, the social and business arrangements and practices that contribute to the production of AI are typically neglected (Boyd and Holton, 2018; Wajcman, 2017). Several social scientists have argued that it is problematic that some of the companies that are developing digital technologies currently have a huge, low-paid, insecure workforce working on training and tuning algorithms. As Wajcman (2017, p. 124) posits – referring to Suchman (2007) –, the magic of technology "is brought about through the masking of labours of production" and the problems that such workers face, including increasing surveillance of how they work.

Other issues with AI development that have been identified by social scientists as problems in the present that are excluded by a focus on effects include the fact that giant corporations often develop such systems primarily due to a profit motive, using technocratic ideologies. Wealth and power is concentrated in a small number of huge companies – over which, according to some authors, there is not enough democratic oversight (Greene *et al.*, 2019). Another topic neglected by adopting a perspective which avoids looking at how technology is developed is how social characteristics (such as the culture of the designers of AI) influence technological development, which results in solutions which are gender and

race biased (Wajcman, 2017). Going even further, some social scientists argue that the dominant paradigm of the design ideology of intelligent technologies is the value awarded to efficiency and the lowering of labor costs, thereby removing the human element and replacing it with technology (Bailey and Barley, 2019). This leaves less space for alternative approaches: the development of technologies aimed at augmenting human intelligence, for example, or designing technologies that can help employees by complementing and assisting their work. What kind of designer ideology dominates has implications concerning what kind of solutions are developed.

Proponents of both Positive and Negative Effects fictional expectations often obscure how such technology-related fictional expectations themselves can shape the future. In the SE literature, Van Lente (2012) discusses the relevance of expectations related to Moore's law – which, as formerly stated, is an argument promoted by some experts for the high speed of development of AI (Pulkka, 2019) – sometimes being treated as if they were natural laws. From an SE perspective, another reading can be developed. Van Lente (2012) argues that when major actors believe in this law, this steers their actions and acts as a self-fulfilling prophecy. Aims are formulated in accordance with Moore's law, and research and development funds are allocated according to these expectations. If there is a risk that proposed increases in performance will not be achieved, then companies take additional measures – for example, by initiating strategic alliances in order to fulfill their aims. However, according to some commentators, Moore's law is no longer a good description of current progress, as development has slowed. Expectations based on Moore's law are thus just examples of "forceful fiction" (Van Lente and Rip 1998) related to the topic of AI.

5.2. Hype rhetoric
In both types of dominant ideal-type fictional expectations, AI is discussed using the rhetoric of hype. On the one hand, there are high expectations about what technology will be capable of in the near future, as well as with regard to its dissemination – the expressions being used for this transformational effect include the "fourth industrial revolution" (Schwab, 2017), etc. From an SE viewpoint, one can argue that it is important to look at how expectations about major and widespread change can themselves steer action.

A consequence of this hype rhetoric may be that technological bottlenecks are obscured and potential issues with the spread of a technology are not taken into account. As the momentum is with such hyping expectations, it can be harder to start conversations that include discussion of the limitations of technology, or potential failure to meet these high expectations. However, as SE warns, promises made during a period of hype should not be taken as a given, as periods of disappointment often follow.

In work related to both Positive and Negative Effect fictional expectations, how the diffusion of a technology will take place is often hyped, oversimplified, seen as unproblematic, and regarded in a functionalist way (Boyd and Holton, 2018) – its spread is mainly perceived as being related to the nature of the technology. How likely it is that a technology will take one's job often seems to depend on the ability of robots to do the task. For example, Frey and Osborne (2013) look at how technology will be capable of doing what is required for specific jobs and equate this capability with the rate of unemployment that may be expected as a consequence. In employing this approach, many social, cultural, and psychological factors that may affect the embedding of AI in society are omitted (Geels and Smit, 2017). Some of the latter phenomena may slow dissemination (for example, if there turns out to be a preference for working with humans, or using humans to provide a service rather than robots or bots, or if local governments decide against using AI instead of humans to avoid layoffs that would worsen the regional employment situation, etc.). Of course, there are also factors that could make the spread of technology faster (such as an organization wanting to be seen as forward thinking), but the point is that many of these

complexities remain hidden in the mainstream rhetoric. In any case, historical data also show that the embedding of technologies is often slower and more contested than functionalist views would imply (Urry, 2016).

Looking at the strong expectations formulated in the current fictional expectations of experts, it is also important to mention that speculation about what will happen with the development of AI and robotics is not a new phenomenon. Several periods of hype and disappointment with AI have already taken place. So far, many earlier technologies have not developed in ways that were entirely foreseen, or at the speed predicted by many (Urry, 2016; Wilkinson *et al.*, 2011). For example, Urry (2016) mentions that it was anticipated in the last decades of the twentieth century that, by the beginning of the 2010s, domestic robots that were capable of doing a range of housework would be widespread. This did not happen.

There have been, however, two important developments in relation to the earlier hype concerning AI. On the one hand, the development of AI has progressed, with new discoveries and increases in computational power – thus there has been a change in material conditions. Even if many of the earlier visions have not yet been fulfilled, in recent years technological advances have happened that some commentators claim will have a considerable effect on the labor market in the very near future, even within the next few years (Ernst and Young Australia, 2019).

On the other hand, not only has technology advanced, but the position of projections seems to have strengthened: strong agendas have started to be built around technology, with these "forceful fictions" potentially having the power to influence the future. Statistics show that many companies are planning to invest in AI in the coming years (Ernst and Young Australia, 2019), and the future of work is a hot topic in many media outlets (Brennen *et al.*, 2018; Chuan *et al.*, 2019).

Taking into account the influence of expectations, institutional investments and arrangements, as well as recent technological advances, it is plausible that even within the next few years a degree of change will take place in workplaces regarding AI. However, it should not be forgotten that many of the visions that look beyond the next 5-10 years and predict major technological disruption (with AI taking over a very wide range of jobs) have high expectations about how AI will develop in the future. Many of the applications that would be required for the predicted automation of jobs and tasks have either not been developed yet, or have not been tested extensively outside of experimental laboratory situations (Boyd and Holton, 2018). In line with hype rhetoric, the fact that real-world usage and laboratory usage are two different things may be obscured. Such developments that have not occurred yet are often said to be "just around the corner." This "just around the corner" rhetoric, however, is not new; it was present in earlier eras as well with respect to AI, and did not always turn into reality. As Dyer-Witherford *et al.* (2019, p. 46) argue, "there is no absolute guarantee" that the AI industry will deliver the goods it promises.

What happens if some of the hype about AI causes disappointment after a while? Some of the characteristics of AI-related hype (involving many different sites, strong actors, and investments in the field) are described in earlier SE-related case study research on other technologies, which showed that even if the former attributes are present, innovation activity could be maintained relatively well, even in disappointment cycles. On the other hand, previous case studies have shown that the negative effect of disappointment on innovation activity can be greater when the legitimacy of a field becomes contested, because framing on a societal level becomes substantially negative (Van Lente *et al.*, 2013). However, so far, even though the Negative Effects viewpoint is a prominent expert perspective in this debate (which takes into account the potentially negative impact of technology on a macro level, thus has negative framing), the related arguments do not center on questioning whether AI technology *should* be further developed – this outcome is typically presented as inevitable. What is interesting in past decades is that calls have been made to halt the deployment of some technologies whose effects were contested,

ultimately leading to regulations against their development or use. For example, GM crops are banned in certain countries (Raman, 2017); a recurrent argument against them (amongst others) being their purported health risks. In the case of stem-cell research, moral/religious qualms about embryos being destroyed resulted in the cessation of research or withdrawal of related state support. However, it is notable that potentially curtailing development as an option is not part of a mainstream rhetoric about AI.

5.3. Level of uncertainty and number of alternatives

A selective "historical amnesia" (Bennett and Maton, 2010, p. 321) is characteristic of some aspects of history in the dominant perspectives. Those who make predictions from both the Positive and Negative Effect positions typically do not discuss how earlier predictions about AI futures did not come true (whilst other historical analogies are used, such as the earlier industrial revolutions, in the case of the Positive Effect position).

Applying the category of "breadth" (Mische, 2009) – which involves analyzing how many possible trajectories are seen by actors who make prognoses about the future – we often see that only one outcome is claimed to be likely to happen in the future.

Some of the related works contain numbers and statistics which, as I have discussed, lends the associated predictions a more scientific and precise air. One popular number is what percentage of jobs (and later, tasks) in a society are liable to be automated (Frey and Osborne, 2013).

The omitting of any mention of the failures of earlier predictions, showing only one trajectory, and the use of numbers can all lead to the downplaying of the uncertainty involved in predicting the future.

The two dominant ideal types see opposing trajectories for the future. The Positive Effect position emphasizes things turning out for the better, or at least not turning worse (Autor, 2015; Bessen, 2016, 2019; Miller and Atkinson, 2013; Peters, 2017), while the Negative Effects position suggests a radical turn for the worse (Ford, 2015; Frey & Osborne, 2013; Harari, 2018; Tegmark, 2017). As Mische (2009, p. 701) puts it, future scripts often have genres such as a "recognizable discursive 'mode' in which future projections are elaborated," with narrative forms that are similar to typical modes of storytelling. The genre (Mische, 2009) of some of these pieces of writing can be defined as horror/tragedy/apocalyptic (robots and AI causing massive unemployment, the emergence of a non-productive class of society, poverty, and inequality, etc.) (Ford, 2015). Krugman (2013, p. 27), for example, writes that "a much darker picture of the effects of technology on labor is emerging." However, a vision of utopia is prevalent in some other works that use arguments such as "technology benefits not just the economy overall, but also workers: more and better technology is essential to …higher living standards" (Miller and Atkinson, 2013, p. 1). Paying attention to arguments that could contradict the main direction of such imaginaries would run counter to the modes of storytelling of the genres. This can result in such work becoming too one-dimensional, one-sided, and lacking in consideration of the multiple directions the future might take, including situations that are not radically bad, or very good, but are something in between. As the two dominant positions contradict each other, some degree of uncertainty is accordingly present in societal discourse, although the two polarized views about likely effects hinder the development of a more nuanced and sophisticated understanding of the topic.

6. Conclusion

In this paper, after introducing the two most prominent ideal-type expert positions concerning the future-of-work debate, and after discussing the sociology of expectations, I linked the two topics. I analyzed the two positions – Positive Effect and Negative Effect – from an SE perspective. I argued that these polarized positions can be characterized by a focus on the effects of AI technology that give

agency to technology and to the future, lead to a hype of expectations, and the obscuration of uncertainty. I then discussed some of the implications of these particular formulations.

Despite the fact that future visions of AI and work are present at many levels in today's societies, little research has sufficiently and intensively explored the role that they play from a sociological perspective (for some exceptions, see for example Boyd and Holton, 2018; Elliott, 2019; Pulkka, 2019; Wajcman, 2017). The current study contributes to the study of the role of predictions about AI and work by treating them as fictional expectations, and applies the repertoire of SE to interpret them.

What does it mean to treat discourse about the future as a form of fictional expectation? It means drawing attention on the one hand to the uncertainty of making prognoses about the future, and on the other to the important role of future projections in guiding and informing action: i.e. the performative and constitutive role of visions.

Sociology can play a vital role in increasing understanding of socio-technical change in connection with AI and work by making explicit the assumptions that are implicit in prevalent visions of the future, as well as by showing how taken-for-granted and dominant visions contribute to closing off alternative pathways to the future. As SE raises awareness about problems with dominant discourses, it can also help with finding new solutions. It offers a less deterministic take on socio-technological change that is sensitive to power, inequality, the reduced imaginings of human agency, and that takes into account uncertainty and the role that expectations play in influencing the future.

I argue that for advancing our understanding of the future of work, the debate needs to be reframed. More sophisticated theorizing is needed that transcends the currently hyped, polarized, and technologically deterministic fictional expectations inherent in the two dominant ideal types of Western expert discourses. The "failed futures" (Geels and Smit, 2017, p. 146) of other technologies, and more concretely, of AI, should serve as a cautionary tale in relation to believing too easily in the accuracy of current framings of the future in relation to AI. Because mutual shaping between society and technology is an iterative and complex process, looking into the future is not as simple as dominant discourses would like us to believe. Other metaphors for the future-present relationship should be considered than the ones inherent in the circulating Effects positions, in which the future dictates what to do in the present.

Although in much of this paper I have emphasized the "nontechnological," this was done to counter the dominant discourse that highlights the technological. The co-shaping perspective applied in the paper does take into consideration the fact that technology shapes the social, although it also stresses that shaping processes, whether technological or social, should not be viewed as omnipotent.

Prominent predictions about AI (amongst other themes) are important, as they have the potential to shape funding, investment, and policies. The technologically deterministic vision present in both dominant positions in the future-of-work debate assigns other kinds of roles to those that a non-technologically deterministic imaginary would. It excludes some areas from public debate and political discussion. A range of STS authors have argued that technologically deterministic conceptions of change are undemocratic and risk favoring an attitude of non-intervention in current circumstances of industries, or in which direction technology is developed. Instead, such ideas foster concentration on policies of adaptation and getting ready for what will happen in the future instead (Dotson, 2015). To ensure the more democratic development of technology, instead of the mainstream focus on the effects of AI, discussions could also center on what social visions these technologies serve, and how technology may be shaped to achieve certain social goals. Power and inequality-related issues associated with the development of technology could be taken into consideration, and work to create more democratic oversight in these areas could prove to be fruitful for society.

One should remember that AI is currently in a period of hype. This can, on the one hand, be regarded as a resource, as funding for research and development purposes is easier to come by. On the other hand, it is important for policy makers and actors in the innovation process to be aware of such periods of hype and not take promises for granted, as the latter are often followed by disappointment cycles. Additionally, to keep in mind that during periods of hype technological difficulties in development are often downplayed. Promises that are more modest might help in the long term, as they lessen the risk of greater disappointment.

The two currently dominant ideal types in the discourse downplay the uncertainty involved in predicting the future, each seeing just one trajectory for the future, without caveats. However, the fact that they are in complete opposition to each other results in ambiguity and uncertainty concerning expectations at the societal level.

The creation of authentic alternative narratives to those of dominant technologically deterministic positions may be useful for countering the closure and lock-in that could lead to non-optimal states, as well as highlight the blind spots of the current framings. These alternative imaginings of trajectories could open up a discourse that goes beyond polarized apocalyptic and Utopian visions and could thus help generate more nuanced conceptualization of AI futures.

One method that could help with devising these alternatives is scenario building methodology concerning the future. Scenario building has a commitment to multiple future possibilities. Forward scenario building can help with generating a range of scenarios that can be considered plausible stories about the future that take into account uncertainty and possible surprises and disruptions (the value of considering potential disruptions surely does not have to be emphasized in an era of Covid-19). These scenario-building exercises help participants to rethink how they perceive reality, to challenge their assumptions and prevailing mind-sets, and thus help new solutions emerge (Bradfield et al, 2005). Considering scenarios can help decision-makers prepare for situations and guide them towards preferred outcomes. In terms of normative solutions, backward scenario building exercises such as backcasting could also help. Backcasting creates a normative vision of an ideal future, and works its way back to the present (in terms of what action could lead towards that desired state). Backcasting works well in an environment associated with an uncertain future and heterogeneous systems where foreseeable trends lead to unacceptable outcomes. While other future research methods often presume that actors simply adjust themselves to trends and events, backcasting assumes that actors deliberately attempt to engender a desired future. Taking the form of a kind of feedback loop, a backcasting event can thus generate action that might influence outcomes and directions (Robinson, 2003).

I agree with Borup *et al.* (2006) that a fruitful next step for dealing with visions of the future in terms of socio-technical development would be to integrate the perspective of SE about the role of visions on the one hand with perspectives from the futures field which seek to look into the future on the other. Indeed, some of the tenets of SE are shared in some conceptualizations of scenario development and foresight (for example, the performative role of visions, and uncertainty about the future), thus, in this sense, scenario building and backcasting are compatible with SE. Some others tenets of SE are not part of the assumptions of typical scenarios research and could be added in to research projects – such as the factors involved in co-shaping technology and society. Taking the arguments of this paper further, in a future study I plan to offer some suggestions in this regard and discuss how sociology and future studies can mutually learn from each other to enhance the work currently being done in these disciplines.

So what will the future of work look like? The goal of the paper was not to argue for one concrete vision of the future, but rather to deconstruct and critically reflect on popular ideal types of imaginaries as a first step to moving thinking forward about this issue. In this sense, the goal was more to argue in which

ways it is not good to conceive of the future. Additional aim was, to present some arguments on how it might be possible to move toward useful insights in the future, both in terms of theory and methodology. Our research team plans to conduct scenario-building research that builds on SE and may generate alternative views of the future, whilst bearing in mind the uncertainties involved in how the future can unfold. It will be based on different premises than what the dominant ideal types imply. However, some statements can already be made based on the analysis of the current paper. I would argue that, as the dominant ideal types operate with problematic premises about the technology-society relationship, and their polarized forms of argumentation downplay anything that would contradict the line of reasoning of the genre of extreme positions, it is logical to suppose that the future will unfold differently to either the Negative Effects or Positive Effects ideal types predict. It seems highly unlikely, even if a great number of jobs are lost to automation, that people will just passively accept being thrust into a state of poverty – as technologically deterministic apocalyptic visions predict that award too small a role to human agency. Some forms of communication between consumers and companies are presently having an effect, such as the Black Lives Matter movement with the #StopHateforProfit campaign, and one could argue that a similar response would occur in the case of automation in the future. On the other hand, some statements associated with the Positive Effects ideal seem naïve, such as supposing that wealth obtained due to the work of robots and AI will automatically be distributed in a way that is beneficial to employees. Also, whilst it is a strong argument that technological change has already resulted in major job creation, each form of technological change is qualitatively different (Campa 2014) and it cannot be stated for sure that the number of jobs created this time will outweigh the number of jobs lost to automation.

I do not claim that considerable socio-technological change will not happen in the future, with attendant effects on society. Technological development with respect to AI has already happened to a degree, and some degree of lock-in seems to have been created. Nonetheless, the extent of the transformation and the forms it may take are less obvious than suggested by the two ideal types and the related hype of AI, with its inflated promises that turn a blind eye to technological bottlenecks and take for granted future technological developments. Based on a great body of work in STS about technologies and the sociology of expectations, one can argue that what will happen, and when, should not be taken for granted. The issue is not just the quantity of jobs that may be created, but their quality. Moreover, change might be even more fundamental, leading to a complete rethinking of entire meaning of work, while there is also the possibility that a range of phenomena that are presently not paid work will become paid work in the future (forms of volunteer work, or providing personal data for AI-related purposes) (Ibarra et al 2017). Even more broadly, configurations of AI and society could result in changes that are broader in scope than just the labor market and lead to change in everyday life, communication, identity, and social relations (Elliott 2019).

I propose that looking at perspectives that are currently left out of the dominant rhetoric can provide insight that is useful in the debate about what the future will be like, and that the methodology of scenario building and backcasting can help in devising these alternative futures. A number of scenario-based research projects have been carried out on the topic of work that are already more differentiated than the two polarized ideal types in the debate. The projects usually formulated from three to eight scenarios. Some scenario projects have assumed that technological advancement is going to be fast and radical, with major effects on work (Daheim et al. 2019), while some others have applied different scenarios in relation to potentially different speeds of technological change (WEF 2018). A common feature of these projects is that they do not just contain extreme positive and extreme negative scenarios, as is the case with the two dominant Positive and Negative Effects ideal types. They show a wide range of possible trajectories for the future. In contrast to the ideal types, they do not claim that there is one sure

path that will emerge from all possibilities, and do not present themselves as predictions; rather, they should be thought of as exercises for helping us think about possible future situations and the dynamics that can influence change. I agree with arguments that a "plausible future may well involve a mixture of scenarios" (WEF 2018, p. 3), and that there may be national-level differences in outcomes (Campa 2014). Discussing in detail the scenarios described in such projects exceeds the limit of this paper, but to indicate the flavor of these scenarios, a few examples are presented here. Dellott et al. (2019) describe four scenarios for the future of work in the UK in 2035: the big tech economy, with rapid technological development and cheap goods, unemployment and wealth concentrated in a small amount of huge companies, and public awareness and self-organization lagging behind technological change; the precision economy, with moderate technological development and hyper surveillance; the exodus economy, with economic slowdown and crisis; and the empathy economy, with automation at workplaces "managed in partnership with workers and unions" and the "empathy sectors" of education, care, and entertainment gaining prominence. In 2018, The World Economic Forum, in collaboration with the Boston Consulting Group, published research about the result of scenario building that included eight scenarios for the future of work based on differences in three factors: the speed of technological change, the speed of learning evolution, and the extent of talent mobility. The study argues that the implications of the scenarios suggest that certain forms of preparation would be useful in relation to these outcomes, such as workforce reskilling, education system reform, etc. Thus, they consider that human action is reactive to technological change, the latter which appears as an external factor.

The argument advanced in the current paper is that an approach that builds more on SE and Science and Technology Studies has the potential to provide additional insight in the case of scenario-based research; for example, by employing a more nuanced understanding of the relationship between technology and society than earlier scenario-based projects about work have used, as well as the role of expectations in shaping the future, which can enhance understanding. Taking into consideration the former factors could involve building on the factors that some argue can change technology-society configurations, such as values, culture changes over time, lock-ins due to current solutions, resistance and conflict in relation to technologies, as well as placing more focus on issues of power, inequality, and marginalization, etc. (Geels and Smit 2017, Urry 2016). For example, scenarios could be created in which AI technology is perceived to develop in different ways because of societal considerations.

One such consideration could be sustainability. Technological change in the Effects visions in mainstream future-of-work discussions is not often considered in interaction with sustainability. In sustainability discourse, the agency of humans to influence future societies is often considered to be significant; we can also see that technologies have been developed in ways that fulfill specific societal goals regarding sustainability. This is in stark contrast to how agency is viewed in the technologically deterministic mindset that prevails in connection with AI and the future of employment. If insights from the sustainability field were better integrated into thinking about future possibilities regarding AI and work, this could result in changing expectations, with the consequence that actors would be awarded different roles to those that are typically assigned to them. Even though sustainability-oriented solutions often revolve around ideas about ecological modernization that rely on future technology, in some conceptions work in a sustainable society is viewed as more (human) labor intensive, with the spread of small-scale, local, hand-made, craft-based work (Zahn and Walker, 2019). In this scenario – in segments of society in which craftwork is of greater value – job displacement by robots and AI is less likely to occur. In terms of normative issues, how AI could help with bringing about environmentally and socially sustainable solutions with respect to the future of work is a relevant question.

I have argued in the paper that instead of focusing just on the effects of AI – which is a central issue in much public, political, business and academic discourse (Boyd and Holton, 2018) – more insight would follow from looking at how AI and society iteratively co-shape each other. The argument of the sociology of expectation that exactly how changes unfold can involve differences in different societies and surprising new combinations that have not been thought of before should not be forgotten. The future might just be different from how we imagine it now, and what we concentrate on with respect to the future can hinder the identification of some aspects of the latter that may be relevant, as well as the understanding that there may be some room to shape it.

Instead of asking what is the future going to be like, an alternative question is what do we *want* it to be like, and how can we achieve this vision. Backcasting methodology could help in answering this alternative. There are strategic decisions to be made with respect to how AI is developed and what to prioritize. Some approaches will bring great wealth to the mammoth companies that develop the related AI, whilst prioritizing other solutions that reduce inequality and make work safer might not be as profitable, but will benefit those in need more. To give an example, a recent article tells of how some sanitation workers in India have died during past years cleaning sewage pipes (Verma 2019). The author of the article raises an important question when he asks when AI will be used to help these and other disadvantaged people, and to empower the marginalized. Democratic discourse could focus more on these issues. Instead of the focus on replacing workers in a wide variety of areas, how technology can be applied to augment workers' capabilities could also be investigated – for example, how virtual reality could be applied in the form of role play and practice interactions with customers in retail.

I have argued in the paper that the focus on the future also leaves problems with current business and social arrangements within the AI industry relegated to the background. These issues include concentration of wealth and power in the hands of a few huge companies, the less than ideal situation of the workforce, and the discrimination and bias inherent in AI solutions that have already been developed.

Policy making could benefit from taking into consideration the suggestions of the current paper. Instead of taking for granted mainstream visions of the future as the basis for policy development, decision makers should remain open to thinking of alternative forms of development. This could help societies to prepare for these situations should they arise, and guide outcomes in the desired direction. For strategy development, asking the right questions and using good methods is vital. I argue that rather than just focusing on mitigating the effects of a supposed vision of the future, the problem should be reframed, with more agency given to humans and to the present, and by increasing sensitivity to power- and inequality-related issues. Scenario building and backcasting are two methods by which stakeholders could be included in useful foresight exercises that benefit policy and strategy development. These methods are compatible with SE and could be used in a way where even more tenets of SE are applied. Of course, what kind of stakeholders are involved in the former is a key question, and power issues should not be forgotten, even in the organization of such exercises.

Acknowledgements

Funding

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