



# Digitalization in Industry

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## Between Domination and Emancipation

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*Edited by*  
Uli Meyer · Simon Schaupp ·  
David Seibt

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## Digitalization in Industry

“This excellent book provides a refreshingly nuanced account of the impact of digitalization on industry. Rejecting the standard binary accounts of digitalization as driving either domination or emancipation, the authors offer a detailed explanation of the possibilities and pitfalls of socio-technical developments for both workers and consumers. The book deserves to be widely read by anyone interested in the future of work.”

—Judy Wajcman, *Professor of Sociology, London School of Economics, UK*

“This collected edition treads a careful path between prevalent utopian and dystopian accounts of digital disruption and manufacturing 4.0 to offer a careful examination of struggles to reshape production and distribution processes and their consequence for those operating (as workers or as users) digital industries. It avoids unhelpful generalisation by theoretically-informed empirical investigation of the configuration of producers, consumer and digital tools in a range of specific settings.”

—Robin Williams, *Director of the Institute for the Study of Science, Technology and Innovation at The University of Edinburgh, UK*

“Whoever is of the opinion that digitalization in industry is a key component of contemporary societies should read this book. Why? Because it provides a serious and multi-faceted contribution to analyze and theorize the empirical triangle of digitalized working practices, smart fabrication, and the novel implications of users—way beyond the commonly cherished visions of hypes and horrors as regards ‘Industrie 4.0.’ To this end, the authors capitalize on a rich repertoire of concepts and methods made available by

- science and technology studies, focusing here on the impacts of digital technologies on society,
- organization studies, emphasizing here on processes and effects of organizing technological change,
- as well as their mother discipline sociology, bringing, among other things, the thorny question of (new) power relations to the table.

Their distinctive perspectives notwithstanding, all disciplinary perspectives are united by the notion that (digital) society and (digital) technology shape each other thoroughly, and will continue to do so. In order to make sense of ongoing changes and (alleged) challenges, and to configure them responsibly, this book

alerts us to the many frictions and ambivalences entailed in digitalizing industry, work, users, us, hence: society, its dynamics constantly moving between the poles of emancipation and domination.”

—Professor Sabine Maasen, *Director of the Munich Center for Technology in Society, Technical University of Munich, Germany*

“This volume is a very important contribution on the discussion around the power effects of digitalization. It is hard to find any analysis on the subject as differentiated and profound as the texts assembled here.”

—Professor Oliver Nachtwey, *Professor of Social Structure Analysis, University of Basel, Switzerland*

Uli Meyer · Simon Schaupp ·  
David Seibt  
Editors

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# Toward an Analytical Understanding of Domination and Emancipation in Digitalizing Industries

*David Seibt, Simon Schaupp and Uli Meyer*

Does digitalization reinforce, or even strengthen, structures of domination? Or does it instead foster social emancipation? These questions are as old as digitalization itself.<sup>1</sup> Various disciplines and fields of study, including sociology, organization studies (OS), and science and technology studies (STS) continue to engage in debates as to how the political qualities of digital technologies play out under different circumstances. Weaving together some of the threads that constitute those conversations, the present volume assembles theoretical perspectives as well as detailed empirical investigations that shed light on the relationship between current forms of digitalization and new dynamics of

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emancipation and domination. However, our contribution distinguishes itself from the larger discussion on digitalization by homing in on a subject that has, regrettably, moved out of focus in the social sciences: industry. While the reorganization of industry and industrial production was at the very heart of classical discussions of social emancipation and domination (e.g., Blauner, 1964; Braverman, 1974; Mackenzie and Wajcman, 1985; Marx, 1976), over the last 30 or so years, it has receded from the limelight. The topic of industry has fallen out of favor both as an empirical phenomenon in Western societies and as a subject of scholarly interest. On the one hand, attention has shifted to processes of consumption and use (Bourdieu, 1984; Featherstone, 2007 [1991]; Miller, 1987; Oudshoorn & Pinch, 2003), on the other hand, to processes of knowledge production (Jasanoff, 2004; Knorr-Cetina, 1999; Latour, 1987; Latour & Woolgar, 1986) and knowledge work (Drucker, 1993; Orlikowski, 2002; Star, 1995).

Only with the most recent wave of digitalization has interest in industry and industrial production been rekindled among politicians, social scientists, and the broader public. Industrial robots have returned to the covers of major newspapers and magazines; governments are negotiating strategies for dealing with the “next wave of digitalization,” and scholars are quick to compete for public and private funding as well as for grandiose claims in journals, at conferences, and in popular monographs. Out of this growing body of scholarship, we have selected the issues of *work*, *digital fabrication*, and the *configuration of users* as the focal points of the present volume, with separate sections of the book dedicated to each of these topics. We chose these themes because they point us to three ongoing debates which strike us as particularly relevant with regard to the dynamics of emancipation and domination in digitalizing industries, and as particularly contested in their analyses of these processes.<sup>2</sup>

Concerning the dynamics of *emancipation and domination in the workplace*, for example, hopes emerged that industrial automation and digitalization would lead to a “postcapitalist” society (Mason, 2015; Srnicek & Williams, 2015). They were quickly rebutted, however, as a fetishization of technology (Fuchs, 2016; Thompson & Briken, 2017). Some authors see networked communication technologies, coupled with the ubiquity of private computers, as a material precondition for democratic organizations (Sattelberger et al., 2015). Others point to the ubiquity of digital sensor technologies in production, warning that it may lead to a revitalization of classical Taylorism and a radicalization of surveillance (Zuboff, 1988, 2019).

*Promises of emancipation through digital fabrication* are frequently connected to this discussion, but often point beyond the confines of the workplace. Technologies like 3D printing are hailed as tools which will democratize production and innovation, encouraging the spread of peer production infrastructures such as shared machine shops, as well as enabling grassroots movements and open source communities (Ferdinand et al., 2016; Gershenfeld, 2005; Raymond, 2001; von Hippel, 2005). Other accounts focus on the instrumentalization of these movements by large firms (Dahlander & Magnusson, 2008; Jensen & Krogh Petersen, 2016) and emphasize the intimate relationships between digital fabrication technologies and the capitalist logic of value production (Braybrooke & Smith, 2018). Moreover, it bears mentioning that grassroots communities have themselves given rise to profit-oriented corporations (Ferdinand & Meyer, 2017).

One related question is how the digitalization of contemporary industries contributes to *emancipating, configuring, and infrastructuring users*. In this area, developments such as digital mass customization platforms (Pine, 1993; von Hippel & Katz, 2002; Piller, 2004) and the increased speed of design iterations have sparked optimism when it comes to escaping the perils of mass production. Yet, critical scholars have pointed out that computer-aided design is also threatening traditional trades and crafts (Sennett, 2008). What is more, mass customization is a long haul from true custom production (coons, 2016). The growing ubiquity of the digital means of production has been said to foster user- and community-based innovation (Benkler, 2006; von Hippel, 2005). More recently, however, it has been argued as well that companies increasingly “produce” users (Hyysalo et al., 2016) or configure them to become sources of unpaid labor (Drewlani & Seibt, 2018; Johnson et al., 2014; Ritzer & Jurgenson, 2010).

While we welcome and, to some degree, participate in this newfound enthusiasm surrounding the promises and pitfalls of digitalization, there are three reasons why we find large parts of the current debates to be somewhat unsatisfactory. First of all, many popular contributions subscribe to a simplistic linear logic of industrial development, labeling current dynamics as the *second machine age* (McAfee & Brynjolfsson, 2014), the *third industrial revolution* (Rifkin, 2011), or even *Industrie 4.0* (Kagermann, Lukas, & Wahlster, 2011). Often driven by an implicit technological determinism, these accounts frequently miss historical continuities, ironies and, above all, the myriad opportunities that



actually exist for companies and users to make a difference in the design, implementation, and use of technologies. Second, many contributions take either an alarmist or a techno-optimist stance toward digitalization in industries. New sociomaterial configurations are either hailed as the forerunners of a technologized utopia (Mason, 2015) or demonized as a new level of domination by states and multinational corporations (Zuboff, 2019) as well as an impending age of mass unemployment (Frey & Osborne, 2017). What these polarizing characterizations miss, however, is the more intricate, and often ambiguous, dynamics that happen between total domination and total emancipation. Third, critical social-scientific analysis is hampered by the vague and indiscriminate use of its central concepts. While notions such as digitalization and industry seem to be everywhere and their relationship with dynamics of emancipation or domination are commonly asserted, these terms are rarely defined or subjected to any scrutiny. Yet, as long as we do not know what we mean by industry, digitalization, and emancipation/domination, any attempt at analyzing the relationships between these concepts is bound to fail or, at the very least, remain incompatible with other analyses.

The remainder of this introduction is therefore dedicated to sketching out how the present volume attempts to tackle these shortcomings by laying some of the foundations for an analytical understanding of digitalized industries and the dynamics of domination and emancipation. While we will introduce the contributions to the volume at the end of this introduction, the most important task that we have set out for this chapter is to provide some conceptual clarity as to how the terms *industry*, *digitalization* and *domination/emancipation* may be understood. As we described above, the extensive debates surrounding these topics suffer from a variety of misunderstandings which are largely due to highly disparate understandings of these terms. Of course, we encourage the development of multiple analytical lenses, as these allow scholars to highlight different aspects of the same topic. However, we would also like to insist that conceptual heterogeneity must inevitably lead to misunderstandings whenever concepts lack clear definitions. Thus, in the following paragraphs we suggest concepts of industry, digitalization, and domination/emancipation which we believe to be useful as a common framework for reading the heterogenous approaches assembled in this volume.

## BETWEEN DOMINATION AND EMANCIPATION

We will begin our discussion by clarifying what exactly we mean by the terms domination and emancipation. While there is a wide range of different approaches to these topics (e.g., in actor-network theory, feminist theory, political science), in the specific context of digitalized industries it seems useful to take a closer look at the corresponding discussions in the sociology of work. Most contributions to this subfield approach the issue of digitalized industries with a strong focus on domination in the form of managerial control. For instance, in the 1970s and 1980s scholars found that computerized production technologies materialized Tayloristic management principles (Braverman, 1974; Cooley, 1980). With a similar focus, more recent studies have repeatedly pointed out that digital tracking enables increased managerial control over the workforce (e.g., Briken et al., 2017; Staab & Nachtwey, 2016; Zuboff, 2019). While these accounts rightly emphasize the extended reach of digital control, they miss an important point concerning the relationship of domination and emancipation: By restricting their analysis to managerial strategies of control, they often do not take into account strategies of agency “from below.” These, however, often present practical critiques of domination and therefore point toward emancipation (Boltanski, 2011). Therefore, in the following, we formulate an analytical perspective that is capable of grasping domination as well as emancipation. To do so, we will start by differentiating between the concepts of domination and control.

Social action is closely linked to control. The essence of control, according to Emile Durkheim (1982, p. 45) lies in the fact that “collective ways of acting and thinking possess a reality existing outside individuals, who, at every moment, conform to them. They are things which have their own existence.” In this sense, control is the basis of expectable behavior, and therefore of cooperation and coexistence as such. This does not exclude individual freedom. Even language-based communication would not be imaginable beyond a mutual set of grammatical rules and their constraints. Language is likewise the basis for social interaction and thus at the same time for individual freedom (Berger, 1967). This general concept of social control must, however, be differentiated further to enable insights on the topic of this book: domination and emancipation. The first differentiation is between internal and external control. The internalization of norms is the prototypical example of internal social control. External social control, on the other hand, may take the form of positive

or negative sanctions for a certain behavior. The second form of control is only possible if there is another factor in the equation: power.<sup>3</sup> It is only through power that other actors can be influenced in their behavior. The most widely acknowledged definition by Max Weber (1968, p. 53) understands power as “the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance, regardless of the basis on which this probability rests.” This definition also covers, among others, the extreme cases of power that can be described as a zero-sum game of competing wills. However, in most cases, power simply manifests as influence over other people’s actions. Indeed, a society not pervaded by power, as conceptualized in the latter way, would be unimaginable, as reciprocity and reciprocal influence over the actions of others are necessary preconditions for cooperation. Reciprocal influence, however, is not the same as acknowledging an omnipresence of domination, the latter being preliminarily defined here as the *structural asymmetry* of power relations (Haude & Wagner, 1999).<sup>4</sup>

Many social scientists deduce directly from the universality of social control to the universality of domination and therefore see the latter as a fundamental aspect of all social action. Ralf Dahrendorf was among those especially eager to naturalize domination in this way. According to his definition, domination, in its encompassing form, can be understood as the authority to set, apply, and enforce norms (Dahrendorf, 1964, p. 96). However, even one of these factors would be enough to speak of domination in some shape and form. Thus, for Dahrendorf any kind of institution that is concerned with the securing or maintaining of norms is enough to indicate the existence of domination in the society in question (*ibid.*, p. 98). But with this conceptual maneuver, society, and domination are tautologically defined and, for all intents and purposes, indistinguishable, as the absence of norms would indeed equal the absence of society as such. It is only in this way that Dahrendorf (1967, p. 334) arrives at his final postulate that “society simply is domination.” This definitional bypass serves an explicitly political end. It is meant to prove the “futility of political utopias” and of “Marxist dreams of society” (Dahrendorf, 1964, p. 84). But other sociologists, including those who are probably less ideologically motivated, have taken the same path. Even Anthony Giddens, who elaborated one of the most sophisticated theories of power, claims that domination has “to be recognized as inherent in social association (or, I would say in social action as such)” (Giddens, 1984, p. 31f.).

From our point of view, the problem with defining domination as an integral element of all social action is that it runs the risk of brushing over the all-important differences in the *forms* and *degrees* of domination. In order to use domination as a category in empirical analysis, rather than one of the basic elements of an ontology of the social, one needs to take into account the immense differences in the extent of domination, which is precisely why we prefer to speak of domination as structural asymmetries of power relations. This argument does not depend on the proof of the complete absence of domination at a certain place and time. Even if domination were an inevitable element of the social world, a focus on structural power asymmetries allows us to see that there are still extremely important differences between different forms of domination. Such differences include the varying degrees of repression, internal and external human costs, interests and content, and basis for legitimation. Moreover, once we reject the notion of domination as a universal constant, we are able to identify forms of social action that cannot be explained within a framework of domination, such as solidarity, mutual support, and all forms of critique and resistance aimed at the structures that secure and legitimize power asymmetries. From this point of view, we are also able to see that there are not only differences in the form, but also in the degree of domination, which makes it possible to empirically identify social constellations that are structured to a greater or lesser degree by domination (Narr, 2015, p. 95).

Defining domination as structural asymmetries in power relations also implies that situations which are less structured by domination are not necessarily void of institutions. The reduction or absence of domination, if it is to be enduring, instead always rests on an institutionalization of non-domination. This means that such contexts are not simply characterized by the absence of certain institutions of domination, but by the explicit institutional inhibition of domination—as, for example, in council-systems, collective justice or the redistribution of material wealth (Haude & Wagner, 1999). To deny these institutions and to naturalize domination on the other hand, as Boltanski (2011, p. 116) notes...

pretty much comes down to supporting overarching theories of domination which, by unmasking underlying effects of domination in any political order whatsoever – this boils down to regarding domination as ubiquitous – have virtually the same practical consequences [...] as positions that definitively exclude the issue of domination.

Narr (2015) therefore suggests a scalar approach for the identification of domination mechanisms. Such an approach would see domination not as a universal constant but also identify instances where it is reduced. These processes of the reduction of domination would then be synonymous with processes of emancipation. In suggesting such a negative and procedural definition of emancipation, we would like to emphasize two of its aspects. Firstly, we are cognizant of the fact that, as domination itself cannot be reduced to one principal social contradiction, the same is true for emancipation. Because domination consists of several intersecting lines of social oppression (Hancock, 2016), emancipation also cannot be thought of as liberation in only one of these dimensions, e.g., a postcapitalist economy. The analysis of emancipation, like domination, should be explicit about the specific kinds of structural power asymmetries it addresses and, where possible, should be mindful about how different such asymmetries relate to one another. The lessening of domination in one kind of relation does not necessarily imply a similar reduction in other regards. Secondly, defining emancipation as the reduction of domination allows us to foreground the dynamics that unfold between these two poles. States of emancipation and domination are rarely, if ever, absolute and remain in need of concrete action. It is in this sense, that domination can be contested and emancipation must be achieved and defended.

While, the contributions assembled in this volume diverge with regard to their definitions of control, power, and domination, they can be framed by these two principles. All of them describe dynamics that play out *between* domination and emancipation and all of them specify the particular *dimensions* in which they are concerned with these. In addition, the chapters are also linked by the fact that they situate their studies in the particular context of digitalized industry. In the following two sections, we will therefore sketch out what we mean by industry and digitalization, and how these may relate to processes of domination and emancipation.

## INDUSTRY

Few would contest the fact that industry is a central feature of modernity in Western societies, where it has historically been linked to ideas of progress and prosperity. Yet, both the term and the phenomena it is meant to describe have had a complicated and contested career. For one thing,

industrial production in the classical sense has shifted from the countries of Western Europe and North America to what economists now refer to as newly “industrialized countries” such as China, India, Indonesia, Mexico, Brazil, South Africa, or Turkey. At the same time, self-characterizations such as “industrial society” or “industrial capitalism” have been replaced with the idea that we are living in a “postindustrial society” (Bell, 1976; Touraine, 1971). Starting from the 1970s, Western sociologists observed that the focus of economic activity in their countries had shifted from the production of goods to the production of services, that white-collar work had become more prevalent, and that knowledge was now the most important form of capital (Drucker, 1993; Moulrier-Boutang, 2011). This change also came with a clear shift in the valuation of industry and the places in which it was located. Where industrial production had long been an emblem of progress, it was gradually stripped of its symbolic value and physically “offshored.” Following a logic of linear technological development within countries and a binary division between them, the division was no longer drawn between industrialized and non-industrialized nations, but between those that were newly industrializing and those that had already moved to a postindustrial state. However, in a somewhat ironic reversal of this trend, discussions around the most recent wave of digitalization have moved the topic of industry back into the public eye and into academic circles. Companies, governments, and social scientists have heralded (and analyzed), among others, “the second machine age” (McAfee & Brynjolfsson, 2014), “the third industrial revolution” (Rifkin, 2011), and the “Industrie 4.0” (Pfeiffer, 2017). In this newly emerging discourse, promises of smart economies based on decentral, networked, and—above all—digital technologies are linked to burgeoning political programs that aim to reinvigorate industrial production in Western countries.

To make sense of these apparently contradictory dynamics and to understand their connection to digitalization and social emancipation, it is necessary to have a clear understanding of what we mean by the term *industry*. Yet, for all the current discussion about industrial transformation, the term is rarely defined and does not feature in any of the more prominent sociological dictionaries (Abercrombie et al., 2006; Bruce & Yearley, 2006; Marshall, 2003; Turner, 2006). In search of a definition, the inclined reader is instead presented with a list of related notions which refer to industry and its related dynamics on at least three different levels.

Of these related notions, first of all, there is the term industrialization. It refers to a change in the modes of production, a concept which, even though it is often thought of as a society-wide development, encompasses a specific relationship between the means of production and the organization of work. In its narrowest sense, industrial production is marked by the large-scale use of machines and their integration into machinery within a factory system (Marx, 1976, pp. 492–642). As Marx noted, the shift to an industrial mode of production entailed a dramatic reversal in the organization of work: “*In manufacture the transformation of the mode of production takes labor-power as its starting-point. In large-scale industry, on the other hand, the instruments of labor are the starting-point*” (Marx, 1976, p. 492). Even though technology has changed tremendously since the time of Marx’s writing, the relationship between technology and the organization of labor is still at the heart of industrial sociology. Digital technologies in particular were central to the controversy around the consequences of automation that developed in the 1960s and 1970s. Inventions such as computerized numerical control machines became a touchstone in the debates around de- and upskilling (Blauner, 1964; Braverman, 1974), the organization of work (Blau et al., 1976; Woodward, 1965, 1970) as well as industrial relations more generally (Burawoy, 1985; Noble, 1984). Today, technologies such as 3D printers, the Internet, or artificial intelligence are equally important for a new round of debate over the relationship between digitalization, the future of work, and the dynamics of emancipation and domination (Frey & Osborne, 2017; Mason, 2015; McAfee & Brynjolfsson, 2014; Srnicek & Williams, 2015). Thus, we can say that on this first level, industry refers to a mode of the large-scale production of goods and services, in which work is to a large degree organized around machines.

Yet, beyond the shop floor, the term industry is also used to refer to higher levels of aggregation and therefore includes the (power) dynamics within larger sets, systems, or networks of organizations. For instance, in economics, industry is understood as the system of production on the macro-level of an economy. On this level, it is broken down into different “industry sectors,” each of which is concerned with the production of a different kind of products. Most famously, Jean Fourastié differentiated between the primary sector of extracting raw materials, the secondary sector of the production of products and the tertiary sector of providing services (Fourastié, 1949). In the shift toward the provision of services, he saw “the great hope of the 20th century,” predicting the

reduction of toil as well as a general increase in social security. A similar distinction can be made on the meso-level of analysis. Here, industries, this time in the plural, are sets of companies producing similar products or services, such as the automobile industry. Economists have usually modeled the dynamics within these sets in terms of competition (Dosi, Teece, & Chytry, 1998; Nelson & Winter, 1982). In contrast, sociologists have employed the concept of “organizational field” to focus on the interaction between firms as well as the institutional order which shapes and is shaped by these interactions (Wooten & Hoffman, 2016). Again, one explicit focus of these studies has been “the emergence of sharply defined interorganizational structures of domination and patterns of coalition” (DiMaggio & Powell, 1983, p. 148).

Finally, it should be noted that the organization and reorganization of industries have always been found to be of wider significance for processes of domination and emancipation in society at large. Changes in industry were never merely discussed as confined to the realm of production. Instead, they were seen as connected to processes of increasing rationalization (Weber, 1968), social fragmentation (Tönnies, 1957), identity formation (Marcuse, 1964; Miller, 1987), changes in gender relations (Bell, 1976), or as the harbinger of a utopian society beyond the toils of manual labor (Blauner, 1964). It is on this level that it made sense to speak of specific societal formations as, “pre-industrial,” “industrial” or “post-industrial” societies, even though it should be kept in mind that such terms often take on a performative quality as normative categories used to constitute a difference between “us” and “them.” It is on the same level, and with similar normative implications, that digitalization in contemporary industry touches upon larger societal developments. Users and “crowds” are transformed into a central source of unpaid creative labor, while, on the other hand, they may themselves become innovators (Hyysalo et al., 2016; von Hippel, 2005; Wexler, 2011) and engage in user or open source communities (Benkler, 2016; Raymond, 2001). Digital fabrication technologies afford opportunities for private fabrication and commons-based peer production (Benkler, 2016; Gershenfeld, 2005) as well as the extension of industrial automation, which may be leveraged to increase control over workers *and* engage in political struggles over national identities and the “reshoring” of production.

In sum, the transformation of industry is connected to the dynamics of social emancipation and domination on three levels of analysis. These



include the organization of work relative to the instruments of labor on the micro-level, the organizational field around the production of similar goods and services on the meso-level, and the (self-) description of specific forms of society on the macro-level. As this brief overview has shown, processes of *digitalization* have frequently been thought of as being at the center of important transformations on all three levels of analysis. Yet, just like the term industry itself, the notion of digitalization is in need of clarification. As things stand, it is merely a buzzword, which is deprived of both technical content and analytical value. In the next section, we attempt to introduce some clarity.

## DIGITALIZATION

Even though digital technologies are by no means new, digitalization has become one of the buzzwords of the early twenty-first century. With the proliferation of the term, however, any clarity in terms of its meaning has all but evaporated. Originally, digitalization was used as a synonym of digitization, describing the transformation of analog data into a digital format.<sup>5</sup> Most of the time this means that some form of input is transformed into an array of zeros and ones which are stored in a way that makes them readable by computers. This can include everything from digitally scanned files, to transferring an automotive design to a CAD tool, to converting work time sheets into a digital database.

More recently, a distinction between digitization and digitalization has been made. Digitization still describes the transformation of elements from the analog world into a digital form. Digitalization, on the other hand, describes “the way in which many domains of social life are restructured around digital communication and media infrastructures” (Brennen & Kreiss, 2016, p. 556). This is not a distinction widely represented in dictionaries.<sup>6</sup> Instead, it is applied in business contexts, public debates, by the media and in scholarly articles. In the business world, for instance, the restructuring of social life through digitalization is reduced to “the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.”<sup>7</sup> With this delimitation of the two terms, digitalization loses its more technical aspects to digitization while maintaining the vague ideas of restructuring social life or business, and all the normative connotations they entail.

Ironically, at the same time the discussion of concrete technological processes is lost, digitalization takes on an air of technological determinism. More often than not, digitalization is used to describe all kinds of changes in society brought about by all kinds of technologies. In this context, digitalization often becomes synonymous with the introduction of digital technologies into new settings. Even where digitalization is perceived in a more limited sense as the introduction of new technology into companies, the variety of phenomena the term is used to describe is immense. It refers in some cases to the introduction of enterprise resource planning (ERP) software in companies—a process which began in the 1970s, or even earlier. In other cases, it relates to the use of artificial intelligence, for example, by human resource departments, or the use of collaborative robots in production—both technologies which have been promised for decades but only on rare occasions have left the prototype or demo stage.

In addition to subscribing to a techno-deterministic logic while simultaneously being emptied of concrete technical content, common usage of the term digitalization also frequently confuses sociotechnical dynamics on various levels of analysis—a finding that corresponds to what we have said about industry in general. As examples such as the introduction of ERP, collaborative robots, or smart factory solutions show, digitalization frequently refers to changes in the organization of work within single organizations. However, digitalization is also frequently used to foreground phenomena of cooperation and competition between firms, which we would situate on the meso-level of analysis. These include, for instance, the increasing ubiquity of digital infrastructures between organizations, as well as the changes in the organization of specific industries, such as the shift to “mobility as a service” in the automobile industry. Finally, there are concepts like the “platform economy” which delineate transformations of large sections of the economy and society more generally.

An example illustrating all of the above problems in the discussion around the digitalization of industry is a debate which, in Germany and other countries, got labeled “Industrie 4.0”:

Industrie 4.0 combines production methods with state-of-the-art information and communication technology. The driving force behind this development is the rapidly increasing digitisation [sic] of the economy and society. It is changing the future of manufacturing and work in Germany:

In the tradition of the steam engine, the production line, electronics and IT, smart factories are now determining the fourth industrial revolution. (Plattform Industrie 4.0)<sup>8</sup>

From this perspective, the digitalization of industrial production takes place because technology is changing on a societal level. However, this debate does not stop there. Organizations and nation-state which do not conform to the narrative of increased digitalization driving a fourth industrial revolution are considered to be in danger of losing their competitive edge. Consulting agencies have therefore started to offer programs to evaluate the “digital readiness” of companies, and states provide funding to companies that want to catch up.

For decades now, STS and OS have argued that such a reduced linear perspective cannot account for the complex and intricate interplay between ongoing technological, societal, and organizational developments (Bijker et al., 1987; Bijker & Law, 1992; Collins, 1983; Jasanoff & Kim, 2009; MacKenzie & Wajcman, 1985; Meyer & Rowan, 1977; Meyer et al., 1983; Perrow, 1986). In this tradition, the contributions in this volume suggest that current developments cannot be explained simply by the advent of new technologies. In order to reclaim the notion of digitalization as an analytical category, it is necessary to acknowledge the enormous empirical complexity of the phenomenon, while analytically disentangling the different relations and influences it encompasses. A first step in this direction is to differentiate between the different levels at which digitalization takes place. Corresponding to the different levels of the notion of industry described above, we propose to distinguish between digitalization on three different levels, for each of which we suggest a specific analytical focus. In this analytical schema, we differentiate between (a) the actual routines and practices observable in contemporary industrial organizations on the micro-level, (b) the strategic planning and decisions by collective actors, such as companies or governments on the meso-level, and (c) societal discourses and debates on the macro-level (Meyer, forthcoming). This framework provides a starting point for a more differentiated understanding of digitalization in contemporary industries.

Returning to the example of industrial digitalization in Germany, it allows us to see that the massive debate on “Industrie 4.0” (level c) has not led to the implementation of smart factories (level a) on a larger scale (Meyer, 2019). But it has triggered a debate on the future

of work (level c). Under the heading “Arbeit 4.0” (work 4.0), state actors like the Federal Ministry of Labour and Social Affairs along with labor unions, works councils, and companies have come together to discuss what work could and should look like in the future (Meyer, 2018). This confluence has led—among other things—to an initiative (level b) where, within a variety of organizations, so-called experimental spaces (‘Experimentierräume’)<sup>9</sup> have been created, within which companies endeavor to test a wide range of ideas about the future of work—often in close collaboration with works councils and labor unions. So, in this case, our perspective enables us to discern how the debate on new technologies and their impact on society triggered a very different debate which by now has probably had a greater impact on organizational practices than the introduction of new technologies, i.e., the original claim and starting point for the debate.

In this spirit, one of our main suggestions throughout this book is to take a closer look at the different levels on which digitalization unfolds. One goal of this edited volume is to question the prevalent view of technological determinism in relation to digitalization. More specifically, we want to push past a perspective that characterizes digitalization solely as an expression of rationalization and increases in efficiency and competitiveness. Instead, this volume addresses the digitalization of industries starting from its wider social context, and specifically from its various relationships to processes of domination and emancipation.

## THE CONTRIBUTIONS

With these conceptual clarifications in mind, the present volume aims to contribute to a growing body of critical scholarship that seeks to deepen analysis, complicate binary logics, weave together disparate strands of arguments, and demonstrate the embeddedness of current developments in larger, often ambiguous or ironic historical developments. While our authors have chosen widely differing subject matters as well as analytical approaches, their contributions converge around three of the major dynamics linking the topics of industry, digitalization, and domination/emancipation in contemporary Western societies. In particular, they present thoughtful theoretical arguments as well as detailed empirical investigations around the three core issues of *work*, *digital fabrication*, and the *relationship between industry and users*. As we have sketched out above, each of these issues strikes us as offering particularly rich

opportunities for exploring the intricate dynamics of social emancipation and domination in digitalized industries, not least of all because they intervene into three deeply embattled strands in the recent literature.

In all three of these sections, this volume aims to contribute to an analytical understanding of the complex relationship between industry, digitalization, and domination/emancipation. Despite the different perspectives assembled here, all of the contributions subscribe to two analytical principles. First, they do not subscribe to a logic of linear technical development and subsequent social change. They challenge the idea of a string of technical or industrial revolutions as much as they are critical of the idea that the introduction of new technologies unidirectionally produces specific social relations. Rather, they carefully analyze specific technological developments as part of the social arrangements out of which they are born and on which they in turn have—sometimes contradictory—effects. Secondly, the volume questions understandings of the relationship between industrial digitalization and domination/emancipation that are based on a simple binary logic, i.e., either postulating digitalization as the technical realization of emancipation or as the final victory of domination. Instead, the contributions emphasize the ambiguities and contradictory potentials of the sociotechnical apparatuses of digitalization (Schaupp, 2017).

The overall thrust of these articles is not to reject all that has been written on the relationship between social emancipation/domination and the ongoing digitalization of contemporary industries. Their approach is rather to deepen, complicate, weave together, and add perspective. The articles do so by tracing the genealogy of current management techniques and technologies (Nosthoff & Maschewski; Schobin & Staab). They investigate the continuities in seemingly revolutionary changes (Butollo et al.; Kalf). They study the complicated relationships between classical industry and the maker movement (Frey & Schneider; Wenten). They lay bare the reshuffling of global inequalities so deeply entwined with the rhetoric around de- or re-industrialization (coons). Finally, they offer a more complicated picture of how digital tools and platforms are connected to specific forms of emancipation for (some) users, while simultaneously materializing new patterns of discrimination, precarization, and exploitation (Bruni & Esposito, Möllenkamp, Tøndel & Seibt).

The first part of the book addresses the relationship between *digitalization and current working practices*. Going against the grain of popular rhetoric about a *second machine age*, a *third industrial revolution*, or an

*Industrie 4.0*, these contributions take a somewhat genealogical approach to the topic, tracing how the dynamics of emancipation and domination have been constructed throughout the long and complicated history of digitalization in industrial work. Opening this section, Yannick Kalff provides a painstaking analysis of the connection between “work 4.0” and the promise of new digital forms of democratic participation in the German context. By tracing how ideas of democratic participation continue to be shaped by well-established hegemonic discourse positions, he shows how its emancipatory scope is limited and turns into a vehicle for increased flexibility and agility in production. Florian Butollo, Martin Krzywdzinski, and Ulrich Jürgens also take issue with the idea of a fourth industrial revolution by pointing out the continuities and discontinuities between the practices of lean production and those of *Industrie 4.0*. They demonstrate that, in contrast to the dominant discourse of greater autonomy for employees, current implementations of *Industrie 4.0* inherit from lean production elements of increased standardization and control, while neglecting more participatory approaches to the organization of work. Anna-Verena Nosthoff and Felix Maschewski span an even longer timeframe by showing how current management practices draw on ideas first popularized in classical cybernetic theory and practice. They analyze how freedom and control are interwoven in classical cybernetic concepts and show how the renaissance of these ideas in contemporary strands of systems and management thinking leads not to the reduction of domination, but to a new form of integral domination. Janosch Schobin and Philipp Staab close the section by presenting a thoughtful analysis of the technological foundations of digitalized working environments through the lens of gamification. By arguing that gamification has been a central element in most, if not all, digital interfaces, they focus our attention on the ways in which attempts at controlling work are deeply woven into the genealogy of our material technologies and how emancipation depends on the ability of users to adapt, master, and subvert these.

The second part of the book is concerned with the promises of emancipation that have always accompanied the history of *automation and digital fabrication*, complementing fears of deskilling, mass unemployment, or domination by the machine. Resisting the binary logic of such narratives, these articles offer deep empirical insight into concrete cases linking digital fabrication to hopes of emancipation. In doing so, they shed light on their inbuilt biases, ironies, and contradictions.