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## Hyper-Taylorism and third-order technologies: making sense of the transformation of work and management in a post-digital era

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### 1 Introduction

Since the mid-Seventies, automation, and latterly digital technology, have become a focus for investment and innovative effort (Woodcock & Graham, 2019) - forming the basis for a new industrial revolution (Brynjolfsson & McAfee, 2014; Schwab, 2017). While such technologies can serve multiple social and industrial ends, such as for example creating a 'sharing economy' (Sundararajan, 2016), the primary focus for development and investment has been, as with previous industrial revolutions, increased productivity and efficiency. In other words, the current technical development is closely entwined with dominant ideas about how work should be performed and for who's benefit. The most recent iteration of digital technologies, so called 'third-order technologies', technologies that communicate directly with each other without human involvement (Floridi, 2013), are designed specifically to perform tasks previously performed by human workers. The effects of this technology are being felt in service delivery, in production and in management.

In this chapter we propose that the search for productivity and efficiency through the implementation and use of third-order digital technologies is leading to a shift in how both work and management are understood. This shift, we argue, draws on and reinforces a Taylorist logic in the design of work, where the norms of rationality and division of labour are key. Furthermore, this shift has consequences in that it allows for a different construction of work.

Building on a sociomaterial framework that foregrounds both the social and material dimensions of work, we treat ideas – such as Taylorism – and materials – such as third-order technologies and other technologies – as constitutively entangled (Orlikowski, 2007). Through such a lens, we suggest that classical Taylorist ideas about how work ought to be organized and managed transform as new technologies have emerged.

As we argue and illustrate, two types of situations have emerged today that reflect how third-order digital technologies re-enforce a Taylorist logic: when technologies are designed to take the position of workers and when they are designed to take the position of managers. Drawing on empirical examples of these situations, we then discuss how hyper-Taylorism can be understood as altering how work and management is understood – and the consequences of such change in understanding.

## 2 The post-digital era, third-order technologies and algorithms

The preceding decades have witnessed the wide-spread diffusion of digitizing techniques to a wide variety of social and institutional contexts to the extent that digital technologies are now largely taken for granted (Tilson, Lyytinen, & Sørensen, 2010). Society, work, management, and other forms of organizing “always entails the digital”, as Wanda Orlikowski and Susan Scott put it (Orlikowski & Scott, 2016, p. 88). Western societies, in particular, are moving into what is termed a post-digital era, in which digital technologies have become ubiquitous, intertwined with personal as well as organizational life, and are perceived to large extent as normal (Cramer, 2015; Pepperell & Punt, 2000; Reeves, 2019).

The technologies themselves have become literally less visible. What Floridi (2013) calls “third-order technologies” work within existing processes collecting data autonomously – without human involvement – and then act upon this information. Unlike first-order technologies (humans interact with the natural world directly, such as the plough, the ax and a saddle), or second-order technologies (humans interact with technologies using other technologies (the key that interacts with the lock); third order-technologies push humans away from action after having been designed (Floridi, 2013). To achieve this, these technologies critically depend on algorithms. Algorithms constitute the abstract representation of computational procedures and the very logic by which these technologies operate (Dourish, 2016); today, in more autonomous fashion than in the past.

Third-order technologies have attracted huge interest and financial investments, making the developers of these technologies driving forces in the post-digital era (Woodcock & Graham, 2019). It has however been pointed out that the use of new technologies is not only a question of technology, but also, if not most importantly, an issue of how work is organized, managed and performed (Brynjolfsson & McAfee, 2014; Schwab, 2017). As will be discussed below, even if third-order technologies push the human out of its own doings, third-order technologies still exist in relation to work. Algorithms stretch beyond the technology alone.

## 3 Classic Taylorism

Taylorism has been a dominant force in the organization of work. Introduced in Frederick Winslow Taylor’s seminal book “The Principles of Scientific Management” (1911), Taylorism builds on ideals of scientific and rules-based rationality underpinned by the imperative of efficiency. It involves the optimization of production through the development of sets of rules for the execution of work. The rules themselves are derived through direct observation and scientific analysis of production processes, the subsequent design and planning of work, and the top-down allocation of tasks to workers, depending on individual skill sets (Rylander Eklund & Simpson, 2020).

The ultimate aim of scientific management was to transfer the craft knowledge and know-how of workers to managers in the form of clear formal instructions for the performance of work tasks (Zuboff, 1988). Managers retain responsibility for planning and controlling work. Workers retain only the responsibility for the robotic execution of tasks (Zuboff, 1988). Taylorism gives rise, quite deliberately, to the de-skilling of workers, since individual workers need only to master a limited set of skills; the ones needed for the particular, delimited production or assembly (Braverman, 1974; Lysgaard, 1961).

While Taylor thought that scientific objectivity and fairness would inspire workers to excel and to be better integrated with management and the organization, the opposite occurred. The work-design approach, which also included efficiency targets relentlessly pursued by managers, merely highlighted the very different interests and positions of workers compared to those of managers (Lysgaard, 1961; Zuboff, 1988). A hallmark of Taylorism is its focus on time and motion studies

with careful observation of the performance of work being central to its scientific knowledge gathering (Taylor, 1911). Having determined how to perform a task, where, at what time, and within which time frame, Taylorism also results in tying the worker to a specific place, often close to a particular machine.

While often presented as a management model, or a management philosophy, Taylorism may also be understood as a way of producing knowledge about work. As described above, Taylorism builds on the idea that work can be conceived of as a series of interrelated but discrete activities that could be subject to scientific scrutiny. From the beginning, Taylorism thus carried with it an assumption that all aspects of work could be fully explicated and grasped by managers if measured carefully enough. Consequently, putting the ideas of Taylorism to use implied a way of configuring work, workers, and managers.

From a sociomaterial perspective, a perspective that seeks to shed light on the effects of both social and material dimensions of work and organizing (Gherardi, 2016a, 2016b; Orlikowski & Scott, 2008), it is clear that Taylorism was more than a mere idea. For it to come together, production technologies, scientific techniques of measurement and data collection, an emerging management cadre, new investment possibilities in and around mechanization and, later, the emergence of markets large enough for mass-produced goods, were important. Put differently, Taylor's ideas, the technologies involved, and the wider conditions were part of a sociomaterial assemblage that together could produce different knowledge about work and thus organize it differently.

We now turn our attention to the post-digital era and examine the experiences of both workers and managers within this shifting assemblage of Taylorism. Based on the illustrations provided, we then discuss how third-order technologies provide a new materiality which invigorates Taylor's ideas; leading to what we call hyper-Taylorism.

#### 4. When digital technologies are designed to take the position of the worker

Robots are already commonplace in manufacturing. On the shop-floor of one firm we studied, a large international steel company producing high-quality steel equipment, robots have taken over much of the work previously performed by humans. The shop-floor is now laid out with cells, each constituting a mini-factory consisting of a robot and 2 -3 machines that perform various operations on the steel; for example, lathing, routing, welding and threading. The workers, today called 'operators', feed the cell with data and materials, monitor the work as it progresses and monitor the health of the machines themselves. They do so not by watching the machine, but by observing computer displays placed outside each cell and even in the coffee room. In addition, workers maintain the machines by cleaning them and by replacing failing parts. The machines themselves are quite capable of drawing attention to worn parts before they become problematic. The workers, freed physically from the machines they are responsible for, now also engage in meetings and discussions about plant related issues – such efficiency and safety.

This type of third-order automation technology is however not limited to blue-collar work. An example of this may be found in a Swedish municipality that we've studied where white-collar administrative workers, previously engaged in second-order digitized work, such as moving data between systems, structuring data or processing data in order to make decisions, were replaced with Robot Process Automation (RPAs). The robot now does the work of linking together and analyzing different sources of data. Consequently, front-line officers of public authorities, the street level bureaucrats that traditionally have been the operational core of government (Bovens & Zouridis, 2002), are substituted by robotic administrative workers with a narrow focus on the discrete work processes that they have been programmed for (Lindgren, Madsen, Hofmann, & Melin, 2019). Mirroring our manufacturing study, we noted the emergence of new roles for public administrators. When RPA was implemented in the economy unit of the municipality, the

administrator previously doing the work now performed by digital robot was tasked to become the ‘robot care-taker’ of the unit. The human administrator’s role also re-focused on cases that the digital robot deemed too difficult (i.e. the types of unique cases that it wasn’t cost effective to adapt the algorithm to handle) and any errors that occurred.

The limits of robot third-order workers is that while designed to take the position of the human worker, they are only able to perform routine tasks according to clear rules (Floridi, 2013); that is, tasks that are digitally legible (Woodcock & Graham, 2019). Algorithms only deal effectively with predictable worlds (worlds that are legible to them); factory shop floors are fine (as long as there are no breakdowns) as are clients with standard and predictable needs. Work that is digitally legible allows formal, rules-based knowledge to be created and can be expropriated from workers. Indeed, much like in the early time studies in 1920’s manufacturing, we have observed how professional workers such as social workers are filmed, timed and interrogated in order to generate algorithmic representations of work. The more hard-won-tacit skills of keeping a factory process running even when some machines are not working entirely properly or dealing with a claimant with an unusual combination of needs, or who simply struggles to communicate what those needs are, remain the province of the human.

We thus see that rather than being simply substituted by third-order technologies, workers are repositioned as care-takers – making sure that the technologies work properly. Human workers are, moreover, no longer tightly controlled by managers when it comes to task, time and space, but they need to adjust to the machines. In fact, some workers prefer to deal with predictable manager-algorithms than less reliable human managers (Woodcock & Graham, 2019).

The removal of humans from decision making facilitates a more efficient delivery of work. However, they do also, in some cases, change the nature of the work’s output. While more efficient and expedient, services in particular also come with a strikingly different ‘understanding’ of the work itself. Services delivered without human intervention tend, for example, to under-emphasize the holistic and interpersonal logic of care work (Laurent, 2008). These elements cannot be translated into digital inputs that an automated case system may incorporate into its algorithmic procedure.

## 5 When digital technologies are designed to take the role of the manager

Where work is digitally legible (Woodcock & Graham, 2019) third-order technologies may calculate the optimal sequence of tasks for a worker; when they should be executed, how long they should take and even where each worker needs to be at a particular point in time. In other words, third-order technologies may also be designed to take the position of the manager.

In an environmental services department in a UK municipality we studied, a digital portal allowing citizens to report issues related to the environment, for example abandoned bikes or graffiti, was put in place. The portal linked directly to software that then allocated work tasks to employees via their smart phones. Completion of the task was then reported back directly to the system. Managers were effectively removed from the process.

There are now many platforms available to control the work in minutiae, replacing not only the jobs of other workers but also of managers. Routing systems that direct drivers along the most efficient routes, systems to control the work of repair technicians, platforms for outsourcing work to freelancers, care assistants, taxi-drivers and cleaners - remove the need even for employment contracts (Woodcock & Graham, 2019). Some of this software is highly sophisticated. Software already exists and is available to, for example the UK police forces as we saw in a study we performed. This software will assess a crime incident report and then automatically dispatch suitably qualified police officers to the incident. Once at the incident further software directs the officer to collect information deemed pertinent to the incident. Thus,

while workers may be left with reduced decision-making autonomy, managers are increasingly removed from the loop all together.

The efficacy of the technology with regards routine decision making suggests that many middle managers are likely to become redundant, as some have argued (Frey & Osborne, 2017). However, it could also mean that the responsibilities of managers also shift; from having been responsible for planning and controlling work, to taking on softer Human Resources type roles. The right mix of staff skills needed for sustaining the organization, efficiency and competitive advantage will need to be addressed strategically and creatively.

Following the introduction of scientific management and automation to factories before the digital age, some factory owners found that workers welcomed machines, at least those that unburdened them from physically hard work. However, other workers found the work intensification that also followed, intolerable (Zuboff, 1988). The same could arguably be true today. Staff retention, motivation and reward will pose new challenges for management skills under hyper-Taylorism. Even in seemingly humanistic operations such as social services, managers must build up a new, more systematic understanding of the work performed in their organization as the right balance of technology and human oversight will be critical to service quality. They will also need to build new relations and alliances with software developers and ICT professionals. Workers that previously might have been seen as support staff and now are the ones with the knowledge to actually change how work is performed by re-programming third-order technologies. Police forces in the UK adopting sophisticated software for storing and interrogating crime data, for example, found that support staff needed to become familiar with inquiry languages to overcome the limitations of how the data was structured.

## 6 Hyper-Taylorism and its consequences

The promise of efficiency has ensured the wide-spread diffusion of third-order technologies in our post-digital societies. At the same time, it has opened the door to a new form of Taylorism; what we would like to call hyper-Taylorism. The analytical capacity unleashed by embedded sensors, seemingly limitless data storage and computational capacity is on another level than the time study-engineer equipped with clip boards, stop-watches and mechanical calculators (Brynjolfsson & McAfee, 2014).

As we propose, hyper-Taylorism reflects a technology-enhanced Taylorism in the post-digital era. As Taylorism reconfigured how work, workers, and managers were to be understood for the sake of efficiency, so do we see change in how contemporary work is understood. Hyper-Taylorism is a concept that moves the focus to another level compared with concepts as, for instance, digital Taylorism. Digital Taylorism is a term that has been used to express the codification and digitization of knowledge in knowledge work by using second-order digital technologies, as for instance when services became industrialized and standardized (Brown, Ashton, & Lauder, 2010). In a post-digital era, however, third-order technologies have become an integral part of how work is to be performed and managed. These new technologies provide a specific way of enhancing the analytical understanding of work that supersedes Taylorism – both pre-digitalization and its digital form. More specifically, the assumptions that knowledge about work is something that can be made explicit, quantified, expropriated and used to plan work can now be materialized in the form of third-order technology algorithms.

Algorithms provide a materiality for both representing work and for performing it based on such a representation. As we have illustrated, when algorithms in third-order technologies perform work, they can be both replace workers and managers. In both cases, the tenets of Taylorism are altered but also enhanced and expanded. As workers, these technologies perform what has been planned in the specific way it was planned, as managers these technologies are able to find an analytical optimization of what needs to be done, how, where and when.

In contrast to Taylorism, managers are no longer positioned in a privileged position as those who are to scientifically code, store and transfer knowledge about work. Instead, new technologies are put to use that do these processes. Although this may not have been reflected upon at the time Taylor wrote his works, in the post-digital era entities that are actually more efficient at computing exist. The scientific knowledge of work that was possessed by human manager can now be possessed by digital technologies, making the presence of humans knowing about work redundant.

Having characterized what we see taking place in a post-digital era, we now turn our attention to which consequences hyper-Taylorism has. To start with, workers' tasks, time and space are either very tightly surveilled by algorithms, or they are dependent on algorithms. This is particularly the case when workers need to take care of the technology. Workers' space of action is, in other words, heavily constrained by the technology. A second consequence is that once "best ways" are materialized, part of organizing becomes "rigid", as work or management is performed in one way, sequentially. This means that other parts of the organization need to adjust by doing another kind of work: caring and repairing (either for workers or for machines).

A third consequence is that humans lose the possibility to negotiate work. As Floridi (2013) also discusses, after the third order technology has been designed and developed, humans become care-takers of technology; monitoring the loop and enabling its' smooth performance. While this may be seen as organizational members having to use higher-level skills, and thus some may consider it an improvement, the use of such skills is demanded by technology needs without any possibility to discuss and negotiate the distribution of work.

Finally, a fourth and crucial consequence concerns the meaningfulness of work. Taylorism has always primarily valued efficiency in work; an aspect that has been to the detriment of workers and their experience of work (Lysgaard, 1961; Zuboff, 1988). There are few indications that things are different in hyper-Taylorisation. After all, the algorithms of such technology do not necessarily reflect or support what humans regard as meaningful. A fitting question is if managers are also to perceive their well-being at risk as their traditional role is replaced.

## 7 Takeaways

In this chapter, we have suggested that new, so called third order, technologies transform Taylorism and outlined the potential consequences there-of. There are two main takeaways from this. First, when technologies are implemented, the work that humans still keep doing also changes; the implementation of technology does not only lead to job loss. Second, this also changes the way 'work' is understood. This change takes place in a subtle way, which is why it may be difficult to apprehend, but something that needs to be taken into account when planning and proceeding with the implementation of yet new technologies. This could for example involve the rewriting of job descriptions, and to continuously consider the evolving nature of work practices. To summarize: there is more to post-digital work than what can be measured in or translated into algorithmic form.

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