



Robots in the Workplace: a Threat to—or Opportunity for—Meaningful Work?

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Abstract

The concept of meaningful work has recently received increased attention in philosophy and other disciplines. However, the impact of the increasing robotization of the workplace on meaningful work has received very little attention so far. Doing work that is meaningful leads to higher job satisfaction and increased worker well-being, and some argue for a right to access to meaningful work. In this paper, we therefore address the impact of robotization on meaningful work. We do so by identifying five key aspects of meaningful work: pursuing a purpose, social relationships, exercising skills and self-development, self-esteem and recognition, and autonomy. For each aspect, we analyze how the introduction of robots into the workplace may diminish or enhance the meaningfulness of work. We also identify a few ethical issues that emerge from our analysis. We conclude that robotization of the workplace can have both significant negative and positive effects on meaningful work. Our findings about ways in which robotization of the workplace can be a threat or opportunity for meaningful work can serve as the basis for ethical arguments for how to—and how not to—implement robots into workplaces.

Keywords Meaningful work · Meaningfulness · Robotization · The workplace · Robots · Robot-ethics

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1 Introduction

Nissa Scott is one of the many workers whose daily work—in her case stacking plastic bins in an Amazon warehouse—has been outsourced to a robot. Fortunately for Scott, this did not mean that she had to find a new job. Instead, she now oversees the robotic arms stacking the bins, making sure that everything goes well, and intervening in case of trouble. She found her former tasks boring and physically tiring. Her new tasks, for which Scott received additional training, are non-repetitive and mentally stimulating (Wingfield 2017). In her new role, Scott has greater responsibility, and she exercises her capacities for understanding and decision-making to larger extents. What she does and how she does it now makes a greater difference to the operation of the warehouse than before. It seems that Scott's work has become more meaningful after robots were introduced to work alongside her.

It is equally well possible, however, that robots in the workplace can pose a threat to meaningful work. The work of metro drivers in Paris was partly outsourced to robots with the introduction of self-driving metros. Some of the metro drivers were offered alternative employment as managers. This new work could be seen as exciting, non-repetitive, and stimulating due to the increase in (formal) responsibility similar to the previous example. However, a follow-up on the metro drivers who were now managers revealed that they were feeling deprived of meaningful work. Instead of being able to respond and act immediately in case of emergency situations, for example, these newly appointed managers were now only indirectly informed of emergencies. Moreover, not being directly responsible for the lives of passengers anymore meant that the metro drivers actually felt a loss of responsibility in their adjusted jobs (Anteby and Nishani 2016). It thus seems that work can also, unintentionally, become less meaningful after the introduction of robots.

Robots have begun entering many workplaces: from order-picking robots in warehouses to delivery robots on university campuses and to bomb disposal robots working alongside teams of soldiers (Royakkers and van Est 2015). This gives us reason to reflect on how to keep work meaningful in the future. What philosophers have mainly discussed so far are threats posed by robots in various work contexts, such as a lack of dignity in relation to care robots (Sharkey 2014) and responsibility gaps in case of military robots (Sparrow 2007). With respect to work in general, the fear for technological unemployment as a result of robots replacing human workers has received significant attention (Brynjolfsson and McAfee 2016; Ford 2016). Given the centrality of work in many people's lives, losing one's job may constitute a threat to living a meaningful life (Danaher 2017). However, the issue of robots' effect on meaningful work has not been discussed much. This motivates the general topic of this paper: the paper investigates both ways in which robots in the workplace might pose a threat to meaningful work and ways in which they might make work more meaningful.

There are several reasons why it is important to understand how robots may impact meaningful work. We will mention three. Firstly, doing meaningful work generally leads to increased job satisfaction and worker well-being (Rosso et al. 2010; Rothausen and Henderson 2018; Wrzesniewski et al. 1997). Secondly, many of us spend a considerable part of our week at work. So, if robots would generally have detrimental effects on meaningful work, this would be highly disruptive for how we live our lives. Thirdly, several philosophers have argued that society has a general duty of justice to

ensure that people have access to meaningful work (Gheaus and Herzog 2016; Roessler 2012; Schwartz 1982). Most of the defenses of this duty involve the observation that people spend a great deal of their time, energy, and other resources on their job. For example, Gheaus and Herzog (2016) argue that people value various goods that constitute meaningful work, such as making a social contribution and experiencing community. It is hard to realize these goods outside of work, partly due to time constraints. Since the burdens and benefits connected to work are regulated by our public institutions, a just society should protect people's access to meaningful work.¹

Our investigation proceeds as follows. We first introduce some key concepts (Section 2). We then draw on philosophical and empirical literature to identify five important characteristics of meaningful work (Section 3). With the five aspects of meaningful work identified, we explore how robots in the workplace might threaten or create new opportunities for those five aspects of meaningful work (Section 4). We summarize our general claims about the influence of robots on meaningful work in a table (Section 5), briefly discuss ethical issues that may arise (Section 6), and end with some concluding remarks (Section 7).

2 What Are Robots and how Do They Enter the Workplace?

Robots are embodied machines equipped with sensors and actuators and some (potentially limited) degree of artificial intelligence,² typically able to perform tasks associated with particular types of work (Royakkers and van Est 2015). Robots come in many shapes and differ with respect to their degree of flexibility and the functional autonomy with which they perform a single task or a variety of tasks.³

First, we can distinguish preprogrammed robots, such as the robots employed in the assembly halls of car manufacturers designed to perform well-described tasks in well-defined and controlled environments. Second, there are tele-operated robots that are under continuous control of human operators at a distance. Paradigmatic examples are drones, robotic submarines, and surgery robots. Third, autonomous robots are able to sense their environment and act with purpose, such as delivery robots in hospitals that distribute and register patient's medicines. A further category of robots is "augmenting" robots, which are connected or integrated with the human body. Examples are exoskeletons by means of which (partly) paralyzed persons can walk, or robotic legs or arms. Such robotic skeletons can also be used to enable workers—e.g., soldiers—to use heavy gear.

Each of these types of robots has already entered the workplace. According to a report by the International Federation of Robotics, the worldwide sales volume of

¹ By way of a further example, Schwarz's (1982) argument focuses on the value of individual autonomy, which a liberal society holds in high regard. Boring routine work, which lacks meaningfulness, prevents workers from exercising autonomous agency. In addition, employees working in such jobs are also threatened in their development of capacities needed for being an autonomous citizen. Therefore, a just society that respects its citizens as autonomous agents ought to make sure that meaningful work is available for every worker.

² We here use "artificial intelligence" in the broad sense whereby a machine has some degree of artificial intelligence if it can perform tasks or functions that humans use their intelligence to perform.

³ For the following classification, see: http://www.mind.ilstu.edu/curriculum/medical_robotics/kinds_of_robots.php

robots in the workplace has risen sharply over the past five years (Shaw 2018).⁴ Within this trend towards higher levels of robotization in the workplace, Decker et al. (2017) notice the following shift. Whereas robotization started mainly with industrial robots that substituted humans by performing routine manual tasks (e.g., the above-mentioned robots in the car industry), nowadays more and more robots collaborate with humans, also performing nonroutine and cognitive tasks. Consequently, their potential area of application is broadening, and increasingly workers will have to cooperate with robots.

The reasons why companies and organizations are introducing robots into the workplace are straightforward. They include projected cost savings, increased efficiency, improved outcomes, dealing with insufficient numbers of workers in certain domains, the need to stay innovative, the need to remain an attractive employer, and so on. Given the clear trend towards more robotization, there is every reason to investigate how the collaboration with robots can result in meaningful work.

3 What Is Meaningful Work?

Our primary focus is the impact of robots on work in the sense of the performance of a set of tasks in exchange for remuneration, regulated by a contract and relevant social norms (Cf. Danaher 2017). Thus, we set aside other important kinds of work, such as unpaid care work for the purposes of this discussion.⁵

Research on meaningful work is scattered across several disciplines including philosophy, organizational psychology, economics, and sociology. A variety of definitions of meaningful work exist across these disciplines. Definitions in organizational psychology focus particularly on the subjective experience of some work as contributing to existential significance or purpose in life (Lips-Wiersma and Morris 2009). Meaningfulness is, for example, sometimes defined as the amount of significance work holds, or as work that helps to answer the question “why am I here?” (Pratt and Ashforth 2003). Meaningfulness carries a positive valence (Rosso et al. 2010). On a general level, then, meaningful work can be characterized as work experienced as “particular[ly] significant and [as] holding more positive meaning for individuals” (Rosso et al. 2010, p. 95). or, more broadly, as “work that is personally significant and worthwhile” (Lysova et al. 2019, p. 375).

Much recent philosophical discussion of meaningfulness operates on a very abstract level, primarily discussing meta-ethical questions (e.g., whether we should accept subjective, objective, or hybrid theories of meaning), or very general questions (e.g., whether death, suffering, and imperfection are threats to living a meaningful life) (e.g., Landau 2017; Wolf et al. 2010). However, some political philosophers have recently discussed meaningful work in relation to the above-mentioned question of whether a case can be made for an individual right to meaningful work. In doing so, they typically

⁴ Increased robotization is part of the larger trend towards more digitization, artificial intelligence, and automation, which is variously named as, among others, the “second machine age” (Brynjolfsson and McAfee 2016) and the “Fourth Industrial Revolution” (Schwab 2017).

⁵ We do this to keep an already large topic within a slightly narrower scope, not making any value judgment about what sort of work is more important. For a discussion of the concept of work, see Veltman (2016), pp. 22–26, who characterizes work as “a purposeful, productive, or goal-oriented activity.”

work with rough and ready characterizations of meaningful work, rather than precise definitions. Nevertheless, there is a lot of overlap in the characterizations of meaningful work they offer and the ones offered in the other disciplines mentioned above, such as organizational psychology. Here, we combine ideas about meaningful work from the political philosophy literature and the rapidly growing literature in organizational psychology on the topic.

Specifically, we looked at what the various authors call, for example, dimensions of, pathways to, and sources of meaningful work, and identified those aspects that are most frequently mentioned in both literatures. On this basis, we take it that work is meaningful to the extent that work involves the following:

- 1 Pursuing a purpose
- 2 Social relationships
- 3 Exercising skills and self-development
- 4 Self-esteem and recognition
- 5 Autonomy

These aspects will serve as our main analytical tools in our discussion of how robotization can be an opportunity for or a threat to meaningful work.⁶ Additionally,

⁶ A few remarks to further explain this method are in place. First, we think that we can best capture the impact of robotization on meaningful work if we focus on the aspects or dimensions of meaningful work on which there is broad agreement. Therefore, we have identified aspects put forward by at least two, but often more, articles from organizational psychology and philosophy each. We do not think it to be fruitful to enter the debate (in organizational psychology) on the best overall definition of meaningful work, because these typically elevate one or two aspects of meaningful work above others.

Second, we believe that these five aspects together capture the essence of what makes work meaningful and experienced as such. Even if some further dimension may be relevant as well, the current five already involve various key perspectives on meaningful work, and together they cover a wide ground. Moreover, additional aspects that are mentioned in the literature are often closely connected to one of our five. For example, “self-efficacy” overlaps with “autonomy” and the “exercise of (complex) skills and self-realization.”

We think that for purposes of our paper, we need not settle the meta-ethical debate between objectivist and subjectivist theories of meaningfulness in life and work. An objectivist theory of meaningful work will hold that our five aspects, or some related and much overlapping list of aspects, are what makes work objectively meaningful. A subjectivist theory will hold, based on the convergence in the empirical literature from the field of organizational psychology, that as a matter of fact people will generally experience work as meaningful to the extent that work exhibits the five aspects on our list. Therefore, for our analytical purposes and for purposes of designing the implementation of robots in the workplace and devising social policies regarding robotization, both objectivist and subjectivist approaches to meaningful work should be able to agree on working with our, or some similar, list (we thank one of our anonymous reviewers for asking us to clarify this issue).

That said, it is crucial to note that the extent to which different people would experience the same job as meaningful will differ a lot based on their individual character traits, capabilities, experiences, and preferences. For example, the skills needed to develop so as to do the job well need to be sufficiently challenging *for them*. Also, people will have different purposes which they find worth striving for, and which gives them the important sense of pursuing a purpose. Yet, not anything will do, and is instructive that the idea of “contributing to some greater good” is a recurrent theme in explaining the relation between meaningfulness and purpose in life and work. Given our psychological make-up, some purposes will be so trivial that hardly any worker will be able to find meaning in pursuing it.

Third and finally, there are several connections between the aspects, e.g., the “process side” of pursuing a worthy cause feeds into feelings of self-efficacy and thus autonomy. The “outcome side” connects to self-esteem, since one can see oneself as contributing to some greater good. Thus, the aspects are not completely independent from each other. Yet, they are sufficiently distinct to justify treating them separately.

by outlining how robotization can impact these five aspects of meaningful work in a positive or negative way, organizations can gain insights into how they can shape the introduction of robots in the workplace such that work remains meaningful.

3.1 Pursuing a Purpose

Looking beyond work, purposefulness is typically seen as a key dimension of meaningful lives more generally. Psychologists posit that human beings have a fundamental need for purpose, the fulfillment of which makes people experience life as more meaningful (Baumeister and Vohs 2002). Having purposes or striving for a worthy cause gives direction and intentionality to our daily lives. Having purposes partly means that we link our present actions to desired future states, which enables us to see our lives as meaningful (Baumeister and Vohs 2002; Ryff 2014).

Likewise, pursuing purpose in our work and making a contribution along the way are widely regarded as making work meaningful (Grant 2008; Martela and Pessi 2018; Rosso et al. 2010). According to Pratt and Ashforth (2003), when we perceive our work as meaningful, we typically judge it to be significant and purposeful. In her book-length discussion of meaningful work, Andrea Veltman writes:

Work can be objectively meaningful in virtue of ...providing a personal purpose or serving a genuinely useful purpose for others, and especially producing something of enduring value (Veltman 2016, p. 117).

In the spirit of the way Veltman phrases this dimension of meaningful work, it is illuminating to make the following distinction. On one hand, we have the activity or *process* of actively pursuing a purpose. On the other hand, we have the results or *outcomes*: what is achieved or the goods brought about. Each side, process and outcome, contributes to the meaningfulness of work in a different way. This is the case even if the achievement of the purposes actively strived for is not yet there, or even not in sight at all, as might be the case for designers working on a tough problem, or psychotherapists seeing no progress yet in the mental health of their clients.

However, actually achieving the desired outcomes further adds to the meaningfulness of work, and to our experiencing it as such. We can think of several valuable outcomes, such as more efficient key processes in a firm, healing patients, and educating students. Some authors particularly single out the importance of making a social contribution, or a contribution to some greater good, as something that makes work meaningful (e.g., Gheaus and Herzog 2016; Martela and Pessi 2018). In general discussions of meaning, it is similarly sometimes said that one key aspect of meaningfulness is to be part of “something bigger than you,” where that bigger thing is something of positive value (e.g., Seligman 2010). Just as that is a common association about meaningfulness more generally, it is also a common idea about meaningful work.

3.2 Social Relationships

Like purposiveness, having good social relationships contributes both to a meaningful life as a whole and to meaningful work more specifically. Social relationships provide people with a sense of belonging and relatedness (Deci and Ryan 2000; Hicks and King

2009; Lambert et al. 2013). Given that the workplace generally involves many social relations, it is no surprise that social relations at work are considered to be a key element of meaningful work. Feeling accepted and cared for by colleagues, cooperating in a positive way, and being mentored or otherwise supported all lead workers to find their work more meaningful (Madden and Bailey 2016; Martela and Riekkilä 2018; Ward and King 2017). In addition, working together may confer a shared sense of agency and common purpose, which enhances meaningfulness as well (Lysova et al. 2019). Moreover, a related impact on meaningfulness comes from the experience of a shared identity due to identification with co-workers (Rosso et al. 2010, p. 111).

3.3 Exercising Skills and Self-development

The idea that the development of skills and talents makes our lives better goes back a long time, with this being one key component of Aristotle's influential theory of human flourishing (Aristotle 2009). So it is no surprise that when contemporary philosophers formulate theories of meaningfulness—and of meaningful work in particular—they tend to include the development and exercise of skills as one of the key components of meaningfulness (e.g., Gheaus and Herzog 2016; Roessler 2012; Veltman 2016). This idea also finds support in the psychological literature. Psychologists posit a general human need for competence or efficacy, by which they mean the need to perceive of ourselves as being able to act and to realize certain things (Baumeister and Vohs 2002; Deci and Ryan 2008). Developing, exercising, and acquiring skills, especially more complex ones, enable people to feel competent and self-efficacious (Ryan and Deci 2004, p. 7). This is typically experienced as meaningful. In this way, humans can flourish and realize their potential.

It is not surprising, then, that exercising and acquiring (complex) skills should be widely seen as a key element of meaningful work (Hackman and Oldham 1976; Lysova et al. 2019; Rosso et al. 2010). After all, work is a context in which many people have opportunities for developing and excelling at new skills. Workers often stay in the same occupation for years, enabling them to build knowledge, social skills, technical skills, and so on. Developing one's skills is often experienced as a challenge that gives focus to doing the job. Via the process of acquiring skills, work can be a powerful source of meaningfulness. Relatedly, in organizations that create an innovative environment aimed at personal growth, workers typically experience more meaning in their work (Lysova et al. 2019). Such personal growth or development of oneself enhances the meaningfulness of work (Lepisto and Pratt 2017; Martela and Pessi 2018; Steger et al. 2012).

3.4 Self-esteem and Recognition

Work can be a source of self-esteem and social recognition, both of which stimulate the experience of work as meaningful. Psychologists posit a fundamental human need for self-worth or self-esteem, and the fulfillment of this need confers meaning to one's life (Baumeister and Vohs 2002, pp. 610–611). When workers acquire and develop skills, when they achieve accomplishments, or make a significant contribution to their organization or society, their experienced self-worth increases. They evaluate themselves more positively and

build self-esteem. When work is conducive to self-esteem, work is meaningful (Rosso et al. 2010). Moreover, the recognition of one's skills, accomplishments, and contributions by others, such as co-workers, managers, and society at large, also enhances the meaningfulness of work (Montani et al. 2017). Self-esteem and recognition are widely seen as integral aspects of what can make work meaningful both in the philosophical and psychological literatures on meaningful work (Gheaus and Herzog 2016; Montani et al. 2017; Rosso et al. 2010; Tweedie 2010; Veltman 2016).

Notably, political philosophers like Axel Honneth also place a high value on recognition and self-esteem more generally (Honneth 1996). Similarly, John Rawls views what he calls "self-respect" as being among the so-called "primary goods" that a just society should provide all its citizens with (Rawls 1971, p. 386).⁷ Like the other aspects of meaningful work we identify, then, those of self-esteem and recognition are widely regarded as key components of good lives more broadly.

3.5 Autonomy

The fifth and last constituent of meaningful work we wish to highlight is a set of aspects that we here gather under the umbrella of autonomy. Some theorists—such as some political philosophers—particularly emphasize freedom in the workplace and the ability to participate in work-related decisions as being central to meaningful work (Bowie 1998; Schwartz 1982). Others particularly emphasize opportunities to shape one's work and to make work-related decisions. We view these as being different aspects of what might be called the autonomy that we have at work. In the organizational psychology literature, such shaping of one's work is called job crafting, and refers to (even slightly) modifying one's tasks, one's interactions with others, and one's own perceptions and constructions of one's work (Wrzesniewski and Dutton 2001).

Just like repetitive work that does not require advanced skills can be experienced as less meaningful, so can work where we lack freedom, have no participation in decision-making, or no opportunities to shape our work be experienced as lacking or low in meaningfulness. Accordingly, organizational psychologists emphasize the importance of autonomy for experiencing meaningfulness in the workplace (Lysova et al. 2019; Martela and Riekkki 2018; Rosso et al. 2010; Ward and King 2017). Moreover, just like all the other aspects discussed above are more broadly linked to having a meaningful and flourishing life in general, autonomy is yet another thing that is widely associated with meaning in life in general. Notably, it is among the things that many theories in political philosophy treat, not only as an aspect of the sort of meaningful work there might be a duty to make available to people but also as something that a just state should promote more generally in people's lives.

⁷ What Rawls understands by self-respect ("a person's sense of his own value," *op cit.*, p386) is very close to what we understand by self-esteem.

4 Ways in Which Robots Could Impact the Meaningfulness of Work

4.1 Robots and Pursuing a Purpose

A Threat? If robots take over many tasks that are part of a job, or if robots take over the most challenging tasks, workers might feel that they serve less of a purpose. Consider, for example, a radiologist, whose job includes interpreting medical images. In recent years, there has been an upsurge in the development of systems endowed with artificial intelligence capable of correctly classifying a certain region on a medical image, e.g., as a benign or malignant tumor. Currently, these systems, which employ machine learning techniques, have accuracy rates comparable to, and often higher than, human doctors (Esteva et al. 2017; Senders et al. 2018; Wang et al. 2016). We can imagine that a doctor might feel that he or she contributes less to arriving at the right diagnosis and thereby helping the patient if the doctor starts working with such a diagnosing machine. If machine learning would indeed do a better job in interpreting medical images than a radiologist, who has gone through years of training, this feeling can appear justified. Thus, more generally, if robots reduce workers' contributions to worthy causes, they may lose purpose.

An Opportunity? However, such a diminished sense of purpose in one's work is not inevitable. If human workers understand themselves as teaming up with robots, they may focus on achieving better outcomes together with the robots. This could particularly apply to the medical profession. Researchers argue for focusing on how doctors and robots can best collaborate, instead of determining which of the two outperforms the other (Senders et al. 2018). One study shows that combining a human pathologist's diagnosis with the AI's classification can lead to an 85% reduction in the error rate compared with the pathologist without the machine. Interestingly, some researchers suggest that this might be due to the human pathologist⁸ and the AI making different kinds of errors (Wang et al. 2016).

More generally, sticking to the same example, several authors explain that the profession of radiology consists of far more than interpreting medical images, such as interacting with patients and communicating the results to other doctors. In fact, supported by robotic helpers, radiologists might be freed from routine and time-consuming tasks, leaving them more time for their patients. Therefore, if a radiologist perceives the purpose of his or her job to provide good care for the patient, robot technology helps to pursue that worthy cause, and consequently enhances meaningfulness.

Similar considerations apply to many professions. If robots help or assist with tasks (rather than fully taking over tasks), or if they take over some boring or tedious tasks (and not the most difficult and challenging ones), human workers can still justifiably feel that they have a clear purpose, perhaps partly by being able to focus on more meaningful-seeming tasks. Therefore, we conclude that robots do not necessarily threaten purpose in our work and might very well help us to be even more focused on pursuing purposes in our work.

⁸ Of course, pathology and radiology are clearly different occupations. But our focus here is on interpreting medical images, which is a central dimension of both.

4.2 Robots and Social Relationships

A Threat? It seems safe to assume that robots may significantly change the social dynamics at work, and that they may therefore impact this aspect of work's meaningfulness. First, if robots replace many or most team members, the amount and variety of social interactions decreases, and workers will lose part of the corresponding meaningfulness benefits. If many people start working together with a robot instead of with one or more direct human colleagues, they will have less consultation with each other, be less dependent on each other, and have a diminished sense of shared agency and purposiveness. Feelings of isolation lead to the experience of meaninglessness (Madden and Bailey 2016). Of course, before the introduction of the robots, the workers may already have been working largely alone. Perhaps Nissa Scott, from our example in the introduction, was already stacking bins on her own, before the robot came along. But it is a live possibility that the introduction of robots reduces social interaction among colleagues.

An Opportunity? One way to counter this unwelcome potential effect is to design robots such that they become seen as team members. Consider, as an example, the case of the military robot “Boomer.” Boomer was a military robot designed to find and detonate explosives, which neither looked like a human nor an animal (but rather more like a small tank or a lawnmower). The team of soldiers working with Boomer became very attached to the robot, and experienced Boomer as “having a personality” of his own. When Boomer was destroyed in the battlefield, the soldiers even wanted to give Boomer a funeral and military decorations (Carpenter 2016; Garber 2013). This case helps to illustrate that it is conceivable that robotic co-workers—especially if they have more advanced capabilities for social interaction—may give many human workers a sense of belongingness that fosters experienced meaningfulness (Carpenter 2016).⁹

As an example of another type of opportunity, consider the work of a mathematics teacher. She has to give lots of individual feedback on the same mistakes over and over again, and often has to model the right performance in front of the class. Imagine that she could team up with some really sophisticated AI, which would give pupils tailored feedback and personalized amounts and types of practice regarding specific mathematical skills, until pupils reach mastery. This teacher could then spend considerably more time on her role as a coach by giving individual feedback on the learning-process, by addressing the student's efforts, motivations, and attitudes. She would surely develop better relationships with her pupils. Similar examples could be worked out for other contexts, such as health-care, given that efficiency gains would indeed be spent on more time to socially interact with colleagues and patients or clients.

⁹ At this moment, however, most robots are still limited with respect to their social capabilities. In addition, there is some question whether robots can in principle live up to the task of replacing human workers as team member. For example, in an article from a decade ago, Groom and Nass (2007) argue that because robots lack sufficiently human-like mental models and a sense of self, they are not able to participate the typical interaction-processes needed for building trust with human co-workers. We leave it as an open question as to whether robots can be developed towards full-fledged colleagues that confer to human workers the sense of relatedness and belongingness that results in the experience of work as meaningful comparable with that of fellow human colleagues. In (Nyholm & Smids, [under review](#)) we investigate that issue in much further detail.

4.3 Robots and Exercising Skills and Self-development

A Threat? Obviously, if robots take over one or more complex tasks from human workers, several human skills may become obsolete. The development and exercise of these skills then will no longer be a source of meaningfulness for human workers, and their job will be less conducive to self-realization. For example, if machine learning techniques become systematically better than human radiologists on nearly all dimensions of interpreting medical images, the need to extensively train human radiologists might seem to disappear. Or if “autoland” systems in airplanes are very safe and generally perform very well (Mindell 2015), pilots may find it hard to force themselves to reach and maintain levels of landing skills comparable with earlier times in aviation. The dangers of deskilling due to reliance on automation technology are real and established by research, and apply to robotization as well. Together with such a diminished need to exercise one’s skills, one’s work-related growth and self-development more generally will probably suffer as a consequence.

An Opportunity? However, robots might equally well have the opposite impact by enhancing the need for workers to maintain their skills, and, moreover, by requiring them to acquire new and additional complex skills. To return to our example from above, in order to be able to oversee the performance of machine learning techniques, the radiologists must still master the relevant interpretative skills herself, just as Nissa Scott needed to learn new skills in order to work together with the warehouse robots in her job. As long as the radiologists on occasion are able to spot an error of the robot technology, this might be highly satisfying and sufficiently motivating to engage in the long training program. Furthermore, we might interpret the ability to spot robotic performance errors as a new and probably highly complex skill. Finally, since the conclusions taken from medical imaging need to be explained to the patients, it seems that radiologists cannot do without their own understanding of these images.

With respect to aviation, David Mindell has done extensive ethnographic study of the occupation of pilots. Surprisingly, the high-performance level of autoland systems for some pilots functions as a model and target, motivating them to raise their own skill level (Mindell 2015, p. 88). Also, pilots need always be able to take over in case of automation malfunction or other problems. In addition, an autoland system “can be complex to operate” (p. 87). So here again we see that the human has to maintain all the traditional skills and to acquire new complex skills for overseeing and handling robotic technology. To conclude, the introduction of robots in the workplace impacts the human development of skills in multiple ways and the overall impact needs to be assessed on a case-to case basis.

4.4 Robots and Self-esteem and Recognition

A Threat? It appears to be a real possibility that if robots do the most difficult tasks and humans merely have to operate or supervise robots, human workers may feel less self-worth and have lower self-esteem. For, as we saw in 3.4 above, it is the exercise of complex skills and achieving accomplishments that is bound up with acquiring self-esteem. Moreover, workers may lose part of the recognition they previously received.

In addition, it is conceivable that it may become easier to qualify for a job when collaborating with a robot than before. For example, in the long run, surgery robots might make the profession of surgeons more accessible, for instance to persons lacking certain physical abilities necessary for managing surgery instruments. This could reduce the social recognition surgeons currently receive, as well as the self-esteem of several of them. On a related note, robots in the workplace may level out the differences between “good” and “top” performers, which may affect the self-esteem and recognition of both.

An Opportunity? However, for several occupations, it may rather be the case that humans teaming up with robots will develop higher levels of self-esteem and gain even more recognition. Consider again the mathematics teacher who teams up with AI teaching software. It will be evident to parents that the teacher still has all her previous mathematical knowledge and skills, but now in addition knows how to successfully employ educational AI, and significantly develops her coaching skills. Suppose, in addition, that in her coaching role she manages to enhance pupil motivation and skills for self-reflection, resulting in lesser parental struggles and better results. Most likely, the social recognition of this teacher will grow, as well as her self-esteem. Taking into account that collaborating with robots often requires more skills and professional development, workers’ self-esteem and social recognition will often be enhanced.

4.5 Robots and Autonomy

A Threat? Some robotic applications in the workplace may require working according to a very strict protocol that leaves little room for human creativity, judgment, and decision-making. For the same reasons, workers’ opportunities to engage in job crafting may be severely restricted. Their tasks and work environment may be so tightly structured by the robots that there is little room for restructuring in ways that make the job more meaningful. If robots had that kind of impact, worker autonomy would be undermined, and consequently the jobs’ meaningfulness as well.

On a related note, the way humans collaborate with robots will probably typically be carefully monitored. Human–robot collaborations may generate a lot of data (Cascio and Montealegre 2016), partly to be able to determine responsibility in case things go wrong and to be able to learn from such accidents. Monitoring and data collection give rise to various ethical surveillance and privacy issues which threaten workers’ autonomy (Lanzing 2016), and hence meaningfulness. With regard to this ethical worry, surveillance and data storage regimes need to be designed in close cooperation with human workers. If so and workers give informed consent, their autonomy may be respected and safeguarded, and the corresponding robot threat to meaningfulness avoided or mitigated.

Another threat to autonomy has to do with the worker’s understanding of the job. Robots incorporate artificial intelligence, which often involves machine learning and artificial neural networks. For most people, these AI techniques are hard to understand beyond the surface level and therefore difficult to control and explain to others when needed. This phenomenon is commonly referred to as the opacity of artificially

intelligent systems (Burrell 2016). The opacity of robots' AI may lead to feelings of alienation and diminished human autonomy. So, here we have another way in which robots could negatively impact work's meaningfulness. Moreover, this is a deep and fundamental problem, not easily solved. Nevertheless, research is done to develop programs that "explain" AI decision-making (Mittelstadt et al. 2016). Hopefully, such programs become available in the future, in order to prevent alienation and diminished meaningfulness at work.

An Opportunity? The workplace may be designed in ways that allow humans and robots to team up while leaving room for autonomous human action. For example, Mindell explains that pilots still have to decide when to use "autoland" and other automation technology in the cockpit (2015, Ch. 3). And Nissa Scott, the Amazon warehouse employee from our introduction, certainly uses her capacities for understanding, judgment, and decision-making more for overseeing robots than when she stacked plastic bins. Her responsibility and autonomy have increased upon robotization of her workplace.

Moreover, as several of our examples show, robots can help workers to better reach realize their purposes in work, and to bring about more value. This enhances the meaningfulness of their work via both the dimensions of purposiveness and the self-esteem and recognition. However, realizing one's aims in life also contributes to being an autonomous person (Oshana 2006). This is therefore another route via which robotization can actually enhance meaningful work.

Our discussion of autonomy reveals a recurring phenomenon: robotization of the workplace can have fully opposite effects on work's meaningfulness, very much dependent on the specific ways in which it is done. Our summarizing table in the next section clearly shows this. Nevertheless, our investigation is, first of all, meant as a general analysis of the possible impact(s) of robotization on each of the aspects of meaningful work. We do not mean to suggest that it will always be possible to enhance meaningfulness on all dimensions. Sometimes, it might be the case that it is precisely the most meaningful tasks that are most eligible for robotization, due to what is technologically feasible and what has the best return on investments. In such cases, employers committed to offering their employees meaningful work should think twice about robotizing those most meaningful tasks of the work in question. In all cases, the ways in which robots are implemented into the workplace should be carefully considered and monitored with an eye on what impact(s) this might have on the meaningfulness of the work. Our analysis in this paper can serve as a tool for this.

5 Summary of Robot's Impact on Meaningful Work

The possible effects of the introduction of robots into the workplace identified in the previous section can be summarized as follows:

Aspect of meaningful work	Robotization as a threat	Robotization as an opportunity
1 Pursuing a purpose		If robots take over the most tedious or boring task, or if teaming up with robots

Aspect of meaningful work	Robotization as a threat	Robotization as an opportunity
	If robots take over many or the most challenging tasks of a job, workers may experience less purposiveness.	helps to better pursue a worthy cause, workers might have an enhanced sense of purposiveness.
2 Social relationships	If human co-workers are replaced by robots, social interaction is reduced, and its nature will change	If future robots are designed as colleagues, capable of high-level social interaction, the need for relatedness may still be fulfilled. If robots take over repetitious tasks, more time is left for interpersonal contact.
3 Exercising skills and self-development	Tasks taken over by robots make corresponding human skills obsolete	Humans often need to maintain the relevant skills <i>and</i> need new complex skills to operate robot technology.
4 Self-esteem and recognition	If robots take over the most difficult tasks, social recognition and self-esteem may be diminished.	Teaming up with robots may lead to expanding skills and better outcomes, leading to greater social recognition and higher self-esteem.
5 Autonomy	Robot control deprives human workers from exercising judgment and autonomous agency. Little opportunity for job crafting. Ethical worries related to surveillance and AI opacity.	Human workers control robots and enhance their capacities for autonomous agency. More room for job crafting.

So far, we have focused on each of the five aspects separately. A moment's reflection, however, will show that they interact in several ways, sometimes reinforcing and sometimes mitigating each other's impacts on the meaningfulness of work. For example, "pursuing a purpose" can be reinforced by sharing this sense with a team of co-workers, and thus interacts with the aspect of "social relationships." It is probably less easy to share such a sense of purpose with a robot. Or, growing complex skills can be an explicit goal in one's career. In that case, the "exercise of skills" also contributes to meaningfulness via the purposiveness aspect. And, acquiring complex skills fosters perceived self-efficacy and competence, which can help one to pursue and achieve one's goals in life. In this way, still more interactions could be pointed out.

6 Ethical Issues

Recall now that some writers argue that society has an obligation to provide its members with opportunities for meaningful work (see Section 1). Suppose, for the sake of the argument, that you agree with that judgment. You can then ask what argument could be developed based on that supposed duty to provide people with opportunities for meaningful work and the various claims about robots and meaningful work that we have discussed above.

The most straightforward argument would go like this: Step one: society has an obligation to provide its members with opportunities for meaningful work. Step two: there are some types of robots, which play certain types of roles within specific

workplace settings, that could help to enhance the meaningfulness of work, whereas there are other ways of introducing robots into the workplace that would constitute a threat to meaningful work. Conclusion: society has an obligation to promote workplace robots of the former, meaning-enhancing sort, as well as a corresponding obligation to try to inhibit the introduction of workplace robots of the latter, meaning-threatening kind. Alternatively put, it might be argued that we should seek ways of introducing robots into the workplace that is guided by what is in the third column of our table above for each of the five aspects of meaningful work that we have discussed, and that avoids as much as possible ways of introducing robots into the workplace that correspond to what is in the middle column of our table above.¹⁰

Of course, this is a general argument schema, rather than a substantive and fully spelt-out argument. In order to generate more specific arguments using this schema, we would need to consider specific cases that feature particular robots. We would need to consider their impact on the meaningfulness of work—for example, by using the types of arguments we have discussed in Section 4. That would then serve as the basis of substantive meaning-based arguments in favor of, or against, introducing the particular kinds of robots into the given workplaces. This is like adding a theory of substantive value to a consequentialist ethical theory that says that we ought to promote whatever is valuable and counteract whatever has negative value (Sinnott-Armstrong 2015 section 3). Such a general idea of what ethics is about only leads to substantive conclusions about particular situations if we specify what values we think there are and we describe how those values relate to particular decision-making scenarios.

It is worth noting, however, that some of the five aspects discussed above are more controversial than others when it comes to making work meaningful in heavily robotized workplace. For example, compare the first and second aspects of meaningful work identified above: the aspect having to do with pursuing a purpose, on the one hand, and the aspect having to do with having good collegial relations, on the other hand. Letting robots take over more tedious and repetitive tasks so as to leave the more interesting tasks to human works can seem like a strategy that it is hard to find much fault with. In contrast, the strategy of designing robots so as to make them interact with people in ways that the human workers experience the robots as good colleagues will be viewed as ethically problematic by some commentators.

To see this, consider Joanna Bryson's main argument in her oft-cited 2010 article that is summed up with the provocative phrase that "robots should be slaves" (Bryson 2010). This phrase is shorthand for the view that since robots will be owned (bought and sold) by people and fully controlled by people, we ought not to design robots in ways that elicit anthropomorphizing responses in people. Rather, we ought to view robots as tools and pieces of property, and therefore their design should make this clear. This might be used as an argument against trying to create robots that will replicate aspects of what it is usually associated with being a good colleague. It might be argued that this aspect of meaningful work—i.e., the aspect having to do with collegial workplace interactions—ought not to be realized by robots in relation to human colleagues. Furthermore, it might be argued that trying to create robots that could help to recreate this aspect of meaningful work would have to involve deceptive tactics: for

¹⁰ Again, as explained at the end of Section 4.5, we do not claim that it will always be possible and feasible to achieve maximally meaningful work with regard to each of the five aspects.

example, designing the robots so as to make them seem as if they care about people and designing them so as to elicit various kinds of social responses in the human workers.

In response to such a Bryson-inspired view, others—for example, David Gunkel or John Danaher—will respond that it is time to start reconsidering the ways in which we view robots and our interaction with them. Gunkel (2018), for example, argues against the so-called instrumental theory of robots, claiming that some robots both are and should be viewed as more than mere tools. Along with Coeckelbergh (2010) who also defends a similar point of view, Gunkel argues that we should take a “relational turn” in our thinking about robots. We should start viewing robots in light of our relations or interactions with them, rather than only in terms of what robots can do for us. Danaher (2018), similarly, argues that if robots replicate certain important aspects of human behavior, this gives us reason to treat these robots less like mere machines and more like we treat humans who perform those same behaviors. Danaher dubs this “ethical behaviorism.” In a workplace setting, such ethical behaviorism might mean that if robots replicate some aspects of the types of behavior that we associate with good human colleagues, we are justified in interacting with these robots in a way that corresponds to how we interact with valued human colleagues (Danaher 2019). The so-called relational turn view might be seen as supporting similar conclusions.

Here, we do not wish to take a stance on this issue of whether it is morally problematic to try to create apparently collegial relations between humans and robots. Rather, our main point is instead that the five different aspects of meaningful work might differ in respect of how defensible it is from an ethical point of view to try to promote these different aspects of meaningful work in a robotized workplace. And we want to note that the second aspect on the list can appear especially likely to divide opinions.

Of the other ethical concerns that can arise from the aim of creating a robotized workplace affording opportunities for meaningful work, another one we wish to highlight here is that of negotiating the trade-off between creating efficient human–robot interaction and respecting the integrity and privacy of the human workers. Here is a brief explanation of what we have in mind.

The ability of robots to function well in any environment depends on the properties of the environment and the information available to the robots. This can mean that an environment ideally suited for a robot (e.g., predictable, without any ornaments) could be rather different than what is ideally suited for a human being (e.g., a more personalized environment, with some ornaments). And it can also mean that if the robot had access to a large amount of data regarding its human co-workers, the robot might be better able to perform whatever tasks it needs to perform. Yet, the humans in a workplace may not wish to work in the sort of environment that has been optimized for robots—nor may they wish to share all the data that might be useful for the robots to have access to. This all means that what is a robot-friendly workplace can sometimes be different from what is a human-friendly workplace—and vice versa (Royakkers and van Est 2015).

Still, at least in principle, we can imagine that some robot-friendly workplaces would live up to many of the aspects of a meaningful work situation, as described above. The human workers might perform important functions, they might be part of a good team, they might exercise skills, get recognition and achieve self-respect, while also exercising some autonomy—but they might be working in an environment

designed more for the sake of the robots than for the humans. And a lot of their personal data might be monitored for the sake of the robots. These are ethically sensitive issues.

Making sure that the work of the humans in the workplace is sufficiently meaningful by the criteria discussed above may go some way to addressing these trade-offs—very much depending on how we understand the idea of workplace autonomy, as well as on how we understand the ideas of recognition from others and self-respect. But we should be careful to avoid thinking that ensuring that work in a human–robot workplace is meaningful by the criteria discussed above is sufficient for guaranteeing that there are no ethical issues that can be raised about a workplace living up to those criteria.

7 Concluding Remarks

This paper provides a general framework for how one can discuss the impact of robotization on meaningful work. In order for this to be investigated more thoroughly, we need to look at the particulars of different types of work and think about what robots in different kinds of workplaces might do with respect to the five aspects of meaningful work discussed above (as well as any additional aspects of work that bear on its meaningfulness). The aim here has not been to give the final word, but to help moving the debate on work and robotization beyond the question of the future availability of jobs. Scholars from various disciplines need to investigate how we can safeguard the meaningfulness of work in an era of robotization that will affect all workplaces.

Specifically, we recommend empirical case studies of workplaces where robots are about to be introduced, and of workplaces that already have become robotized, both workplaces being in the same domain. This will help researchers and policy makers to gain more detailed insights into the impact of robotization on the meaningfulness of work.¹¹ In addition, we propose more economically and empirically oriented research that aims to assess what the likely overall effect of robotization will be on the availability of meaningful work, in contrast to just the number of jobs as such. Finally, we recommend more philosophical debate about the question as to what moral obligations the state and business owners have to make sure that robotization does not lead to a loss but rather an increase of meaningful work.¹²

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¹¹ Currently, we are involved in conducting this type of research.

¹² We thank the journal's anonymous reviewers and our colleagues Pascale Le Blanc and Sonja Rispen for extensive and valuable comments. Thanks are also due to an audience at the 5th annual OZSW conference in 2017, where Sven Nyholm presented a precursor to this paper.

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