

Why Do Humans Remain Central to the Knowledge Work in the Age of Robots? Marx's *Fragment on Machines* and Beyond

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Abstract

The integration of new technologies into the process of production has recently resuscitated the question of world-without-work. Accounts that regard a workless future as a strong possibility often base their arguments on a body of work that upholds that new machines already tend to eliminate the category of work, including knowledge work. This article challenges this view by revisiting Marx's *Fragment on Machines* through the lens of autonomist Marxist writings. It offers an answer to the research question, inscribed in the title, that in contemporary capitalism the principal source of value and wealth lies in the general intellect embodied in living labour, *living-knowledge-as-mêtis*, that cannot be crystallized in and reproduced by the system of machinery and organizational tools in any meaningful way. The political implications of this argument will be discussed in the conclusion.

Keywords

digital technologies, future of work, knowledge work, Marx, politics of production

Introduction

The idea that advances in production technologies can culminate in a workless future is not new. It dates back to the Luddite rebellion (Bailey, 1998) in the 19th century and resurfaces over time often in parallel with the advent of new production technologies. In history, many prominent scholars, including Keynes (1931), Gorz (1985) and Rifkin (1995), argued that machines could bring about the abolition of work in the near future.

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Recently, the rise of the grander technologies (e.g. algorithms, artificial intelligence, internet of things) and their application into the production process have resurrected the question of world-without-work.

The current perspectives that regard a workless future as a strong possibility may be gathered in two camps. The authors of the first camp (Brynjolfsson and McAfee, 2014; Cameron, 2017; Ford, 2015; Oxford Martin School, 2016) suggest that we tend towards a workless future insofar as the emerging technologies and machines, possessing human-like capabilities, can sweep away our jobs in the future. Accordingly, it is advised, we must start formulating solutions to preclude or manage the coming crisis of today's socio-economic order. The authors of the second camp (Fraser, 2016; Mason, 2015; Srnicek and Williams, 2016) seem to agree that the replacement of human labour by new technologies and machines is not far away. However, they celebrate this prospect as it heralds, for the authors, the end of capitalism. What is remarkable here is that both camps back their projections with the same maxim: 'this time it is different'. This difference is founded on the argument that human-like machines already tend to eliminate not only manual work but also the category of work per se, involving knowledge work, whose growth has previously compensated the vanishing of old jobs and, thereby, secured or compelled the continuity of work.

Indeed, there is a growing literature that suggests that humankind has already lost its hegemonic role at work. It is now the machines, it is argued, that perform calculations, make decisions and take actions even in the realm of complex knowledge work. For example, Thrift uses the concept of 'technological unconsciousness' (2005: 213) to emphasize that new technologies perform many aspects of work without any benefit of human cognition. Lazzarato writes on finance work and argues that financial traders are no longer sovereign or rational but impulsively responsive; they 'no longer reflect' (2015: 200). Parisi (2015) likewise holds that the new system of machinery takes a course of action in a way that largely exceeds the human mind, awareness and control. What traverses all these accounts is the idea that new machines operate in a way that largely exceeds the limits of human cognition, perception and well-timed reaction. The replacement of humans by machines at work, therefore, seems to be a matter of time.

Herein, I want to draw attention to two critical contributions, challenging the idea of the 'failure' of humans at work. Firstly, Beverungen and Lange's (2018) ethnographic research on high-frequency trading (HFT) finds that smart machines cannot simulate the market accurately. They are reliant strictly on the design, test, intervention, operationalization, withdraw, redesign, retest and monitoring of human traders. The latter 'are thus not passive parts of a system' (Beverungen and Lange, 2018: 91). Human traders are not even secondary; they 'remain central to HFT' (Beverungen and Lange, 2018: 90). Secondly, Pettersen (2019) applies Dreyfus's (1972) famous thesis¹ to the category of knowledge work. She argues that the latter deals with problems that do not have universal solutions. Their solutions rest on Polanyi (1967) 'knowing' that cannot be separated from 'the processual and relations aspects that are situated in historical, social and cultural contexts' (Pettersen, 2018: 6). Accordingly, she concludes, 'knowledge work can be assisted and enhanced, but not replaced, by computers' (Pettersen, 2018: 8).

Beverungen and Lange's research is a significant contribution to the literature. However, it suffers from 'Callonistics' (Fine, 2003) in that the authors, in tune with

(Michel) Callon-inspired “‘new” new economic sociology’ (McFall, 2009), provide some vivid descriptions of a socio-economic phenomenon by drawing on the categories of social studies of finance but fail to ground their empirical findings in any form of economic theory (neither orthodox nor heterodox). Likewise, Pettersen (2019) has a hard time combining her insights with a broader critical explanation of the dynamics of capitalism as a whole. Both studies, therefore, seem to be under the influence of the ‘descriptive turn’ in sociology (see Savage and Burrows, 2007), which neglects that ‘it is imperative that sociology does not simply describe . . . but questions, explains, and analyses the structures and mechanisms through which they [social phenomena] are created, reproduced, and sustained’ (Gane, 2019: 4).

The objective of this *D&C* article is to develop the existing critical perspectives further by drawing on Marxist thought, in tune with Spencer (2017) and Toscano’s (2012) call for an integration of critical political economy into the area of the sociology of work. In particular, this article elucidates why humans remain central to the knowledge work by revisiting Marx’s (1993) *Fragment on Machines* through the lens of autonomist Marxist writings. It ultimately promotes an argument that humans remain central to the process of production because in today’s capitalism the principal source of value and wealth lies largely in the living knowledge of workers, *living-knowledge-as-métis*, that cannot be encapsulated in and reproduced by machinery in any meaningful way. The conclusion will offer the political implications of this argument.

Revisiting *Fragment on Machines*

The famous *Grundrisse* section, *Fragment on Machines*² (henceforth *Fragment*), has been referred back to many times by Marxist scholars as a ‘sociologist’s toolbox’ (Virno, 1996a: 265) to grasp the implications of new production technologies for the relationship between capital and labour. The *Fragment* is a provocative text insofar as Marx does not only put his renowned argument here, namely ‘capitalism . . . works towards its own dissolution as the form dominating production’ (1993: 700), but he also asserts that this dissolution will be driven precisely by the technological advancements in production and happen in the not-too-distant future. This section of the article has three parts. The first part will discuss the general argument of the *Fragment*. The second part will offer an autonomist Marxist reading of the text to elucidate why Marx’s historical projection did not come to pass and, in parallel, the priorities of contemporary capitalism. Finally, the third part will offer, in the light of previous discussions, an insight into the research question, inscribed in the title of this article.

Marx’s *Fragment on Machines*

In the main, the *Fragment* is on i) the emergent configuration of labour and developing machinery in the production process, and ii) what this particular configuration might bring about in the near future. In terms of the former, Marx explains that capital necessarily seeks productivity advances. These advances, he discusses, have initially been accomplished through the fragmentation and simplification of the labour process. Later, the system of machinery has been introduced to the production process. With the rapid

and persistent development of machinery, Marx observes, ‘the production process has ceased to be a labour process in the sense of a process dominated by labour as its governing unity’ (1993: 693). Labour has become ‘subsumed under the total process of machinery’, and its unity has begun to confront workers as a simple ‘link of the system’ and their ‘individual, insignificant doings as a mighty organism’ (Marx, 1993: 693).

In this machinic-system or ‘automaton’ (Marx, 1993: 692), that is, it is no longer workers or their work, understood in the conventional sense of the word, that acts as the principal force of production. To describe the emerging productive force, Marx offers a number of interchangeable terms: ‘the general powers of the human head’ (1993: 694), ‘social intellect’ (1993: 706), ‘the general productive forces of the social brain’ (1993: 709) and, as widely known, ‘the general intellect’ (1993: 706). All these terms refer to ‘the ensemble of sciences, languages, knowledges, activities, skills that circulate through society’ (Thoburn, 2001: 81) and that become crystallized in machines and organizational systems. Indeed, one of the most controversial arguments of the *Fragment* is that the general intellect is not an attribute of living labour but of fixed capital; in particular, machinery and organizational systems. This is evident when Marx writes that ‘the general productive forces of the social brains, is thus absorbed into capital, as opposed to labour, and hence appears as an attribute of capital, and more specifically of fixed capital’ (Marx, 1993: 694). For Marx, after all, the objectification of the general intellect in fixed capital and the latter’s arrival as the new productive force will have consequences.

Since the production process will progressively depend less and less on living labour than the general intellect crystallized in fixed capital, capital will necessarily reduce labour time to a minimum and, consequently, the worker will ‘step to the side of the production process instead of being its chief actor’ (Marx, 1993: 705). This projected state of affairs contains in itself a fatal contradiction for two reasons. Firstly, capital creates the material and social conditions for the development of workers as it creates free time to enjoy. However, one of the structural invariants of capital is ‘to convert it [free time] into surplus labour’ (Marx, 1993: 708). Capital, therefore, simultaneously creates and destroys the self-realization possibility of workers, causing an explosive social irrationality (Smith, 2013). Secondly, capital cannot generate profit when the wage of workers, principally securing the consumption of commodities on the market and hence the realization of surplus value as profit, is allocated in proportion to their labour time, which is now vanishing (Bowring, 2004). Marx anticipates that this two-fold contradiction will explode and, consequently, a new socio-economic order (a form of communism) will emerge in the near future.

*The Fragment in autonomist Marxism*³

Marx’s historical projection has materialized only partially. Capital’s unceasing absorption of the general intellect has culminated in a massive expansion in the use of sophisticated machines and computers at work, algorithm-driven work processes, robotic factories, digital work platforms, and so forth. Nevertheless, we have not witnessed any Marxian explosion towards the abolition of work. Fleming (2019) demonstrates that work is not disappearing; instead, it is thriving in the robotic era.⁴ As we know all too well, we are not living in a new socio-economic order as anticipated in the *Fragment*. In

a word, Marx's projection of 'communism of general intellect-rich production outside work' (Thoburn, 2001: 83) did not come to pass.

The theorists who are associated with the movement of autonomist Marxism offer an explanation for this 'failure' precisely from a Marxist perspective (Dyer-Witheford, 1999; Vercellone, 2007, 2013; Virno, 1996a, 1996b, 2007). Even though they interpret the *Fragment* differently, they principally settle over three points. Firstly, they all agree that what Marx had argued about the configuration of labour and new machinery in the *Fragment* found its highest expression in the mid-20th-century industrial capitalism. Secondly, they argue, the historical projection in the *Fragment* was interrupted by what Marx had not foreseen, that is, workers' insurgency against being an appendage of the system of machinery. In connection, thirdly, Marx could not anticipate, they suggest, how the general intellect would become a defining attribute of living labour, and the mode of work prioritized by capital would change accordingly. A closer look at these ideas may allow a better understanding of the ethos of contemporary capitalism.

The first argument is that there is an *intensified continuity* between the technologies and the social organization of early capitalism and the mid-20th-century capitalism. Marx's projection here was impeccable. The mid-20th-century industrial capitalism was marked by advanced assembly lines and heavy-machinery, devoted to the mass production of standardized commodities. The productivity advances were mainly secured by the incorporation of science to the immediate production. Indeed, 'application of science to the immediate production itself became a factor determining and soliciting science' (Marx, 1993: 704). The emerging hegemony of knowledge objectified in machinery and organizational systems was accompanied by a separation of intellectual labour (conception, design, plan) and manual labour (execution). The worker was estranged from the general intellect as the latter became a sole attribute of fixed capital. The subsumption of living labour under capital was real,⁵ and the worker's mental make-up was argued to resemble 'the ox than any other type' (Taylor, 1911: 59).

In the *Fragment*, Marx finds the possibility for a new socio-economic order in the intensification of the subsumption of labour under machinery. The text reads as if the scientific and technological advancements in production were an autonomous revolutionary force. Nevertheless, the 1960s and 1970s witnessed the mass insurgency of workers particularly in the northern world, which, in a sense, interrupted the *Fragment's* projection. With the slogan of 'refusal of work', the workers revolted against, among other things, being a cog in the automaton with its stagnant wages and living a tedious life with its fixed mentality and reproduction schemes (Brenner et al., 2010; Smith, 1990). Capital was then confronted with 'an enormous exfoliation, diversification, and multiplication of demands, created by the revolt of subordinated and super-exploited sectors of labour' (Dyer-Witheford, 1999: 75).

There is a vast amount of literature on the emancipatory outcomes of the mass social struggles of the period.⁶ In terms of our subject matter, Vercellone (2007, 2013) highlights two fundamental developments: i) the capitalist welfare state, already socializing a significant portion of the costs of reproducing labour power, began to fund the socialization and democratization of access to knowledge (i.e. free, mass, long-term formal and informal education, training, and skill development); and ii) the social wage was significantly enhanced, enabling workers to create a margin for

freedom and to engage more in self-developing activities such as art, research, science, and social and affective communication. With the success of mass insurgency, in other words, the workers penetrated and enjoyed what used to bypass them, namely the general intellect or the accumulated social intellect of the society. This state of affairs entered into the literature as the rise of ‘mass intellectuality’ (Virno, 1996b), indicating the diffusion of knowledge horizontally across the society and, in parallel, the expansion in workers’ cognitive and affective capabilities.

Now, one can make a better sense of why the *Fragment’s* general intellect-rich production beyond capitalism did not come to pass. As Thoburn (2001) acknowledges, the *Fragment* is marked by a dichotomy between the worker on the one side, and the system of machines on the other. In this dichotomy, the general intellect is construed as a ‘pure’ invention, passing around the worker as it is integrated into the system of machinery. It is in this context Marx assumes that machines will step into workers’ places in the future and a fatal contradiction will unfold from this development. Nonetheless, history proved that the notion of general intellect could exceed the idea of the encapsulation of knowledge in machines. The same general intellect became ‘a direct attribute of living labour, as a repertoire of a diffuse intelligentsia’ (Virno, 1996b: 194).

Capital, on the other side, did not respond to the *social crisis of capitalism* by scurrying off the stage of world history. Instead, it addressed the demands of workers for more creative, flexible, communicative, relational, innovative or, in a word, more self-fulfilling forms of labour which would correspond to their continuously developing cognitive, affective and social capabilities. Capital accordingly mutated into a new form, a new historical system of accumulation, which was based increasingly on the mobilization and expropriation of the general intellect embodied in living labour, that is, the living knowledge of workers rather than dead knowledge crystallized in machines and organizational systems.⁷ In today’s capitalism, in other words, the source of value principally lies in living knowledge of workers, not in dead knowledge crystallized in fixed capital (Lucarelli and Vercellone, 2013; Moulrier-Boutang, 2011; Vercellone, 2007). But what does living knowledge – which was not elaborated by the theorists – mean? How is it different from dead knowledge? And how is it even relevant to our research question inscribed in the title?

Living knowledge as Metis

While reflecting on these questions, the author found inspiration in Greek mythology. As one of the most striking myths goes, when Zeus is in trouble with his father, Metis creates an effective strategy empowering Zeus to defeat his father. Zeus, fascinated with Metis’s intelligence, soon after gets married to her. Later, however, Zeus begins to see his wife as a threat due to a given prophecy that their second child will betray his father and displace him as the ruler of gods and mortals. Zeus, terrified, tricks Metis. She becomes a fly and Zeus swallows her. However, Metis is already pregnant with their first child, Athena. She creates weapons and tools for her daughter from the materials she finds in Zeus’ gut. Zeus begins to feel a pain in his stomach, which grows and captures his whole body, including his head. Unable to bear the pain any longer, Zeus orders Hephaestus to strike him in the head with an axe. Athena, fully armoured, is thus born from Zeus’ head.

The concept of *mêtis*, emerged from this myth, can be found in the writings of De Certeau (1984), Detienne and Vernant (1991), Dolmage (2009), Scott (1998) and Zeilinger (2017). What marks these accounts is the given emphasis on the difference between *mêtis* and *techne*.⁸ In the main, *techne* denotes craft or skill that is impersonal, analytical, and quantifiable. It is about calculation, explanation, proof and rational action. *Mêtis*, on the other side, connotes improvisation, cunning, adaptive intelligence and intuition. *Mêtis* is often enacted as ‘flair, forethought, the subtlety of mind, deception, cleverness, opportunism, and experience’ (Dolmage, 2009: 5) in ‘situations which are transient, shifting, disconcerting and ambiguous; situations which do not lend themselves to precise measurement, exact calculation, or rigorous logic’ (Detienne and Vernant, 1991: 3–4). It brings about ‘contextual, heavily localized and specialized practical actions’ (Zeilinger, 2017: 11). Whereas there exists an analytical distinction between *techne* and *mêtis*, it is important to note that they are inseparable; they co-exist in the human body and mind.

It seems useful to integrate the concepts of *mêtis* and *techne* into our discussion to offer an insight into the research question. As noted, in today’s capitalism the source of value principally lies in knowledge, which takes two forms: dead knowledge and living knowledge. By dead knowledge, one might envision the knowledge repertoire of workers which is swallowed and objectified in machines and organizational systems, that is, *techne*. For example, the knowledge repertoire of a computer programmer that is used for the development of software for the market becomes dead knowledge under the harsh regime of intellectual property rights. By living knowledge, on the other side, one might envision the knowledge repertoire of workers which is swallowed by *but* cannot be objectified in fixed capital, that is, *mêtis*. For example, the knowledge repertoire of the same computer programmer that enables her/him to fix problems in faulty codes, update, control and maintain the system is living knowledge because machines – still – cannot fix their own errors, update and maintain themselves. While contemporary capitalism makes use of both forms of knowledge, it relies essentially on the exploitation of living knowledge of workers, that is, *mêtis*.

Humans remain central to the knowledge work in the age of robots because, in today’s capitalism, the creation of value and material wealth increasingly depends on ‘human touch’ (Scott, 1998: 320). This touch is not as simple as it sounds. It is distilled from one’s accumulated soft skills, affective and social relations, expert thinking, creativity, foresight, tacit insights, intuition, and so forth that cannot be transferred into machines and reproduced by them. It is enacted only by humankind to address complex situations which are fleeting, bewildering, equivocal; situations to which universal or generic solutions cannot be applied. This touch is *living-knowledge-as-mêtis*, that is, the principal force of production in contemporary capitalism.

Conclusion

The accounts that foresee a world without work in the near future find their inspiration in a body of work that asserts that so-called smart machines (e.g. algorithms, artificial intelligence, internet of things) already tend to abolish the category of work, including the knowledge work. This article contributes to critical perspectives that challenge this assessment and highlight the continuing centrality of humans to the knowledge work. Its

argument, erected upon an autonomist Marxist reading of *Fragment on Machines*, is that in contemporary capitalism the principal source of value lies in the forces of general intellect embodied in the living labour, that is, one's life-long accumulated affective and social relations, lived experiences, soft skills, tacit insights, expert thinking and intuition, that is, *living-knowledge-as-métis* which cannot be encapsulated in and reproduced by any sort of technology in any meaningful way.

The author hopes that this article will move the cloud hanging over technology-at-work studies in our area. It cannot develop a convincing criticism on the works of Bergvall-Kåreborn and Howcroft (2014), Fuchs (2014), Huws (2014), Spencer (2017), Wood et al. (2019) that challenge (either indirectly or directly) the fetishism around new technologies and discuss elegantly why the development of these technologies cannot be separated from the issues of ownership and power, and how they ultimately promote the interest of capital. Nevertheless, the acrid pessimism here, neglecting that technology is always a double-edged sword, might cause political frustration and passivity for those who (still) believe in a world beyond capitalism. As advocated in this article, in today's capitalism the living knowledge of workers on which capital fixes its eyes cannot be absorbed and reproduced by technological apparatuses in any meaningful way; they remain intact in humans. What exceeds the subsumption mechanisms of capital might always enable workers to penetrate the structures of the dominating regime and transform it from the inside by drawing on the same 'weapon' which is directed upon them. This is not naivety but reality which can be observed, for example, in the growth of alternative operating systems (e.g. Linux), peer-to-peer social projects (e.g. FLOK society), non-profit learning platforms (e.g. Wikipedia, EdX) as well as subversive organizations (e.g. Robin Hood Hedge Fund). In this regard, what is *also* needed, perhaps, is a political reflection on the ways in which technological apparatuses that promote the interest of capital can be counter-used to foster workers' autonomy in the antagonistic relationship between labour and capital.

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Notes

1. According to Dreyfus (1972), sophisticated technologies cannot solve complex problems since the latter do not have universal, generic solutions.

2. *Fragment on Machines* covers the end of Notebook VI and the beginning of VII in *the Grundrisse* (Marx, 1993).
3. Autonomist Marxism, *operaismo* and (later) post-*operaismo*, is not a unified school or tradition of Marxist thought (Wright, 2002). Rather, it is a heterodox intellectual and political movement that brings together scholars, students, activists who are dedicated to 'read Marx politically'. The latter indicates a reading of Marx to determine the meaning of socio-economic events and transformations in production relations in terms of the immediate development of working class struggle (Cleaver, 2000). Autonomist Marxism is thus characterized by the diversity of interpretations of Marx, which gives the movement its dynamism.
4. At the time of writing, unemployment stands at 4.7 per cent in the UK, 6.3 per cent in the EU, and 3.5 per cent in the US.
5. 'The real subsumption of labour under capital' is used by Marx in *Capital* volume 1 (1990: 1022–1035). It expresses what he calls 'capitalist production proper' (Marx, 1990: 1027), marked by the integration of the labour process into the intricate processes of machinery.
6. A good starting point might be Vinen's (2018) *The Long '68* and Ali's (2018) *Street Fighting Years*.
7. This state of affairs was recognized in this journal through the concepts of knowledge work and knowledge economy (see Benson and Brown, 2007; Donnelly, 2009; Frenkel et al., 1995). It is important to note that this proposition does not deny the continuity of manual, repetitive, routine labour or the conventional manufacturing in factories. It points at a macro-economic tendency that 'in recent years, a new constituent has emerged as a key driver in the economic growth: immaterial. During *The Glorious Thirty*, economic success was based mainly on the wealth in raw materials, the manufacturing industries, manual labour, and the volume of material capital available to each nation. This remains true, of course, although it is becoming less so. Today, the real wealth is not concrete, it is abstract. It is not material, it is immaterial. It is now the capacity to innovate, create concepts and generate ideas that structures the competitive advantage on both micro and macro levels' (Levy and Jouyet, 2006: 1, my translation).
8. For the distinction between *mêtis* and Aristotelian *phronesis*, see Dolmage (2009).

References

- Ali T (2018) *Street Fighting Years: An Autobiography of the Sixties*. London: Verso.
- Bailey BJ (1998) *The Luddite Rebellion*. New York, NY: New York University Press.
- Benson J and Brown M (2007) Knowledge workers: what keeps them committed; what turns them away. *Work, Employment and Society* 21(1): 121–141.
- Bergvall-Kåreborn B and Howcroft D (2014) Amazon Mechanical Turk and the commodification of labour. *New Technology, Work and Employment* 29(3): 213–223.
- Beverungen A and Lange A-C (2018) Cognition in high-frequency trading: the costs of consciousness and the limits of automation. *Theory, Culture & Society* 35(6): 75–95.
- Bowring F (2004) From the mass worker to the multitude. *Capital & Class* 28(2): 101–132.
- Brenner A, Brenner R and Winslow C (2010) *Rebel Rank and File*. London: Verso.
- Brynjolfsson E and McAfee A (2014) *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York, NY: W.W. Norton & Company.
- Cameron N (2017) *Will Robots Take Your Job? A Plea for Consensus*. Cambridge: Polity Press.
- Cleaver H (2000) *Reading Capital Politically*. Edinburgh: AK Press.
- De Certeau M (1984) *The Practice of Everyday Life*. Berkeley, CA: University of California Press.
- Detienne M and Vernant JP (1991) *Cunning Intelligence in Greek Culture and Society*. Chicago, IL: University of Chicago Press.

- Dolmage J (2009) Metis, mêtis, mestiza, medusa: rhetorical bodies across rhetorical traditions. *Rhetoric Review* 28(1): 1–28.
- Donnelly R (2009) The knowledge economy and the restructuring of employment: the case of consultants. *Work, Employment and Society* 23(2): 323–341.
- Dreyfus H (1972) *What Computers Still Can't Do: A Critique of Artificial Reason*. Cambridge, MA: MIT Press.
- Dyer-Witheford N (1999) *Cyber-Marx: Cycles and Circuits of Struggle in High-Technology Capitalism*. Champaign, IL: University of Illinois Press.
- Fine B (2003) Callonistics: a disentanglement. *Economy and Society* 32(3): 478–484.
- Fleming P (2019) Robots and organization Studies: why robots might not want to steal your job. *Organization Studies* 40(1): 23–37.
- Ford M (2015) *The Rise of the Robots: Technology and the Threat of Mass Unemployment*. London: Oneworld Publications.
- Frase P (2016) *Four Futures: Life after Capitalism*. London: Verso.
- Frenkel S, Korczynski M, Donoghue L, et al. (1995) Re-constituting work: trends towards knowledge work and info-normative control. *Work, Employment and Society* 9(4): 773–796.
- Fuchs C (2014) *Digital Labour and Karl Marx*. London: Routledge.
- Gane N (2019) Against a descriptive turn. *The British Journal of Sociology* 71(1): 4–18.
- Gorz A (1985) *Paths to Paradise: On the Liberation from Work*. London: Pluto.
- Huws U (2014) *Labor in the Global Digital Economy*. New York, NY: Monthly Review Press.
- Keynes JM (1931) *Essays in Persuasion*. London: Macmillan.
- Lazzarato M (2015) *Governing by Debt*. Los Angeles, CA: Semiotext(e).
- Levy M and Jouyet J (2006) L'économie de l'immatériel: la croissance de demain. Paris: Ministère de l'Économie, des Finances et de l'Industrie. Available at: <http://www.astrid-online.it/static/upload/protected/Rapp/Rapport-Jouyet-Levy-Economie-de-l-Immat-riel.pdf> (accessed 18 October 2020).
- Lucarelli S and Vercellone C (2013) The thesis of cognitive capitalism. New research perspectives. An introduction. *Knowledge Cultures* 1(4): 15–28.
- McFall L (2009) Devices and desires: how useful is the 'new' new economic sociology for understanding market attachment? *Sociology Compass* 3(2): 267–282.
- Marx K (1990) *Capital: A Critique of Political Economy vol. I*. London: Penguin.
- Marx K (1993) *Grundrisse: Foundations of the Critique of Political Economy*. London: Penguin.
- Mason P (2015) *Postcapitalism: A Guide to Our Future*. London: Allen Lane.
- Moulier-Boutang Y (2011) *Cognitive Capitalism*. Cambridge: Polity.
- Oxford Martin School (2016) Technology at work V.2.0: the future is not what it used to be. Available at: <https://www.oxfordmartin.ox.ac.uk/publications/technology-at-work-v2-0-the-future-is-not-what-it-used-to-be/> (accessed 18 October 2020).
- Parisi L (2015) Instrumental reason, algorithmic capitalism, and the incomputable. In: Pasquinelli M (ed.) *Alleys of Your Mind: Augmented Intelligence and Its Traumas*. Lunenburg: Meson Press, 125–138.
- Petersen L (2019) Why artificial intelligence will not outsmart complex knowledge work. *Work, Employment and Society* 33(6): 1058–1067.
- Polanyi M (1967) *The Tacit Dimension*. New York, NY: Garden City.
- Rifkin J (1995) *The End of Work: The Decline of the Global Work-Force and the Dawn of the Post-Market Era*. London: Penguin.
- Savage M and Burrows R (2007) The coming crisis of empirical sociology. *Sociology* 41(5): 885–889.
- Scott JC (1998) *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press.

- Smith S (1990) The workers' rebellion of the 1960s. *Socialist Worker*. Available at: <https://socialistworker.org/2011/08/26/workers-rebellion-of-the-1960s> (accessed 18 October 2020).
- Smith T (2013) The 'general intellect' in the Grundrisse and beyond. *Historical Materialism* 21(4): 235–255.
- Spencer D (2017) Work in and beyond the second machine age: the politics of production and digital technologies. *Work, Employment and Society* 31(1): 142–152.
- Srnicek N and Williams A (2016) *Inventing the Future: Postcapitalism and a World without Work*. London: Verso.
- Taylor FW (1911) *The Principles of Scientific Management*. New York, NY: Harper & Brothers.
- Thoburn N (2001) Autonomous production: on Negri's 'new synthesis'. *Theory, Culture & Society* 18(5): 75–96.
- Thrift N (2005) *Knowing Capitalism*. London: SAGE.
- Toscano A (2012) Sociology. In: Fine B and Saad-Filho A (eds) *The Elgar Companion to Marxist Economics*. Cheltenham: Edward Elgar Publishing, 327–333.
- Vercellone C (2007) From formal subsumption to general intellect: elements for a Marxist reading of the thesis of cognitive capitalism. *Historical Materialism* 15(1): 13–36.
- Vercellone C (2013) From the mass-worker to cognitive labour: historical and theoretical considerations. In: Linder M and Roth KH (eds) *Beyond Marx: Theorising the Global Labour Relations of the Twenty-First Century*. Leiden: Koninklijke Brill NV, 417–445.
- Vinen R (2018) *The Long '68: Radical Protest and its Enemies*. London: Penguin.
- Virno P (1996a) Notes on the 'general intellect'. In: Makdisi S, Casarino C and Karl R (eds) *Marxism Beyond Marxism*. London: Routledge, 265–273.
- Virno P (1996b) Virtuosity and revolution: the political theory of exodus. In: Virno P and Hardt M (eds) *Radical Thought in Italy: A Potential Politics*. Minneapolis, MN: University of Minnesota Press, 189–213.
- Virno P (2007) General intellect. *Historical Materialism* 15(3): 3–8.
- Wood AJ, Graham M, Lehdonvirta V, et al. (2019) Good gig, bad gig: autonomy and algorithmic control in the global gig economy. *Work, Employment and Society* 33(1): 56–75.
- Wright S (2002) Storming Heaven: Class Composition and Struggle in Italian Autonomist *Marxism*. London: Pluto Press.
- Zeilinger M (2017) Metic action in digital culture. *Platform: Journal of Media and Communication* 8(1): 8–23.

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