

The hard matter of abstraction

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The hard matter
of abstraction
A guidebook
to domination by
abstraction
Tomislav Medak

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Hyperbolic diagnostic
 When faced with the question, what are the developments that structure the present, the social imaginary resorts to hyperbole. The epochal changes over the last decades, catalyzed by the parallel rise of digital communication technologies, the knowledge economy, the “new global order“, the global neo-liberalization, the creeping crisis of US hegemony, climate change, the war on terror, and the mass surveillance, form a complex matrix of interdependent social transformations that neither common sense nor critical analysis can easily encompass and comprehend in their totality. Faced with this

Three ways to approach abstraction

1 _____ These are respectively central concepts in Gilles Deleuze, “Postscript on the Societies of Control”, in “October” 59 (January 1, 1992), 3–7; Michael Hardt and Antonio Negri, “Empire” (Harvard University Press, 2000); Giorgio Agamben, “State of Exception” (University of Chicago Press, 2005); Comité Invisible,

“A nos amis” (La Fabrique Eds, 2014); Paul Cruizen et al., “The Anthropocene: Conceptual and Historical Perspectives”, in “Philosophical Transactions of the Royal Society” of London A: Mathematical, Physical and Engineering Sciences 369, no. 1838 (March 13, 2011), 842–67, doi:10.1098/rsta.2010.0327.

complexity, the social imaginary develops a diagnostic that tends to isolate one social transformation—a hyperbole—that it sees as a privileged point of entry or one transformation that dominates all of the others.

So much so that the chosen social transformation then typically serves as a name giver for an entire epoch. We are thus purported to live under societies of control, Empire, permanent state of exception, regime of governing by crisis, the anthropocene, and so on.¹ Technology-driven transformations are in particular conducive to such detection of epochal change. Technologies can have a disruptive impact on our social relations and our relations to the environment, an impact that seems to be even less under our

control than the political or social transformations. We are thus purported to live in an epoch dominated by the rise of robots, the circuits of cybernetic control, the dragnet of algorithms, the dataveillance, the trappings of narcissistic self-representation, or the black box societies.²

C_____ritique of ideology
Such ascriptions of epochal agency to an isolated social or technological transformation can indeed have a powerful explanatory effect. By isolating only a single transformation they provide an intuitive grasp of the processes that are too complex and too opaque to be fully understood by social actors at the level of their immediate social reality. To access the abstract logic of relations

2. _____ For more on these concepts see Paul Krugman, "Rise of the Robots", in "The New York Times", accessed May 21, 2015, <http://krugman.blogs.nytimes.com/2012/12/08/rise-of-the-robots/>; Alexander R. Galloway, "Protocol: How Control Exists After Decentralization" (MIT Press, 2004); Glenn Greenwald, "No Place to Hide: Edward Snowden, the NSA, and the U.S.

Surveillance State" (Metropolitan Books, 2014); Lev Grossman, "You — Yes, You — Are TIME's Person of the Year," in "Time", December 25, 2006, <http://content.time.com/time/magazine/article/0,9171,1570810,00.html>; Frank Pasquale, "The Black Box Society: The Secret Algorithms That Control Money and Information", 1st Edition (Harvard University Press, 2015).

that operates at the level of social structure and sets the condition for their action would otherwise require a methodological inquiry—a daunting task. However, by focusing rather on isolated elements of that structure—what in Whitehead's words constitutes a "fallacy of misplaced concreteness"—these diagnostic readings achieve an understanding of social reality that is not necessarily false. First, they reflect the perspectival positions of particular social actors as conditioned by social structure—i.e. their "cognitive mapping" of how processes at the level of social totality structure and restructure the reality accessible to their experience and their social categories.³ Second, they reflect how social institutions are responding to

3. _____ The notion of cognitive mapping follows Jameson's definition: "a situational representation on the part of the individual subject to that vaster and properly unrepresentable totality which is the ensemble of society's structures as a whole." Fredric Jameson, "Postmodernism, or, the Cultural Logic of Late Capitalism" (Duke University Press, 1991), 51.

those processes by creating adaptations in the organization of economic, institutional or legal affairs to accommodate or countervail them—i.e. forms of social reflexivity in response to the processes unfolding at the level of social structure.

If we don't want to simply wave off these readings, but want to take them at their word, we have to go analytically a level further in abstraction. A critical account of those positions requires showing the generative relation between the social categories available to a particular social position of those doing the reading and the social institutions that ground such readings in their respective social realities. Both the categorial and the institutional are the result of a reified social practice

and can be understood in terms of their historic specificity. Thus, to unfold an ideological critique of those categories and the social institutions that ground them, we would need to start from an analysis of their coevolutionary relation. To transform them, we need to resort to collective acts of determinate negation from within that relation.

R_____eal abstraction

This guidebook, however, does not intend to pursue any of those hyperbolic diagnostic readings nor develop further a critical ideological account of such readings. Instead, it will go yet another analytical level of abstraction further by analyzing the real abstraction that grounds and regulates the relations of such epistemic

notions to their social reality in the abstract logic of capitalist relations. It will chart a general theoretical outline of how abstraction—at the various levels of social reality, starting from relations of production all the way to property relations—acts as a concrete material force in the world, how abstraction organizes the rationality of social institutions, and how abstraction structures categories used for their understanding. By grounding the categories and institutions in the abstract logic of capitalist relations, the real abstraction drives the historic transformations that reproduce the capitalist domination.

But before we continue with the analysis of real abstraction, a word is warranted about the contradiction between the high-

ly practical format of a guidebook and the highly impractical topic of abstraction that is bound to raise some eyebrows. Appearing in a publishing series dedicated to manuals, this guidebook in fact looks at how the division between the concrete, practical, and manual on the one hand versus the abstract, structural, and intellectual on the other is constitutive of a historically specific and reified social reality that we inhabit. As we move through economic, technological, and cultural environments that compose our social reality, their complexity is made navigable for us through procedures, signals, and instructions. And yet as we move through these environments, often perusing manuals ranging from workplace task lists to psychological self-help books,

in which those procedures and desired actions are laid out for us, we move through systems with little impact on the general direction of structures governing their operation. To act on those requires different modes of operation and different manuals, instructing us rather how to lose our sense of the practical and how to betray the logic of the operative. Such is this manual: aimed at charting how multiple and nested forms of real abstraction at various levels of our experience operate as a material force shaping our reality and reproducing the domination of capital over labor.

The guidebook will start from the notion of abstract domination in capitalism, circumscribe how it shapes social epistemology and technoscience, and then

give more detailed analyses of how that highest level of abstraction under capitalism is reflected in lower level abstractions that are specific to the dynamic of technological development and the transformations of the organization of production, regulation of commodity flows, and property relations that follow in its wake. It is these lower level abstractions that stand closer to the concrete experience of social actors and their capacity to oppose the operation of abstraction in their lifeworld.

A _____ abstract labor,
commodity, value

Under capitalism workers must sell their labor power in order to earn money with which they can buy products needed for their own subsistence and the subsistence of their families. Their labor thus enters into an exchange with the products of other laborers' labor. In order to be able to enter into the exchange with the products of other laborers' labor, their labor has to become quantifiable in a universal measure of value – the general equivalent. The qualitative aspects of concrete labor they perform, their specific actions and skills that go into executing them, as well as the qualitative aspects of

Domination by abstraction

use values they produce by their concrete labor are thereby transmuted into an abstract labor and an exchange value that can be quantified and exchanged for the product of any other labor.

This transmutation of concrete, use-value-producing labor into abstract, exchange-value-producing labor is accomplished by the double character of commodity that is a synthesis of use value and exchange value.⁴ By entering into an exchange of their labor power for wage, the workers contract out their productive capacity to capital. The capital in turn undertakes to maximize the productivity of their labor power to produce as many commodities as possible that it can then endeavor to sell above the cost

4. _____ For a succinct exposition of the real abstraction of value-producing labor see Michael Heinrich, "Kritik der politischen Ökonomie: Eine Einführung" (Schmetterling Verlag, 2005), 45ff.

of contracted labor and other investments into production, thus generating a surplus it can appropriate. In the continuously expanding production of that surplus value, where the surplus value produced is reinvested to produce more surplus value, the productivity of labor progressively grows, resulting in an ever greater social material wealth that remains unequally distributed between those who own the means of production and those who own nothing but their labor power.

The inherent measure of value of any commodity is a quantity of abstract labor that is socially considered necessary to produce it. That quantity of abstract labor is measured in equal units of time. It is socially necessary in so far as it is deter-

that analyze the capitalist mode of production from the standpoint of labor, while failing to notice that it is exactly labor—in its abstract-mediating form—that dominates the society. These theories situate the problem of capitalism in the mode of distribution—i.e. property relations and social redistribution—without being able to ground their critique in the mode of production.

5. For an elaboration of how form-determinations of abstract labor, commodity and value mediate the totality of social production see the chapter “Abstract labor” in Moishe Postone, “Time, Labor, and Social Domination: A Reinterpretation of Marx’s Critical Theory” (Cambridge University Press, 1995), 123ff. Postone is particularly poised to ground social mediation in the category of abstract labor in order to oppose theories

mined by the level of productivity of all competing producers producing a particular commodity and by the relative need for that commodity in the totality of goods that are needed in a society. Hence, the value is determined not directly when a commodity is produced, but only later when it enters exchange. If more use value is produced than turns out is needed, its exchange value will drop. If it is produced in less time than is on average required by competing producers, it will produce a higher surplus. Thus, the value of a particular labor and its product is determined only from the totality of values produced for exchange and mediated through the real abstraction of abstract labor, commodity and value.⁵

The social production under capitalism is not coordinated by an agreement between associated producers nor forced onto them by a person or a class of persons. Rather, it is a form of social production coordinated and dominated by an abstract mediation of production for exchange at the level of social totality, conducted under the imperative of the self-expansion of value. The law of value works “behind the back of the producers”. While they come together as private individuals pursuing goals of subsistence and reproduction, their coming together is organized by the invisible hand of production for exchange. Thus, abstraction appears as an impersonal, autonomous, and objective force that both provides a form of social synthesis that holds the

social system together and orients its structures and development towards the continuous expanded reproduction of that system.

The structuring categories of the capitalist mode of production—labor, commodity, and value—all have a double character: concrete labor—abstract labor, use value—exchange value, material wealth—self-expanding value. They double firstly as the material process of production needed for sustaining the livelihood and secondly as an interrelated set of higher level abstractions. The self-reproducing logic of these interrelated abstractions structures social relations and is a fundamental characteristic of the capitalist mode of production, one that abstractly dominates

the capitalist society. As a consequence, in that nexus of real abstraction, labor is not only dominated by capital, but also dominated by its own abstractly-mediating character. If the capital's ownership over the means of production were to be abolished and the value-producing organization of labor maintained, as was largely the case in real-existing socialisms, proletarians would continue reproducing capital-relation by the dint of their own value-producing abstract labor. Only by working to abolish the domination by abstraction, including the abstractly-mediating character of labor itself, do they begin emerge from that domination.⁶

Real abstraction, social epistemology and technoscience

As already indicated, capitalism accomplishes the transmutation of use-value-producing concrete labor into an exchange-value-producing abstract labor. This abstract labor, as a value producing labor, is not a separate, additional labor to concrete labor, but rather an immanent aspect of labor under the capitalist mode of production.⁷ This is an abstraction that is an abstraction operating in the real and with real effects on the character of labor and social relations. Marx speaks, accordingly, of real abstraction.

In Marx's critique of political economy the central categories live a double life. At the structural level they appear as categories of essence—commodity form, surplus value, self-expanding value, and capital.

7. Michael Heinrich, "Kritik der politischen Ökonomie: Eine Einführung" (Schmetterling Verlag, 2005), 46-47.

6. Ibid., 123ff.

But, proceeding from the most abstract level of analysis of capital viewed in isolation to the level of the reproduction of capitalist system under the regime of many capitals as they are experienced in the economic reality, Marx is able to show that the categories of appearance in which they are perceived by social actors—profits, goods, prices, and wealth—are necessary for the realization of capital and thus for the continuous reproduction of capitalist relations. How social actors perceive their reality is structured by the relations of their immediate reality to real abstraction that structures the social totality. Yet, their perception of the social totality unfolds through the lens of their immediate reality and that sets the perspectival horizon of

their socially productive activity, of which we have said a few words in the introduction. Thus the social categories that actors use are not mere mental abstractions derived from the neutral observation of concrete processes. They maintain an internal and structured rapport to the social totality. The structure of social cognition and the social construction of cognition in general is thus structured by the processes of real abstraction.

The implications of real abstraction on mental abstraction, i.e. of form-determinations of capital on formalizations of abstract reason, initially indicated by Marx, were further developed in the work of Alfred Sohn-Rethel.⁸ Sohn-Rethel sought to demonstrate that the

8. ———, Alfred Sohn-Rethel, "Intellectual and Manual Labour: A Critique of Epistemology" (Macmillan, 1978).

cognitive abstractions of modern reason become historically only possible once the concrete labor is abstracted and society held together by the synthesis of commodity exchange. In his view, all the building blocks of pure reason are the result of that abstraction: time and space as the abstract medium wherein the circulation of commodified goods unfolds, substance as the immutable character of commodity in exchange, causation as the negative implication of commodity's potential perishability.⁹ There's a distinct sense of overreach and simplification in Sohn-Rethel's schema—particularly as he grounds the capitalist social synthesis in the process of exchange rather than in the relations of production. The historic trajectory of his diagnostic starts

9. Thus Sohn-Rethel manages to demonstrate that the foundation of modern epistemology, with the historically particular Kantian articulation of its grounding concepts and with the historically specific formation of individual subject performing the intellectual labor, is

part of the development of social relations and not simply a reflection of trans-historic features of a human species. In Sohn-Rethel's terms the social synthesis is prior to the transcendental synthesis. *Ibid.*, 169.

with the emergence of monetary exchange in Antiquity. He thus fails to delimit historically and conceptually the capitalist mode of production and the science under its domination from earlier modes of production and earlier developments of science. However, if we limit the analysis to the historic period where capitalist mode of production is socially dominant, it is warranted to claim that the fundamental notions of technoscience and its directions of development are grounded in the real abstraction of capitalist social structure.

This is primarily evidenced in the division of intellectual and manual labor. Under conditions of monopoly capitalism capital organizes the production process in the method of constant

flow to mass produce a uniform product. This requires that the work be analyzed, segmented and accelerated in terms of sequences and time. Once the work has been analyzed and workers assigned their strictly separate tasks, the intellectual aspect in the execution of work can be fully transferred to the management that can now organize work in accordance with the exigencies of constant expansion of production. But, once it has been separated from the execution of work, the intellect is no longer appropriated solely by management. With the conscription of modern science into the service of industry, it assumes a reified character of an autonomous social force acting above the level of an individual factory in the shape of a system of tech-

noscience. It is to this fetishized character that Sohn-Rethel refers when insisting that this transcendent activity of intellectual labor “is made almost unassailable by modern positivism which places the origins of science outside the range of questions which can be asked.”¹⁰ [...] The practice of science in the service of capital pays allegiance to an idea of the intellect which is a fetish concept of the human mind seen as the spontaneous source of the non-empirical concepts basic to science.¹¹ As an expansion of the subordination of manual labor to a scientifically managed process of production, the division of labor into intellectual and manual functions to reinforce the domination of capital over labor.

¹¹ _____ibid., 180.

¹⁰ _____ibid., 158.

Having established the structural relation of technoscience to the highest level of real abstraction, we now turn to various facets of lower level abstractions through which the capitalist system of technoscience informs and transforms the concrete reality of the production process: the recomposition of labor, the ambivalent class position of intellectual labor, the standardization processes and the intellectual property regime. These are organizational, institutional and legal abstractions that are of particular relevance for the question how abstraction structures, reproduces and regulates domination under capitalism.

¹² Harry Braverman, "Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century" (NYU Press, 1998), 58.

S_____cientific management and the deskilling of labor
Harry Braverman in the opening passages of his Labor and Monopoly Capital notes: “the distinctive capacity of human labor power is therefore not its ability to produce a surplus, but rather its intelligent and purposive character, which gives it infinite adaptability and which produces the social and cultural conditions for enlarging its own productivity, so that its surplus product may be continuously enlarged.”¹² It is this innovative and productive capacity of human labor that the capital wants to harness in its pursuit of ever greater surplus value. However, the infinite adaptability of human labor

Abstracting the labor

power that can lead to higher productivity and higher surplus value for capital can be optimized and maximized only under a specific organization of labor process. To wit: while the work of skilled craftspeople can be highly innovative and productive, their labor can neither be easily made more efficient nor cheap enough to extract the highest surplus product.

The historic development of capitalism had to overcome this obstacle and organize the process of production in such a way that the skills immanent to labor could be made conducive to capital's interest. This it first achieved, as famously observed by Adam Smith, through the detailed division of labor in manufacture and, as observed by Charles Babbage, its subse-

quent simplification and cheapening. But this process didn't come into its full actualization before Fredrick Winslow Taylor developed and applied the methods of scientific management. In Braverman's analysis the scientific management formalized three principles that catalyzed the full-fledged development of the capitalist mode of production. First, the separation of the conception from the execution of work. Second, the transfer of control over the conception and thus command over organization of work into the hands of the management. Third, the transfer of technical knowledge from the direct producers to the specialized R&D sectors directly responsible to the management. This abstraction, separating the intellectual from manual labor

and handing it into the hands of managerial control over labor, has had a number of significant consequences for the development of capitalism. First, the constant deskilling of labor which allows for the substitution of a highly trained, skilled workforce with less skilled, easily replaceable, and cheaper members of the reserve army of labor. Second, the subsumption of workers to the production process shaped by organizational, technological and scientific requirements of capital. Third, creation of a middle class of more skilled managerial, technical, and administrative workers who are themselves subsumed under the scientifically organized detailed division of labor and gradual deskilling. Fourth, automation, replacement of workers by machines, and

resulting gains in productivity that create a growing reserve army of labor. Fifth, commodification of ever broader aspects of everyday life such as production and preparation of food, care work and maintenance work, and their replacement by the service industry, which now absorbs both the sections of workers left unemployed by automation and the new sections of female workers enlisted from the now-commodified activities of domestic labor.

The cumulative trajectory of the process of real subsumption of skilled labor under the capitalist organization of production has been the weakening of the position of labor. Even under the conditions of growing employment, the expansion of the reserve army of labor as

a result of commodification of domestic labor, global integration of capitalist production, and labor migration, has kept the solidarity and resistance of labor in check.

It is particularly after the crisis of overproduction and profit squeeze of early 1970s that the fragmentation of organized labor as an effect of scientific-ly managed capitalism has shown its full force. Relocation of production has successfully subjected the skilled and organized segments of the labor force to the threat of unemployment, whereas outsourcing has pushed the replaceable, unskilled segments of the labor force into casualization.¹³ While sector-level collective bargaining agreements and workers' participation in management in

rare countries such as Germany were able to set standards for the employees across the entire labor market and fend off this process, in most of the countries the trend was in the opposite direction leading to increasing fragmentation and weakening of the proletariat.

Some of the social effects of this process have been buffered by the expanding availability of private credit that followed in the aftermath of the crisis of 1970s. High interest rates imposed by monetarist policies in the early 1980s spurred the tremendous growth of the financial sector, where capital suddenly discovered high levels of profit that were absent from the real economy. However, since the credit crunch of 2008 the palliative effects of private

¹³_____. An updated view of how processes of deskilling have transformed since Braverman's ground-breaking work published in 1974 can be found in Ursula Huws, "Labor in the Global Digital Economy" (Monthly Review Press, 2014), 34ff.

credit, on both the underemployed labor and the capitalist expansion, seem to be over.

As long as production still requires the consent of workers, the place of production remains an important arena of social conflicts. But, as labor finds itself on the defensive—fragmented and fearing the threats of automation, outsourcing, and relocation of production—its concern becomes more maintaining what it's got rather than developing the forms of class struggle that are anti-systemic and transformative. The class struggle can no longer be pursued by labor unless it starts from the problem of changed class composition, where an increasing number is left outside of the wage-relation or in a casualized relation to it:

the un(der)employed, the subproletariat, the indebted students, the poor and all the other factions of the underclass. The power of labor “inside the knot”¹⁴ that can challenge capital at the point of production is dulled by the growing segment of those who remain outside.

L_____abor in the circuits of computerization

However, the class re-composition cuts both ways, making alliances within the ranks of labor daunting. Deskilling is not a one-way process: activities and tasks that are simple, segmentable into steps, repetitive, and thereby optimizable find themselves subject to automation. Nowadays, computers are replacing those administrative and service tasks in which the data processing activities

can be computerized, the interaction between operations optimized, the costs of regulation externalized, and/or the transaction costs lowered or passed on onto the consumer. This is exactly what is now happening in tourism, retail, and transport sectors where the process of disintermediation unleashed by internet platforms is cutting out the historically established intermediary occupations and services such as travel agents, traditional airlines, hotel accommodation, bookshops, record shops, or taxis.

In that process of replacement, however, the innovating workforce continues to be highly skilled and in demand. The middle corporate ranks of engineers, scientists, designers, and creative workers find

themselves in an ambivalent position where they are wage laborers having to sell their labor and where their work contributes to the conception and managerial command of the production process. This aligns their professional interest with the technical optimization for the benefit of the enterprise and frequently to the detriment of workforce that is replaceable. This can be observed in the tech industry where the polarization between top talent, enjoying superior salaries, benefit plans, and stock options, and casualized workers, on workfare and zero hour contracts with no access to perks such as gourmet cafeteria or company campus bicycle, is sustained by a highly complex process of optimization of large-scale operations. Consider warehouse

workers at Amazon¹⁵ or “Scan-Ops” at Google¹⁶. Between them stand middle management, administrative and clerical occupations that are no less subject to deskilling, outsourcing, or automation.

The replacement of highly demanding tech jobs is, in turn, made difficult due to the frequently indeterminate and changing nature of those tasks. For example, the profession of programmer has been particularly hard to define. From its emergence in the 1950s, the profession has been—as Nathan Ensmenger details in *The Computer Boys Take Over*¹⁷—marked by a permanent crisis of definition of what constitutes its core skills. This has resulted in a perpetual scarcity of trained programmers, as well as in

resistances the profession encounters from the activities and occupations that it is supposed to automate. Early commercial computers required up to 30 programmers, meaning that the computer manufacturers could produce much more hardware than there were operators available to run them. Pioneering large-scale software projects, such as the development of the SAGE air defense ground system initiated in 1955 by the RAND corporation, required more programmers than existed at the time and the project had to train 7,000 programmers over five years to meet its own demand. Given the lack of high-level programming skills in the newly-recruited workforce, the programming tasks were subdivided into detailed small tasks, not

15. ———, “Anger at Amazon Working Conditions”, Channel 4 News, accessed August 4, 2015, <http://www.channel4.com/news/anger-at-amazon-working-conditions>.

16. ———, “Workers Leaving the Googleplex”, accessed August 4, 2015, <http://www.andrewnormanwilson.com/Workers-Googleplex.html>.

17. ———, Nathan L. Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise* (MIT Press, 2012).

16. ———, “The disadvantaged position of workers digitizing books for Google was aired to the public through the work of the US artist Andrew Norman Wilson”,

unlike those at the production lines. Elsewhere the lack of programmers pushed the paradigms of software development toward the production of code that could be reused across tasks and platforms, leading to the subsequent development of routines, subroutines, assemblers, compilers and programming languages. The inherent tensions in the applied programming between creative aspects of programming and tedious negotiation of complex organizational structures with which software was supposed to interface, as well as the disagreements whether programmers should be trained as computer scientist or receive practical training through certification and practice, has continuously perpetuated the ambivalent position of pro-

grammers in the ambit of class struggle. That position is further made ambivalent by the fact that programmers can easily move up the ranks or leave the employment and become employers themselves. The trend of start-ups has worked to that effect, driven by the investment frenzy of venture capital and interests of large IT monopolies that want to make sure they are the first to acquire any new service that emerges and that might threaten their monopoly position if bought up by another large competitor. The hacker no longer works the day for the corporation and the night for the cause. Rather he himself – and it's still mostly a him – becomes the corporation working to develop a cause to sell it to yet larger corporation.

This oscillating position between being inside and outside the working class instills two opposing value orientations among programmers: one toward autonomy, another toward social engineering. It's a class conflict in a single individual that is reflected in technological choices. Communities of technologists have an impact on which innovations and technologies are developed to optimize the processes of production, but their position is structurally ambivalent and thus never neutral.

**A_____utomating the automators
Yet, not all is rosy for the programmer either. If we go back once more to the early history of computing, we'll see that regardless of its unstable class identity, the programming**

profession has been subject to both automation and upskilling from the very start. In the early days, before the profession was actually born, it was based on clerical female labor that consisted in connecting cables to enter numerical operations into the first universal computers. Soon, as repetitive tasks of entering numbers were replaced by automatic programming, the programming was upskilled to a predominantly male engineering and scientific profession. The replacement of numerical programming by symbolic programming—in the form of computer aided programming and early programming languages—was motivated to a large degree by the need to rationalize the programming work in order to reduce its tediousness and the demand for programming

workforce. These processes of rationalization were both driven and opposed by the programmers. Structured programming with its engineering approach to the task of programming a computer allowed to move the profession “from a craft to a standardized industrial practice, and [worked] as a way to create disciplined programmers who dealt with abstraction rather than numerical processes.”¹⁸

In fact, in a trenchant inversion of perspective on the early computer history proposed by Wendy Chun, the automation of cybernetic control through the development of universal computer steered by command instructions can be seen as an extension of the control of male military officers who were issuing commands to the female

clerks. These female clerks were wetware computers before there were hardware computers, tasked with repetitive mathematical calculations required in operations planning or commanded as input operators on the WWII cryptographic machines. “One could say that programming became programming and software became software when commands shifted from commanding a ‘girl’ to commanding a machine.”¹⁹ The emergence of cybernetic systems is deeply characterized by the military and gendered character of the institutional setting from which it emerged and the suppression of the female clerical and scientific workforce and its contribution to the development of universal computer. The growing abstraction of software, which was initially nothing but

19. _____, *ibid.*, 33.

18. _____, Wendy Hui Kyong Chun, “On Software, or the Persistence of Visual Knowledge”, in “Grey Room” (January 1, 2005): 37, doi:10.1162/1526381043320741.

the circuitry of the hardware programmed by physical switches and cable connections, led to an increased demand for ever more powerful hardware. This has led to an enormous advancement where nowadays functions of a computer can be fully emulated within the virtualization software layer of large arrays of computer farms that go by the name of “cloud”. If the first software was nothing but hardware, much of the hardware today is nothing but software. In this advancement the processes related to programming are themselves subject to constant computerization, the automators themselves are automated – replaced by automations.²⁰

Algorithmically driven automation

The classical approach to analyzing the substitution of labor by machines arranges the tasks along two axes: cognitive as opposed to manual tasks and routinized as opposed to non-routinized tasks. It is primarily jobs which are based on labor-intensive routines that tend to be replaced. While the industrial automation was focused primarily at removing the detailed and routinized manual jobs, the focus of computer-based automation is removing the routinized cognitive jobs and technologically complementing the work of laborers doing the non-routine jobs. The aggregate effect of industrial and computer-based automation in the developed economies such as the US since the 1960s and

1970s was a strong trend of replacement of routine manual and cognitive jobs, followed then since the 1980s by a strong trend favoring a more skilled cognitive workforce performing non-routine tasks.²¹ First the blue-collar manufacturing jobs were lost to assembly line robots, then the white-collar clerical jobs were down-skilled by business machines, and finally a widening income gap opened between the highly skilled workers and the rest of the labor force. Since the 19th century technologies have helped drive the prosperity of wide segments of the population of developed economies, but over the last four decades technological advancement and automation have deepened the structural unemployment, produced the winner-takes-all markets,

21. D. H. Autor, F. Levy, and R. J. Murmane, "The Skill Content of Recent Technological Change: An Empirical Exploration," in "The Quarterly Journal of Economics" 118, no. 4 (November 1, 2003): 1296, doi:10.1162/003353303325252801. See Figure 1.

22. Erik Brynjolfsson and Andrew McAfee, themselves no foes of either capitalism or automation, are warning against this development in their "Race

Against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy" (Lexington, Mass: Digital Frontier Press, 2012).

23. Graham Joncas, "Machine Labour in the 21st Century", accessed August 3, 2015, https://www.academia.edu/12215044/Machine_Labour_in_the_21st_Century.

24. *Ibid.*, 2.

and created high levels of individual enrichment.²²

The future for large occupational segments does not look bright either. Recent research confirms that the technological replaceability of cognitive tasks without elements of creativity, problem sensitivity, and flexibility continues to hold.²³ But, more complex cognitive tasks are no longer immune to replacement either. While computers can be complementary to the engineering and scientific occupations—serving not only as a tool, but as knowledge-catalyzing machines that can, for instance, recognize patterns from large sets of data where establishing those connections isn't possible for human cognition²⁴—they can now increasingly solve non-routine tasks and

recursively learn, thus making possible the replacement of even some less creative non-routine cognitive tasks.

A case in point is the high frequency trading where, as Alberto Toscano has observed, the financial sector and stock traders in the pit of the stock market, drivers of the financial derivation processes, are themselves coming under the dominion of automation: “The ‘algorithmic revolution’ could thus also be seen as a phase shift in the organic composition of finance, curiously a domain that had fiercely resisted the depersonalization and deskilling of labour like few others. This devaluation of the embodied knowledge in the pit is the obverse of the valuation of bleeding edge knowledge in

physics, mathematics, and the ‘plumbing’ of markets.”²⁵

After deskilling and replacement of manufacturing labor through industrial automation and after the removal of non-routine cognitive tasks in administration through computerization, the newest trend in technological unemployment brought about by more advanced algorithms in robots is poised to hit the occupations in logistics and transportation, retail and support, and construction. According to a recent study by Carl Benedikt Frey and Michael Osborne, the comparative advantage of humans in mobility and dexterity over robots is diminishing, making 47% of all American occupations fall under the risk of automation.²⁶

²⁵_____. Alberto Toscano, “Gaming the Plumbing: High-Frequency Trading and the Spaces of Capital”, accessed August 3, 2013, <http://www.metamute.org/editorial/articles/gaming-plumbing-high-frequency-trading-and-spaces-capital>.

²⁶_____. Carl Benedikt Frey and Michael Osborne, “The Future of Employment: How Susceptible Are Jobs to Computerisation?” (Oxford Martin School), 44, accessed August 5, 2015, <http://www.oxfordmartin.ox.ac.uk/publications/view/1314>.

However, the findings indicating that tasks can technically be automated does not yet imply that they will be automated, not at the level that they potentially could. There are other economic and non-economic factors at play that might slow down or avert replacement: risk of investing into constant capital might be too great, it might be cheaper to relocate the production, policies might lower the cost of keeping the jobs or might develop new sectors of employment. But, most importantly, it is the resistance of organized labor that can do the most to obstruct the processes of abstraction whereby technoscience shifts the command over productive forces into the hands of capital.

T_____he standardization and the soft law of global exchanges **So far we have outlined how abstraction operates on reality, be it as form-determinations structuring capitalist social relations, as transfer of embodied skills into the technoscientific-ly driven process of production or as increasingly powerful capacity of automation with real-life effects on class composition. Now we turn to the legal regulation and ownership over processes of abstraction through technoscience. While the capitalist mode of production is, at the highest level of abstraction, regulated by an impersonal mediation of abstract labor, commodity, and value, in its dominant form—as a capi-**

Owning the abstraction

talist system with the private ownership over the means of production—the abstraction is regulated, and appropriated, by property relations—as evidenced in unprecedented levels of inequality between societies and staggering accumulation of private wealth within them. Owning the abstraction translates into the legal and economic power to exclude others from the wealth-producing effects of abstraction.

Let's start from the most benign form of regulation—standardization. Standardization is a heterogeneous process that cuts across different scales to enable optimization and reliability of global production and distribution flows. From the segmentation of labor tasks, over the uniformization of production and

management processes, to the interoperability of logistical systems, it cheapens the commodities, streamlines their exchange and secures the legal standing of international business operations. Before a job is broken down into elementary tasks and the experience of the worker is codified, the workplace cannot be easily outsourced or replaced.²⁷ Before a standardized measure in international shipping transport is introduced and the containers become standardized, the revolution in logistics cannot proceed apace.²⁸ Before the international organizations and treaties establish standard-setting procedures, standards cannot “create a, soft law’ of global exchanges.”²⁹

27____ Ursula Huws, “Labor in the Global Digital Economy” (Monthly Review Press, 2014), 72.

28____ Deborah Cowen, “The Deadly Life of Logistics: Mapping Violence in Global Trade” (University of Minnesota Press, 2014), 44.

29____ Keller Easterling, “Extrastatecraft: The Power of Infrastructure Space” (Verso Books, 2014), 18.

An important cornerstone of standardization is the International Standards Organization (ISO), which regulates a range of technical and management specifications related to environment, labor, health care and safety, corporate responsibility, governance and management that allow corporations to get a global seal of approval for their products and operations. Accredited in this international voluntary membership organization are mostly standard-setting bodies and consortia of some 160 states that represent private entities and interest groups such as business, trade associations, consumer and labor organizations. Its standards are copyright protected and licensed to a huge number of certifying private companies across the world. Its most popular

standard is ISO 9000, a quality management standard that has over a million organizations certified according to a set of rules that codify primarily internal operations of private commercial entities. While the ISO 9000 standard codifies the procedural aspects, it makes, for instance, no mention of the conflictual aspects of relation between the employer and employees, thus allowing the certified companies in the zones with low labor protections to claim technical and managerial excellence without making a mention of their problematic role in the international division of labor.

A major boon for the standardization in international trade was the WTO's agreement on Technical Barriers to Trade

Agreements signed in 1995, giving international standards “a major role in harmonizing the technical specifications of goods traded on the global markets so as to avoid such specifications to be turned as an impediment to international trade.”³⁰ Already in 1999 OECD estimated that some 80% of international trade was affected by standards. The industrial standard-setting thus became a “private form of governance [that] continues to enter and assert its authority in a public arena without a public political dialogue.”³¹

Clearly, efficiency and quality are not social bads in themselves. They enable rationality and interoperability of systems. However, the imbrications of standardization with the global

31 _____ *ibid.*, 175.

30 _____ “European Trade-Union Confederation, “Why Standardisation Matter?”, accessed August 6, 2015, <https://www.etuc.org/why-standardisation-matter>.

commodity production catalyzes vectors of international norm-setting and codification that are, in that context, enablers of exploitation of some and proletarianization of others. It is in the process of standardization that the imbrication of institutionalality and rationality of global capitalism come to the fore. Thus the norm-setting presents organized labor with a field of strategically vital yet painfully asymmetric contestation.

Copyrights and labor wrongs

As noted above, the solidification of software into a separate entity, no longer based on direct input of instructions into hardware, but on writing code in a programming language to be executed on an operating sy-

32. _____ "The current status of software as a commodity, despite the fact that its instructions are immaterial and nonrivalrous indicates the triumph of the software industry, an industry that first struggled not only financially but also conceptually to define its product. The rise of software depends both on historical moves, such as IBM's unbundling of its services from its products, and on abstractions enabled by higher-level

languages." Wendy Hui Kyong Chun, "On Software, or the Persistence of Visual Knowledge", in "Grey Room" Winter 2005 No. 18 (MIT Press, 2005), 38.

33. _____ Catherine L. Fisk, "Working Knowledge: Employee Innovation and the Rise of Corporate Intellectual Property", 1800–1930 (University of North Carolina Press, 2009).

stem, introduced a layer of abstraction that transformed programming from a craft into an industrially organized occupation. This separation of software from hardware was underpinned by the creation of property rights and commodification of software. The occupational knowledge of the early coders was being transformed into property rights of their employers.³²

This development isn't new. It follows a long established pattern since the beginning of the 20th century whereby the expertise of employees is transformed into property of employers. As Catherine L. Fisk elaborates in her study of historic relations of worker innovation and industrial property rights,³³ in the competitive capitalism of small industrial firms of the

second part of the 19th century the innovation was the legal title of the engineer, just as the literary work was primarily the legal title of the writer. Back then it was established that the product of intellectual labor morally belonged to the person of the inventor and if the inventor wasn't the owner of the company, but rather a junior partner or an employee, he would frequently move on to start his own company and compete with the former employer on the basis of the new invention. The technological innovation itself was driven by the experience in the production process and not by a separate activity of research. However, with the rise of the large integrated firm, with the separation of R&D and creative departments from manufacture, the stakes for the

companies to secure the intellectual property rights over the innovations and creations produced internally by their workers were suddenly raised—the capacity to exclude the competitors from encroaching on their market became increasingly important. The property rights now had to be brought into the hands of corporations.

However, for this to become an established practice and instituted in law, several legal innovations had to occur. First, as legal title to patent in inventions and copyright in artwork had its foundation in the rights of a person, it was unusual for a legal entity to receive such a title—thus, corporations had to first attain a status of legal personality in order to make

this nexus of individualism of right-holding person and corporatism of innovation in a large firm stick. This is exactly what unfolded in the US around turn-of-the-century.³⁴ Second, the inventors and partially creators had to become wage workers, so that their labor contract would entail that the wage compensates them for the fruit of their work, transferring in return the title to property to their innovations and creations to the firm. The working knowledge now became a secret or industrial property of the company, forcing inventors frequently into non-disclosure agreements and barring them from taking their innovation or their expertise to the competitor or starting their own competing businesses.

34. ____ As Fisk details, two transformations preceded in lockstep: the judicial understanding of corporation slowly migrated from the concept of corporation as an incorporated endeavor of a collective of individuals toward a corporate personhood independent from and contractually bound to individuals. Over the same exact

period, the understanding of copyright slowly migrated from the focus on moral aspects of individual authorship of employees to contractual relations between the employer and employee, resulting in 1909 in a revision of copyright law instituting employer ownership of copyright over works created under employment.

The “working knowledge” of creators didn’t fare better either. Initially promulgated as an equal right meant to incentivize creators and their publishers, with the rise of modern creative industries the copyright was transformed into a right only credited to a person, but almost exclusively benefiting a corporation fighting to assert itself in the market against its competitors. Transformations both in manufacture and culture had the effect of making the economy of intellectual property rights increasingly concentrate in the hands of corporations and decreasing economic significance for the innovators and creators.

The levels of concentration in the industries with large portfolios of various forms of intel-

lectual property rights is staggering. The film industry is a US\$88 billion industry dominated by six major studios. Music industry is a US\$15 billion industry dominated by three major labels. The publishing industry is a US\$55 billion industry where the top 10 take over half of the revenues. Among patent holding industries the situation is a little more diversified, but big patent portfolios in general dictate the dynamics of market power and technological development.

C_____ommodified science and disutility of copyright
Scholarly journal publishing draws the levels of concentration and disservice to the authors and the public into particularly stark relief. It's a US\$ 10 billion industry dominated by

five major publishers, financed up to 75% from the subscriptions of mostly publicly funded libraries and achieving extreme year on year profit margins—in the case of Reed Elsevier regularly of over 30%, with Taylor & Francis, Springer and Wiley-Blackwell barely lagging behind. Given that the work of scientists contributing their scholarly work to the journals of these publishers is not paid, but financed by their institutions and that the publications nowadays come mostly in the form of electronic articles licensed for temporary use to libraries and no longer sold in print, the public would not have to pay twice for the work of publishers and its interest could be served at a much lower cost by leaving commercial publishers out of the e-

quation. But that is not possible. The chief reason is that the system of academic reputation and ranking based on publish-or-perish principles has become fully entangled with the business of commercial academic publishers. Anyone who does not want to put their academic career at risk is advised to steer away from being perceived as renegading on that not-so-tacit deal. While this is patently clear to many in academia, the alternative of open access means not playing by the rules and not playing by the rules has real-life consequences, particularly for younger academics. They have to publish in prestigious journals if they want to advance in the highly competitive and exclusive system of academia.

In scholarly journal publishing copyright exclusively serves as a mechanism of transfer of economic power from the producer to the publisher, giving publishers an instrument of cementing their strangle-hold on the output of academia. However, it's not only copyright that sustains their control. They have also devised forms of control over citation and metrics to keep close tabs on the system of allocation of academic reputation. As a group of researchers in their paper on oligopoly of academic publishing write: “unfortunately, researchers are still dependent on one essentially symbolic function of publishers, which is to allocate academic capital. [...] Young researchers need to publish in prestigious journals to gain tenure, while older researchers

need to do the same in order to keep their grants, and, in this environment, publishing in a high impact Elsevier or Springer journal is what ‘counts’³⁵. Copyright and reputation are extortive instruments that publishers can wield against the authors and the public to prevent the alternative from becoming a norm.

Copyright is a powerful abstraction. All creative work is captured under its commodifying thrall. As soon as something is published, it’s copyrighted. The copyright has a double function—serving as a mostly nominal economic right promising minimal protection to authors and serving as a mechanism of commodification and market power for copyright industries. The benefit of the

companies is argued as the benefit of the authors. Which it is. But only marginally. The producers of creative works—and the public—are held hostage to this arrangement. Just as the wage workers, these creators, scientists and inventors have to sell the products of their labor or directly their labor power in order to secure commodities for subsistence. Thus, their work is transformed into commodity-form.

By commodifying the products of intellectual labor, the intellectual property rights control and regulate the levels of abstraction upwards. The reified technoscience, operating as an autonomous and objective force enabling the abstract domination in the immediate process of production, is thus

³⁵_____, Vincent Larivière, Stefanie Haustein, and Philippe Mongeon, “The Oligopoly of Academic Publishers in the Digital Era”, in “PLOS ONE” 10, no. 6 (June 10, 2015): e0127502, doi:10.1371/journal.pone.0127502.

itself abstractly transformed into commodity-form and controlled by property-form. Real abstraction folds onto real abstraction. Forming a spiraling vortex of capitalist domination leaving human impoverishment and environmental destruction in its wake. Waiting for a tidal wave of history, swelled by the abolishing rise of the wretched of the Earth and the irreversible disruption of the wretchedness of the Earth, to sweep it away.

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