



SPECIAL ISSUE PAPER

New social relations of digital technology and the future of work: Beyond technological determinism

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Abstract

This introduction sets out the context for the Special Issue and offers an in-depth reflection on key themes addressed by our contributors. The Special Issue aims to place the social relations of production at the centre of debates about technology and the future of work, and create space for greater critical reflection on what it means to go ‘beyond technological determinism’. We identify ways in which aspects of technological determinism continue to influence debates on technology, the labour process and industrial relations, despite efforts to reject it. We argue that this influence is manifested in some persistent problems within the literature including overly rigid periodisations (such as ‘platform capitalism’), a narrow conceptual repertoire (which reifies notions like ‘algorithmic control’) and a constricted empirical focus. We elucidate the value of a social shaping of technology (SST) approach to overcome these challenges and provide a brief overview of the articles contained within the issue.

KEYWORDS

industrial relations, social shaping of technology, technological determinism, technology, work and employment

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INTRODUCTION

The spectre of technological determinism is haunting, once more, work and employment research. Since at least the 1970s, technological determinism has been recognised as a reductionist approach that overstates the influence of technology on society and understates social influences on the development of technology (MacKenzie & Wajcman, 1999). Technological determinism can lead to significant analytical problems in work and employment research, some of which we discuss in what follows. Yet, despite widespread criticism, technological determinism periodically re-emerges (Mokyr et al., 2015). Commentary on digital technology has provided/witnessed the latest resurgence; most notably, but not limited to, automation and robots (Howcroft & Taylor, 2022; Spencer et al., 2021). This Issue, and this introductory article, therefore, aims to look beyond the limits of technological determinism, to identify concepts and approaches which can better understand the current epoch of digital technology and the social relations within which it emerges. It challenges determinist narratives about technological change and work, and aims to catalyse a discussion which sees technology in dynamic interaction with a wide range of other variables and social forces.

While mainstream economics continues to treat technological change deterministically as an exogenous variable (see, e.g., Acemoglu & Restrepo, 2019; Autor et al., 2003; Graetz & Michaels, 2018), versions of what MacKenzie and Wajcman (1999) term ‘hard technological determinism’ are unusual in studies of technology and work in the labour process and industrial relations traditions. More often, determinism manifests residually. It may appear in problematic assumptions or unexamined ways of thinking about technology, including tendencies to overstate the novelty of technological systems even when wider employment practices remain unchanged. It may also prompt a narrow empirical focus on technologies that capture the popular imagination (currently, anything algorithmic) at the expense of the more mundane but equally important (see discussion of Global Positioning Systems [GPS] below). Moreover, it can induce a lack of attention to the ways technologies change after they are introduced (a topic more developed in the social construction of technology (SCOT) studies than in the sociology of work). Associated with the latter point is an overreliance on ‘snapshot’ analyses of the implementation of new technologies, to the detriment of understanding incremental change in the capability and use of existing technologies—both old and new—that may nonetheless have implications for large numbers of workers.

To avoid these determinist undercurrents, we identify important resources in the *social shaping of technology* (SST) approach that can steer the future discussion. We draw on empirical and conceptual insights from SST—‘a perspective rather than a theory’ (Williams, 2019, p. 147)—to suggest how they might lead to better understandings of the new social relations of digital technology and work. In doing so, we build on previous contributions and ongoing debates in this journal that reveal the value of SST (Den-Nagy, 2014; Fraher, 2015; Ibrahim, 2012).

We begin with an overview of the theoretical challenges facing work and employment scholarship, noting three problematic trends: an overemphasis of the transformative aspects of phenomena like platform work, leading to overrigid periodisation; an overreliance on a narrow conceptualisation of control and, a disproportionate empirical focus on platform work. We then outline an alternative approach drawing on SST perspectives. Next, we situate and define technological determinism within a historical account of antideterminist perspectives, demonstrating how these could enrich work and employment research. Finally, we introduce the contributions comprising the rest of this Issue.

THEORETICAL CHALLENGES IN RECENT RESEARCH

Criticism of technological determinism is not new (Baldry, 2011; Howcroft & Taylor, 2014). Indeed, much literature professes a rejection of it. For example, Howcroft and Taylor (2014, pp. 1–2) comment acerbically on authors who ‘self-consciously try to avoid the optimistic-pessimistic Manicheism of previous waves [of technological change]’. However, the evolution of technology, and the debate around it, has often defeated these aspirations, with new waves of technology typically giving rise to an interest in prediction, particularly about the potential for job loss, which allow ‘a relapse into the technological determinism that [authors have] claimed to be striving against’ (Howcroft & Taylor, 2014, p. 2). Holtgrewe (2014) similarly emphasises the process by which assumptions about the ‘newness’ of technologies often steer authors towards an overemphasis on the novel, lending towards the kinds of ahistorical, decontextualised predictions Howcroft and Taylor (2014) pinpoint as routes into technological determinism. Critical social science, especially in this journal, has often sought to counter these analytical problems by situating the dynamics of technological change in wider structures of ownership and political economic ‘systems’ (see Howcroft, Taylor, Schaupp, and others, in this Issue). Nonetheless, as the debate has evolved over time, there is a recurrent tension between efforts to avoid technological determinism, and an understandable interest in new technologies, which can produce unexpected routes back towards it. It remains a perennial source of difficulty in the sociology of work (Thompson & Laaser, 2021). The following section examines the challenge in greater detail, identifying three issues within the literature that, we argue, allow technological determinism back in.

The ‘this time it’s different’ fallacy

Technological determinism can manifest in motifs of rigid periodisation, where certain technological developments are presented as defining characteristics of epochal transformations, each with their own modes of labour regulation and business organisation. Recent discussion of robotisation has recapitulated older debates characterised by extremes of pessimism and optimism, predicting, respectively, mass technological unemployment (Ford, 2015; Frey & Osborne, 2017) or a future of leisure and plenty (Bastani, 2019; Srnicek & Williams, 2015). As the debate has evolved, it is clear the real impact of robots, and digital automation more generally, is more varied, complex and unpredictable than either optimists or pessimists allow (Spencer et al., 2021).

Alarm over robotisation is a specific case of a general problem: the tendency to view new technology as heralding a radical break in social relations and practices. Such accounts, even at their most sophisticated, usually include a foundational premise of technological determinism.

A prominent example is the epochal break implied by discussions of the ‘platform economy’ or ‘platform capitalism’ (see Azzellini et al., 2022). The problem with such periodisations, based on a belief in the transformative power of certain technological innovations, is that they tend to ignore the complexity of change in sociotechnical systems; usually, by overstating technological novelty and understating social continuity, and ascribing decisive causality to the former. They present a reductive picture of history divided into discrete stages based on waves of technological innovation.

A reduced conceptual repertoire

Another challenge is the tendency to analyse complex and contradictory social formations using a restricted set of conceptual tools. We focus, here, on two concepts that appear widely in the literature: the notion of *control*, and more specifically *algorithmic control*. The latter is now widespread, especially but not exclusively in relation to platform work, as a means of grouping together diverse mechanisms including ratings systems, pay systems, forms of ‘nudge’ processes, and more. Indeed, articles referring to ‘algorithmic control’ now number in the hundreds. We do not dismiss the importance of control or algorithms. Rather, we argue that a residual technological determinism has led to overemphasising these aspects in the literature, to the exclusion of other important features.

Regarding control, recent discussions address important issues in the use of digital technology, but use an impoverished version of the concept as compared with accounts from earlier periods, especially the second wave of labour process research in the 1970s and 1980s. While recent research draws on the labour process tradition, it often lacks the analytical depth found in earlier accounts (Joyce & Stuart, 2021). For example, it is rare to find differentiation between levels of control, as in Edwards’s (1990) distinction between ‘detailed control’ of the labour process and ‘general control’ of the overall productive system. Contemporary accounts of digital technology at work also seem to exhibit what Storey (1985, p. 194) calls the ‘functionalist premises that capital must and can devise coherent systems of control’. This problematic assumption leads to explanations of digital technology as the straightforward expression of this functional imperative to control (Azzellini et al., 2022). Finally, recent accounts of technology and the labour process often lack attention to how, once introduced, the way in which ‘[technologies] are actually used will be moderated by ... responses and resistances’ (Baldry, 2011, p. 180). Thus, a determinist assumption that technology achieves the ends for which it was intended combines with a functionalist understanding of why those ends were intended, to produce a limited view of labour-capital relations and agency in the labour process. Overcoming these restrictions depends on deepening and broadening understanding of control in the labour process (Joyce & Stuart, 2021); broadening understandings of control as going beyond the labour process itself into wider circuits of capital (Greer & Umney, 2022; Kelly, 1985); and on developing a clearer critique of technological determinism.

Meanwhile, the problematic creation of new concepts by adding the prefix ‘algorithmic’ has led to the reification of key digital technologies, to the concealment of important distinctions within technologies. In recent accounts, the adjective ‘algorithmic’ has preceded an increasingly diverse selection of familiar aspects of paid work, such as ‘algorithmic governance’, ‘algorithmic surveillance’, ‘algorithmic boss’, ‘algorithmic labour’, ‘algorithmic information asymmetries’, ‘algorithmic pricing’, ‘algorithmic uncertainty’ (about work rules) and ‘algorithmic despotism’ (variously, Aloisi, 2022; Anwar & Graham, 2020; Bronowicka & Ivanova, 2020; van Doorn, 2020; Gregory, 2020; Griesbach et al., 2019; Lee et al., 2015; Rosenblat & Stark, 2016).

Here, as elsewhere, repeated use of techno-terminology buttresses assumed differences between those work processes that involve interactions with or via digital technical artifacts, and those that do not. Often, however, recognising continuities with nondigitally enabled forms, as well as differences, would offer greater insight. For instance, it is unclear that the incorporation of customer ratings into staff assessment (‘algorithmic rating’), harsh firing policies (‘algorithmic replacing’) or unfair, unreliable and nontransparent payment systems (‘algorithmic rewarding’) (see Kellogg et al., 2020) are novel attributes of algorithmic

technology, when these have been commonplace features of work since the earliest days of capitalist work organisation.

The notion of algorithmic control is rarely unpacked. The problematic use of an impoverished understanding of control and its uncritical pairing with the algorithmic catch-all, serves to obscure important distinctions that warrant more attention from researchers. Two important matters, in particular, are neglected by this narrowing of analytical categories.

First, researchers have reached significantly different conclusions about algorithmic control, but these differences are rarely discussed. Many researchers see algorithmic control as a significant increase in the degree of control exercised by managers over workers. Kellogg et al. (2020, p. 388), for instance, cite the notion of an ‘algorithmic cage’, to claim that ‘algorithmic control can be more encompassing, instantaneous, interactive, opaque and disintermediating than the historical regimes of control that employers have used over the past two centuries’. In marked contrast, Wood et al. (2018, p. 15) draw a distinction between Taylorism, task direction or machine pacing attributed to information and communications technology tools and algorithmic control, arguing ‘remote gig work is a long way from being an “assembly line in the head” ... or “electronic sweatshop” ...’. Instead, they emphasise that algorithmic management facilitates ‘high levels of autonomy, task variety and complexity, as well as potential spatial and temporal flexibility’ with the problematic effects of platform work resulting from global labour market pressures that force workers into long and unsocial hours of work, much of it unpaid (see also, Anwar & Graham, 2021). To an extent, this difference is to be expected because Wood et al. examine geographically dispersed project-based work carried out via platforms, rather than geographically tethered service work. Even so, it is striking that such clearly divergent views about the nature of algorithmic control have not prompted more vigorous exploration of differences. Instead, there is a problematic tendency for important differences to be hidden and debates stunted by determinist (mis)understandings of technology. This can generate accounts of algorithmic and platform technology that produce a homogenised view of technology rather than the complex, differentiated and mediated understanding that featured in high points of research on previous waves of new technology and work (for instance, Wilkinson, 1983).

Second, the focus on algorithmic aspects of platform work mask important nonalgorithmic features that are crucial to its operation and to worker experiences. In the case of app-based delivery and taxi work, for example, this includes GPS location and navigation systems. Without the capacity to geo-locate drivers, customers and destinations, these types of platform-based work are impossible. Yet, the role of GPS and similar systems is rarely discussed. In taxi driving, the introduction of GPS-type systems predates the rise of platforms and algorithmic work organisation, and is instructive for contextualising later developments. For example, Mathew’s (2008) study shows how the compulsory roll-out of GPS tracking allowed the City of New York to gather data on trips made, placing drivers and their unions at a disadvantage in pay negotiations.

Similarly, the compulsory introduction of credit card payments technology into the licenced taxi trade—which again predates algorithmic platform technology—represented a significant shift of power away from taxi drivers towards taxi firms and ‘brokers’ (intermediaries). With credit card payments no longer going directly to drivers, the new arrangement gave owning firms and intermediaries the capacity to make nontransparent and potentially manipulated deductions before drivers received remuneration (Mathew, 2008, p. 220).

The similarities with descriptions of platform work are striking, yet these are not platform workers but licenced New York cab drivers. No algorithms were involved in these

technologically enabled power shifts, which built on pre-existing labour–capital imbalances but did not give rise to them (cf. Wajcman, 2002). Separating the algorithmic element from other aspects of platform technology illuminates important continuities with types of nonplatform work that are overlooked when platform technology is essentialised and reified as ‘algorithmic control’.

Narrow empirical focus

The third challenge relates to a disproportionate emphasis on certain empirical phenomena, specifically on platform work. Research on platform work accounts for a disproportionate quantity of published research on new digital technology and employment (Azzellini et al., 2022), which is further skewed towards particular types of platform work; notably, app-mediated transport network services such as the Uber and Deliveroo models. There is, therefore, a real danger of scholarship becoming preoccupied with very specific empirical niches. Conversely, there is less research on incremental change in existing technologies, despite the fact that these account for the majority of workers’ experiences of technology at work.

However, it is worth briefly interrogating how platforms are treated in the sociology of work, in light of the preceding theoretical discussion. It is common in the literature to situate platform work within wider narratives such as ‘platformization’, ‘platform capitalism’ and the ‘platform economy’, which posit an epochal transformation precipitated by platform technologies. Researchers of work should be well-placed to critically interrogate these narratives. There is, however, a risk that scholars either sidestep a critical engagement with it, or else implicitly or explicitly endorse the narrative of platform work as part of a grand shift towards flexibilisation, precarisation and the like (Azzellini et al., 2022). There is a need for more research with an interest in continuity, thick description and contextualisation, as well as transformation.

These biases in the literature reflect residual technological determinism inasmuch as they prioritise technological matters over social relations. Thus, for instance, despite the well-known racialisation of platform taxi driving workforces in cities of the global North, race is insufficiently considered as a factor shaping the emergence of platform technology. Similarly, given the importance of gender and technology in the labour process discourse of the 1980s (Cockburn, 1983; Crompton & Jones, 1984; Cockburn & Ormrod, 1993), it is surprising that the gendered aspects of technology are underexplored in analyses of platforms, with some notable recent exceptions (van Doorn, 2017; James, 2022). This narrowing of the full spectrum of social relations is compounded by a wider methodological problem of neglecting the Global South, especially in leading Anglophone journals; a problem that is starting to be addressed (e.g., Amorim & Moda, 2020; Chen, 2018), including from contributors to this Issue (e.g., Parth et al., 2021; Morales & Stecher, 2022).

Prioritising the technological aspects of platform work leads to the deprioritisation of the nontechnological. Yet, the management of platform work is reliant upon key nontechnological aspects, such as the widespread use of a self-employed workforce, the extraction of a commission on every transaction and pervasive ‘legal and regulatory arbitrage’ to avoid standard regulatory regimes (Moore & Joyce, 2020). Furthermore, many low-wage areas of platform work appear to depend on the presence of insecure, racialised and gendered workforces (van Doorn, 2017). The persistent downplaying of these key social relations of

platform work underline the general problem of prioritisation of technological over social, economic and other factors in recent understandings of platform work. The next section draws on SST literature to develop potential solutions to these challenges.

TECHNOLOGICAL DETERMINISM AND ITS DISCONTENTS

In their influential SST approach, MacKenzie and Wajcman (1999, p. 1) define technological determinism as the belief that ‘Technologies change, either because of scientific advance or following a logic of their own; and they then have effects on society’. This definition has two parts; one concerning the origin of technology, and a second concerning its effects. A more developed version of this two-part definition is set out by Williams and Edge (1996, p. 868):

‘technological determinism [holds]:

1. that the nature of technologies and the direction of change [are] unproblematic or pre-determined (perhaps subject to an inner “technical logic” or “economic imperative”);
2. that technology [has] necessary and determinate “impacts” upon work, upon economic life and upon society as a whole: technological change thus produces social and organisational change’.

Both parts of this definition matter, and rejections of technological determinism that encompass only one part of it leave scope for problems to re-emerge.

The first part—the notion that technology develops according to its own logic, external to social relations and dynamics—the exogenous view of technology—is now unusual in research on work and employment. Nevertheless, the exogenous view remains current in other fields—notably mainstream economics—and periodically it seeps into sociological research, especially in studies of new technology. Most recently, the spillover from economics is visible in debates around the likely impact of digital automation, which has seen many claims that, in contrast to previous predictions about technologically driven job loss that did not materialise, robotisation means it really is different this time (Paus, 2018). In such accounts, new technology simply arrives and then has impacts.

The resulting predictions of impending, technologically-driven mass unemployment also fall foul of the second part of the two-part definition, concerning the ‘effects’ of technology. Much of the robotisation debate has viewed technology unproblematically in terms of its ‘impact’, with discussion limited to issues like how many jobs will go and what will happen to those remaining (Paus, 2018). Whether intended or unintended, the effects of technology are seen as determinate, with little consideration given to the known modifying effects of social relations and practices, institutional arrangements and firm-level effects (see Spencer et al., 2021). While such accounts are habitually pessimistic, debates triggered by the current wave of digital technologies are unusual in having also generated more Utopian speculation, which envisions the end of work (e.g., Bastani, 2019). However, the key point is the analytical similarity of pessimistic and utopian prognoses; the shared determinist view of technology as something that happens and has effects.

Such predictions have been subject to theoretical and, increasingly, empirical criticism. Theory provides good reasons to expect significant social mediation of new technologies, as has persistently happened in the past (for instance, Orlikowski, 1992). Indeed, strikingly similar but equally mistaken predictions, especially of technological mass unemployment, are a recurring

feature of mainstream economics (Mokyr et al., 2015). Furthermore, emerging evidence from the current spread of robots and related automation technologies suggests not mass unemployment but more complex shifts, including occupational and organisational restructuring, and even an increasing gender pay gap (Aksoy et al., 2020; Antón et al., 2022; Chung & Lee, 2023). Developing understandings of these processes, which are not grounded in determinism, remains an urgent task for researchers in work and employment.

Turning from economics to work and employment research, there is a widespread understanding that technology is not neutral but shaped by powerful social actors, and that new technologies often reinforce the interests of dominant groups. Such approaches reflect understandings of technology rooted in the SST tradition, especially through the wide influence of MacKenzie and Wajcman's (1999) foundational work, as well as more radical SCOT approaches (Russell & Williams, 2002). Within this journal, in particular, scholars have explored the benefits of an SST approach for analyses of industrial relations and the labour process. For example, Fraher's (2015) research draws inspiration from SST to show how different stakeholders shape each stage of the development and implementation of airline safety technologies. Ibrahim (2012) and Den-Nagy (2014) have noted the value of SST for counteracting a determinist focus on the 'effects' of technology, though the latter also notes its use as an 'umbrella' term rather than a well-defined theory; a challenge taken up in particular by Howcroft and Taylor in this Issue.

Perhaps the clearest recent examples of this critical approach appear in the burgeoning literature on platform work. There is a widespread perception that platform technologies are not neutral, but are designed to reinforce managerial control at the point of production (e.g., Bronowicka & Ivanova, 2020; Griesbach et al., 2019; Lee et al., 2015; Morales & Stecher, 2022; Parth et al., 2021). These approaches avoid treating technology as disconnected from social relations and thus avoid problems associated with the first part of our working definition of technological determinism. Too often, however, problems re-enter via the second part; that is, that technologies have 'necessary and determinate' effects on the organisation, management and experience of work. Consequently, while the origin of technological features such as algorithmic management are treated critically as the product of social relations, the impact or effects of such technology are treated much less critically. Notably, there is a widespread assumption that technologies of control can achieve that end more or less unproblematically. Reality is much less straightforward.

While the all-control view of platform technology has already received criticism (Joyce & Stuart, 2021), this example illustrates a wider point; that studies of technology and work tend to problematise the social shaping of the origins of technology, but the role of social and institutional mediation and agency following the implementation of new technology is persistently under-researched and undertheorised. As Wajcman (2002, p. 347) notes, this problem reflects a wider tendency within sociology to 'see technology as the impetus for the most fundamental of social trends and transformations'. In reality, considerable innovation in technological design and use takes place during 'implementation', when organisations work out how to use new technological acquisitions. The implementation of new technologies is subject to multiple mediations by a range of social actors, commonly leading to modifications in the understanding, use and even the design of technology (Russell & Williams, 2002, p. 50; Williams & Edge, 1996).

In part, this problem results from study designs that take a short-term snapshot view of the 'impact' of new technology. Too often absent is an understanding of what happens afterwards—the complex processes of coevolution of technology, work, workplace relations

and management methods (inter alia), as organisations adapt to new technology and new technology is adapted by organisations. This is especially likely to be the case for the complex systems typical of contemporary technological development, such as large-scale information and communication technology systems (commonly, organisation-wide or larger), which ‘are developed and unfold over many sites and extended durations’ (Williams, 2019, p. 154). For example, given the current condition of platform work as plainly unfinished, economically insecure and still highly contested, its further evolution as a sociotechnical system seems unavoidable, yet these processes are likely to have significant implications—in platform work and more generally—for the experience of technology at work. These limitations stem from the tendency towards local case studies and ethnographic methods, which almost inevitably produce snapshot views of the deployment of new technology, but are nevertheless used as the bases for generalisation. We are certainly not opposed to the use of such methods. Considerable care is needed, however, when drawing conclusions based on these methods—that are inevitably constrained in terms of time and place, and often of subjects—to avoid a view of technological change as a one-off event rather than an ongoing process. Again, the outcome can tend towards technological reductionism by default.

There is much to be gained through greater engagement with SST, where the central contribution has been to both generate detailed empirical studies and develop a range of conceptual tools that take analysis ‘beyond technological determinism’. These approaches attempt to capture both the sociality and the materiality of technology (Russell & Williams, 2002; Williams, 2019; Williams & Edge, 1996), contra social constructionist approaches, allowing that materiality matters, without collapsing materialism into determinism. One approach has been to insist on a sociotechnical understanding, in which technologies are viewed as systems of sociotechnical relations and technological artifacts irreducibly enmeshed in social and organisational relations. From this perspective, technological change is always also social change, either within organisations or in society at large.

An influential attempt to provide a more thoroughgoing theoretical model comes from the SCOT school. Orlikowski (1992) builds upon Giddens’s notion of structuration as a way of resolving the persistent tendency to treat technology and social relations as a sharply distinguished dualism—a separation that is foundational to both determinist readings of technological change and pure social constructivist accounts. For Orlikowski, technology and social relations form a duality (rather than dualism), in which:

technology is physically constructed by actors working in a given social context, and technology is socially constructed by actors through the different meanings they attach to it and the various features they emphasize and use,

while at the same time,

once developed and deployed, technology tends to become reified and institutionalized, losing its connection with the human agents that constructed it or gave it meaning, and it appears to be part of the objective, structural properties of the organization. (Orlikowski, 1992, p. 406)

From this perspective, the apparent externality of technology to social relations is a product of social relations themselves; where the power of technology is rooted in the ways technology is enmeshed in social relations and the processes of institutionalisation. More recently,

Orlikowski has developed a broad conception of sociomateriality, intended to capture ‘the fusion of technology and work in organizations’ (Orlikowski & Scott, 2008, p. 434). This move has generated considerable debate that we are not able to comment on here (see, Leonardi, 2013; Mutch, 2013; Scott & Orlikowski, 2013). The general point, though, is to emphasise the considerable theoretical resources available to scholars of work and employment seeking to go ‘beyond technological determinism’.

This is not to say, however, that all technologies are equally amenable to reconstructions of meaning or physical form. The specific materiality of different technological artefacts, as well as the social and institutional settings within which they emerge, mean that patterns of social shaping and reshaping will vary. Consequently, empirical evidence is needed to establish the relative influence of local and contingent relations and practices. In particular, this approach facilitates an engagement with social theory, which necessarily requires bringing the role of structural conditioning, social interaction and institutional and cultural factors into engagement with technology and undertaking studies at the level of implementation and use. To this understanding, approaches from industrial relations and labour process studies of work and technology can offer those things that are often omitted in social constructivist and socio-material approaches (Leonardi & Barley, 2010). These include the effects of overarching social structures of power, dominance and exploitation like gendered and racialised hierarchies and, in the case of paid work, managerial imperatives of control.

In addition to theoretical difficulties posed by continuing commitment to forms of technological determinism, practical difficulties arise when carrying out research in the field of work and employment. First, from a structural perspective, the initial processes of technology design are temporally and spatially separated from the work sites where employment researchers conduct their investigations; some companies build and sell technologies while other companies put them into use. Consequently, even though the diffusion and implementation of technology entails processes of social shaping and reshaping, significant parts of the social shaping processes are complete before research on work processes begins. This contributes significantly to the illusion of exogeneity of technology. Consideration of this is required to avoid the reification and hypostatisation of new technological developments.

The obvious contemporary example is in assumptions that new digital technologies are developed in work and employment settings for the purposes of managerial control. While managerial control may be an aspect of their use, control is seldom the only (or even the main) aim of management (Joyce & Stuart, 2021; Kelly, 1985). In this regard, the classic study of Noble (2011 [1985]) is exceptional, since it was concerned precisely to detail empirically the process whereby the control imperative became incorporated into the version of computer numerical control (CNC)¹ technology that achieved dominance in manufacturing. By contrast, much recent research on new digital technology simply assumes that control was the reason for its development, thereby falling into the difficulty identified by SST research of simply reading design off pre-existing social relations. Important as these often are, it seems to us that there are more interesting stories to tell about how, when, and why such processes take place, and the extent to which they vary across different settings and different technologies. To better appreciate these processes, future research may consider studying the process of technological development.

¹CNC technology is a method for computer control of materials processing machinery.

CHALLENGES OF RESEARCH METHODOLOGIES

The second area of practical difficulties for work and employment research on new technology derives from its standard research methods, such as surveys and case studies. The problem is that these methods often generate snapshot views, almost always specific to a particular temporal moment, whereas the SST unfolds over longer periods of time. Thus, a common format is for studies to investigate an early deployment of new technology and, on that basis, to draw generalised conclusions about its ‘effects’—of various types—on work and employment. What is missed, as a result, is understandings of how a technology is shaped over the longer term as a result of being embedded in a particular social setting. It is rare, for instance, to find longitudinal studies of technologies, or studies of mundane technologies and incremental change. For example, in warehousing work some important research has emerged into firms on the technological cutting edge, such as Amazon, that picks apart the potential and implications of robotisation and extended surveillance capabilities (Delfanti, 2021), as well as drawing vital links between intensive performance management regimes and increasingly coercive welfare systems (Briken & Taylor, 2018). Yet the more humdrum process of adaptation and implementation (and indeed rejection) of technologies across the complex landscape of warehousing workplaces, is less well-understood. Such conditions must account for the great majority of experiences of technology in work and employment, yet they are underplayed in the literature.

Finally, Williams (2019) outlines current directions of SST research, two of which seem especially relevant for work and employment research. The first comprises the ‘social learning perspective’, derived from Sørensen (1996). This approach seems particularly apposite as it focusses on the ways in which organisations appropriate or domesticate technologies ‘through extended trial-and-error processes of “learning-by-doing”’ (Williams, 2019, p. 152)—alternatively termed ‘innofusion’ by Fleck (1988; Fleck et al., 1990)—to capture the ways in which the diffusion of technology also involves processes of innovation and reshaping. Such approaches have been especially helpful in understanding the adaption in use of IT systems (Williams 2019), and would likely also apply in understanding the use of new digital technologies. For instance, algorithmic surveillance and big data technologies are all known to present considerable technical difficulties in terms of their development (e.g., Tamba et al., 2019), yet such problems are often neglected. An exception is a study by Brooks et al. (2021) looking at the adoption of new breathing apparatus in the UK fire service. Presented as a study of changing skills and institutional learning and unlearning, this research presents a fascinating account of the complexities that accompany the introduction of new technology, and the organisational struggles involved in making it ‘work’. More such work would add a great deal to work and employment scholarship. The second potentially fruitful approach outlined by Williams (2019, pp. 154–155) is the ‘biography of artefacts perspective’, which attempts to replace the usual snapshot of newly installed technology with a longer-term lens on the development, implementation and evolution of technologies in particular settings. The obvious difficulty of such an approach is that ‘the timescales of technology development, implementation and use are far longer than the duration of typical research projects’ (Williams, 2019, p. 155). Designing research to follow the ways that technology is shaped and reshaped as it is embedded and utilised within specific organisational settings certainly presents significant challenges. Nevertheless, this approach offers the potential to move beyond the determinist problem of seeing technology’s ‘impact’ in once-and-for-all terms and avoids problematic overgeneralisation from a snapshot initial encounter with new technology. We

might consider, for example, technology such as the moving production line, which was initially expected to prevent worker organisation, but which nevertheless gave rise to some of the most powerful unions of the 20th century (Littler 1982). With these insights in mind, the final section summarises the articles within this Special Issue, and reflects on their contributions.

THE CONTRIBUTIONS

The contributions to this volume are diverse and span a number of different perspectives and empirical topics, featuring institutional scholarship, political economy, science and technology studies (STS) and SST, ethnographic and sociological studies of the workplace, and more. Together they open up intriguing new theoretical questions, and help us to think through what it may mean in concrete terms to move beyond technological determinism. They also include a good representation of scholarship from and about the global South—often underrepresented in research on work and employment—which presents a wealth of empirical insight, and challenges ideas that are commonplace in scholarship in the global North.

To begin in the global South, Bisht et al. adopt a labour process lens to examine the diffusion of digital technologies into Indian workplaces; specifically, in microfinance service work. They observe an intriguing paradox: that digital technologies appeared to increase the level of control exercised over workers, yet were associated with widespread increases in job satisfaction. Bisht et al. identify contingent factors leading to these results such as perceived increases in job security and social status.

Also adopting a labour process approach, Huang examines food delivery in China. Taking the familiar topic of control, Huang adds new insight through a typological analysis of forms and sources of control. This breaks interesting ground by explicitly drawing the role of the state into discussions of platform work to show that the Chinese state regime for controlling migration and the rights of migrants—in the context of market-centric restructuring—has important implications for workers' experiences of platform work.

Parth et al. also focus on India, analysing the intersections of simultaneous online and offline organising among delivery riders, via the notion of 'phygital space'. This analysis also offers extremely rich qualitative data, which brings compelling depth and life to the discussion of a widely studied group, but in a geographical context that is to date understudied.

Completing the quartet of articles from the global South, Morales and Stecher look at platform work in Chile. Again, the authors examine new forms of control, in this case 'neonormative'. While seeking to avoid Foucauldian views that minimise worker agency, they demonstrate insightfully the importance of ideological factors in the management of platform work. They thereby extend discussion beyond a narrow focus on technology, in a contribution that is likely to make an important impact on the debate around algorithmic control.

Elsewhere, Ianuzzi examines the cross-national diffusion of aspects of Industry 4.0, through a detailed case study of the Veneto region of Italy—and implied comparison with Germany—showing how industrial context can reshape the objectives, implementation and outcomes of new technologies. Ianuzzi thus provides a sceptical response to accounts of Industry 4.0, leading to a much more selective and mediated vision of industrial change, and brings out the full complexity of multidirectional causal influences mediating technological change.

Similarly, Lloyd and Payne's examination of the introduction of robots in food and drink processing shows how particular institutional configurations shape and reshape the

implementation of new technology in workplaces. Through a comparison of Norway and the United Kingdom—that underlines the continuing benefits of comparative institutional analysis—they show how embedded trade union power in Norway secured both more advanced technological deployment and better outcomes for workers.

Taking a radically different approach, the contribution from Leonard et al. is a distinctive and original presentation of new and intriguing ways of thinking about technological change and work. The authors investigate the different ways that actors perceive the role of technology and the future of work, and show how these ‘imaginaries’ map onto different levels of agency within their case study organisation. They show how the prevalence of these competing visions of technology—including enduring scepticism and pessimism as well as optimism and determinism—are inseparable from the social relations of the workplaces. This novel contribution opens up new questions about agency and subjectivity among workplace actors.

Schaupp provides a compelling view of the tension between automation and algorithmic management. Schaupp takes a historical and theoretical view of technological development in workplace regimes, and gives an account where algorithmic management and automation proceed in faltering and contested waves against a backdrop of recurring economic crisis, stuttering profitability, intracapitalist competition and continuing labour-capital conflict, which combine to precipitate attempted technological ‘fixes’ but leave contradictions unresolved. This intriguing argument provides a trenchant alternative to narratives around the inevitability of automation, and centralises social relations of production as a key influence on technological development at the grand level.

Meanwhile, Wood et al. continue a long-term exploration of remote platform work with an examination of patterns of protest. They seek to understand what factors make remote gig workers more likely to support union organisation, and to take individual action against clients. This contribution seeks to disentangle which factors shape dynamics of protest in the sector in global perspective. Once again, the emphasis is on complex multicausal explanation, encompassing workers’ attitudes, their individual socioeconomic situations, their level of connectedness to others, and also workers’ own subjectivity and willingness to contest the terms of jobs.

The theoretical contribution by Howcroft and Taylor focuses a critical SST lens on widespread technological determinism in recent account of automation technologies and the future of work, underlining once more the value of this approach. Their account centralises class relations as shapers of technological development, alongside economic factors, gender and the state, as well as the material influence of previously existing technology.

Finally, Pulignano et al.’s study of food delivery in Belgium brings out the complexity of empowerment and disempowerment in platform work. They argue that labour relations in the industry are more complex than previously recognised, and broaden the focus beyond workers and the platform, taking in a wider circuit of value including customers and restaurants. This approach offers a refreshing alternative to the habitual overemphasis of the novelty of platform work, which sets it within wider social and economic relations.

This introductory article has sought to contextualise the rich set of contributions found in this Special Issue. It has advanced an argument intended to push forward research on work and technology by bringing labour process and industrial relations-focused studies into more fruitful dialogue with conceptualisations of technology and work developed through organization studies and SST. In surveying the current state of the field, it has underlined some recurrent problems that, despite widespread acceptance of the critique of technological determinism, allow it to persist: an emphasis on rigid periodisations; a narrow conceptual

repertoire exemplified by notions like algorithmic control and a narrow empirical focus that overemphasises certain types of work. It has also commented in some detail on SST and related approaches, and how, concretely, these might be adopted in work and employment research. We hope that these thoughts, and the articles collected in this Special Issue, can help advance the work of moving beyond technological determinism.

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