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Paško Bilić

Department for Culture and Communication, Institute for Development and International Relations.

Zagreb, Croatia. pasko@irmo.hr

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Paško Bilić

Department for Culture and Communication, Institute for Development and International Relations. Zagreb, Croatia. pasko@irmo.hr

Abstract: In this article, I argue that the debate about the irrational consequences of rationality discussed within the tradition of the Frankfurt School, and applied to technology and machinery in the concept of technological rationality (Marcuse 1941; 1960; 1964; 1965), can help us better understand and criticize contemporary algorithmic capitalism. I present the example of Google (Alphabet Inc.) and analyse documents such as the Securities and Exchange Filing (SEC) Form 10-Ks in the period between 2004 and 2016, as well as Search Quality Rating Guidelines (SQRG) between 2016 and 2017. I argue that the company developed on the foundation of three different rationalities: organizational rationality of flexible management values and labour utilization; informational rationality of generating value from advertising and audience labour; and technological rationality of surplus value accumulation based on reification of labour and consciousness. The company produces two main types of commodities: audience commodity and algorithmic commodity. Reification blurs the contradictions embedded in algorithms, the relations of production, and commodity exchange in the market.

Keywords: algorithms, automation, reification, technological rationality, commodity exchange, labour, value, praxis

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1. Introduction

“Along with automation and the introduction of labour saving machinery and techniques in some parts of the economy, whole new industries have arisen and may be expected to arise.”

The reference is from a 1955 report to the Congress of the United States by the Subcommittee on Economic Stabilization titled *Automation and Technological Change*. The Subcommittee gathered opinions from witnesses associated with production and industry, management and labour as well as experts in the field of technology and economics. While discussing the introduction of automation in post-war US economy there is a tone of balanced excitement and caution when it comes to the possible effects of these technologies on the economy. Automation was introduced during economic growth and low unemployment. The hearings were analysed in detail by Pollock (1955)



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who warned about potential social and economic risks that automation might bring if introduced without oversight and adequate management.ⁱ

In contemporary digital capitalism (Schiller 1999), the proponents of automation in the form of algorithms promise to bring economic growth and multiple benefits to society. Algorithmic automation is not only influencing the efficiency of the production process but also consumption in digital, online markets of information exchange. Algorithms are aggressively implemented in areas such as finance, stock-markets, health, internet of things, public administration, job search, government surveillance, self-driving cars, social media, and so on. A key difference compared to post-war introduction of automation is the lack of broader institutionalized discussions, regulatory and policy debates prior to the introduction of such rationalities in society. Instead of managing the process, the US government is only reactingⁱⁱ to what many companies, especially in the Silicon Valley and Wall Street, are already doing without oversight and democratic sense of direction.ⁱⁱⁱ Major corporations use automated algorithms under a cloud of intellectual property rights (Pasquale 2015). Simultaneously, the discourse is to trust the benevolent nature of corporate oversight and to have faith in the neutrality and objectivity of technical tools devised for fulfilling our own desires and needs. Algorithms can only bring multiple benefits to humanity.^{iv} Yet the understanding of humanity and human experience advanced by major companies is reduced to more efficient, or obsolete, workers as well as streamlined consumption in the digital marketplace. Such cost reductions do not benefit citizens, but serve as tools for automated accumulation of surplus value by processing information and metadata (Pasquinelli 2009; 2015).

This paper offers a critique of the political economy of algorithms by focusing on the corporate production, dissemination and global management of algorithmic artefacts by Alphabet Inc., a company that owns Google as one of its flagship corporate segments. To provide theoretical grounding, I will evoke the concept of technological rationality developed by Herbert Marcuse (1941; 1960; 1964) and update his ideas to contemporary capitalism. I also address some of the contemporary readings of the Frankfurt School (Kellner 1991, 2005; Honneth 2006), especially in the works of Feenberg (1999; 2010; 2014), and Fuchs (2016). Alphabet develops a unique type of technological rationality with the ultimate goal of maintaining global control and dominance over transnational information flows, and internet advertising investments.

The empirical material consists of Securities and Exchange Commission (SEC) Fillings such as Form 10-Ks in the period between the Initial Public Offering (IPO) of the company in 2004 until 2016. In total, 13 market reports (10-K) were analysed and coded to make sense of Alphabet's corporate development. Selected economic indicators published in these reports were also gathered, systematized and presented to provide key indicators of corporate growth. Other supplementary documents published by the company are also used. Most importantly, the Search Quality Rating Guidelines (SQRG) describe the construction of search engine quality, utility and relevance in global markets.



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2. Should we speak of a one-dimensional algorithmic rationality?

In the immediate aftermath of the 2001 dot-com bubble crash new internet companies entered, or expanded, into the re-emerging digital market with a cautious business approach. As a way of re-gaining investor confidence, the new breed of internet companies argued for user-participation, collaboration, choice, access, creativity, obsolescence of mass communication, and transcendence of “old” corporate models.^v The digital discourse (Fisher 2010) promoting the balance between free access and new business strategies was also supporting innovations in internet advertising. Once hailed as flexible, cooperative, collaborative, and user-oriented, companies such as Apple, Alphabet, Amazon, Twitter and Facebook have now come to dominate the global internet, turning it into a consolidated market^{vi} with major global implications. It is justifiable to wonder how certain ways of doing things through iTunes, Google search, social networking, and online book purchasing, become so dominant that we are nearly paralyzed in terms of conceiving, providing and fostering alternatives. To answer that question a deeper philosophical approach is needed. At stake is not only a critique of corporate ownership and dominance, but also, more importantly, an understanding of how major companies “constrict choices in leisure and entertainment”, “control information and consolidate consensus” (Murdock, Golding 1973).

2.1. The rationality debate

The first generation of Frankfurt School theorists developed a materialist critique of the irrational tendencies of rationality in culture, society and economy. Feenberg (2014, 120) argued that it was neither utopian, nor dystopian, but instead demanded for situating rationality within the political where its consequences are a challenge to human responsibility. The position is evident in the early works of Horkheimer (1933) as a dialectical quest for understanding the development of human character defined in the economic situation and individual strengths. The quest was not for universal psychological characteristics of humans but their social, individual and historical determination. Critical Theory promoted by Horkheimer (1937) called for a grounding in a critique of commodity exchange, which influences the human condition and leads to a heightening of social tensions. Similarly, Marcuse (1965, 162) criticized the notion of rationality as neutral, formal, objective: “neutrality is *real* only when it has the power of resisting interference. Otherwise it becomes the victim, as well as the aid, of every power that wants to use it.” Technology is for Marcuse a historical-social project built on the projected ruling interests of what society wants to do with “men and things”.^{vii}

Unfortunately, the Frankfurt School has gained a somewhat ill reputation as, for example, Fuchs (2016) and Kellner (2005) argue. Within the tradition of cultural studies, it is depicted as pessimist, elitist and without concern for audiences and everyday life. Despite the cultural studies’ important focus on texts, audiences, popular culture, difference and multiplicity there is also a risk of neglecting the glaring power imbalances in contemporary digital society. Instead of arguing for an exclusively cultural or a political-economic approach my contention is that both represent important elements in the development of capitalism and its technical apparatus as it changes over time and space. By following Kellner (1991), I argue that the lesson Marcuse offers in



that regard is that critical social theory should analyse containment and stabilization as well as contestation and struggle. The global internet is currently at a tipping point where corporate consolidation and containment by major global players are causing more and more regulatory struggles and contestations. The resolution of these contradictions is yet to be determined.

To contribute to these developments, a revision of certain ideas developed within the tradition of the Frankfurt School Critical Theory is needed. In particular, the central debate about the “irrational” tendencies of the rationalization process can provide a broad conceptual apparatus for a critique of the type of technological domination promoted in algorithmic capitalism. Untangling the web of corporate control of choices in everyday life requires an understanding of the underlying logic of technological rationality (Marcuse 1941; 1964) of algorithmic capitalism. To revisit the dialectic between humans and oppressive rationality in algorithmic capitalism three major ideas developed in the tradition of the Frankfurt School need to be revisited and updated (Honneth 2006, 357): normative motif of a rational universal, the idea of a social pathology of reason and the concept of emancipatory interest.

The contemporary dominating rationality in technical artefacts such as software, code, algorithms, devices and gadgets is presented as a rational universal whose production process and commodity nature are reified behind smooth technical designs. The rationality provides a biased and skewed, quantified^{viii} representation of humans. Pathologies are becoming increasingly evident in surveillance, privacy abuse, fake news, and other negative effects on culture, economy, and democracy. The emancipatory potentials for conceiving alternatives need different types of rationalities that will abide to democratic procedures and oversight. The following section explains in more detail how Marcuse understands technological rationality and why it is relevant for contemporary relations between technology, labour and ideology in algorithmic capitalism.

2.2. From one-dimensionality to critical rationality

Human labour is objectified in commodities exchanged in the market. Commodities acquire existence that makes the labour process invisible and intangible. That is the core idea behind commodity fetishism as described by Marx (1867): social relations take the form of the “relations between things”. There are multiple elements at play in Marx’s definition of commodity fetishism: a critique of commodity exchange, a critique of the ideological nature of commodity exchange, and alienation of human labour. Lukács (1923) provided a strong elaboration of this basic assumption by outlining its objective and subjective dimensions. The objective dimension is the world of objects, commodities, governed by laws and invisible forces of generating power. The individual cannot modify the process by his own activity. The subjective dimension is the estrangement of man from him-/herself. The governing principles are rational calculations, mathematical analyses of work-processes, special laws governing production, and specialisation of operations that relate to use-values. The fragmentation of the ob-



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ject of production ultimately fragments its own subject. Human qualities and idiosyncrasies appear as sources of error when contrasted to abstract laws. Man becomes a mechanical part incorporated into a mechanical system:

“Reification requires that a society should learn to satisfy all its needs in terms of commodity exchange. The separation of the producer from his means of production, the dissolution and destruction of all natural production units, etc., and all the social and economic conditions necessary for the emergence of modern capitalism tend to replace natural relations which exhibit human relations more plainly by rationally reified relations.”

Marcuse (1964, 172) took this line of thought one-step further and introduced the role of technology as the “great vehicle of reification”. Reality becomes defined as a reality without substance, or rather, a reality in which substance is represented by its technical form which becomes its content. Every signification and proposition is validated within the framework of men and things - “a one-dimensional context of efficient, theoretical, and practical operations” (Marcuse 1960, 135). There is nothing controversial in the technical artefacts of machinery (Marcuse 1941, 41), for they are the result of the social conditions from which they emerge: “[t]echnics by itself can promote authoritarianism as well as liberty, scarcity as well as abundance, the extension as well as the abolition of toil.” *Technics* becomes a tool for control and domination under a rationality that favours commodity exchange, and high profit rates. Machinery, therefore, has a double social role for Marcuse. On the one hand, it is a product of human society and social conditions. On the other hand, its objectified existence exerts a specific form of influence over behaviour and consciousness of humans.

Technological rationality within capitalist social relations promotes competition, efficiency, and calculation, closes-down alternatives and critical reflections. Rationality loses its liberating function and transforms into a logic of adjustment and “compliant efficiency”. Reason finds its resting place in the system of standardized control, production and consumption where it reigns through efficiency and expediency (Marcuse 1941, 49). The “machine power” makes it the “most effective political instrument in any society whose basic organization is that of the machine process” (Marcuse 1964, 5). Yet Marcuse follows the idea of control and domination with a possibility of reversing the political trend in the material conditions of the machine as “the stored-up and projected power of man.” Such a change is grounded in a “critical rationality”, a prerequisite for liberation over control and dominance: “it envisions the rational form of human association as brought about and sustained by the autonomous decision and action of free men” (Marcuse 1941, 55).

A surge of interest in untangling the negative consequences of rationally devised, computational artefacts is a testament to the development potential of critical rationality in algorithmic capitalism.¹⁸ Current research on algorithms aims for opening the black box (Pasquale 2015) of algorithmic *technics* and demands more transparency and accountability (Diakopoulos 2016) of the social power of algorithms (Beer 2017). The grounding in the ideas of the Marcuse helps further develop the debate by focusing



on two additional problems: the hidden relations of algorithmic production and reified consciousness of the commodity exchange of information commodities. It is precisely within the unconsciousness of the cultural horizon under which technology is designed, that technology exerts its complete legitimizing effectiveness (Feenberg, 2010: 18). Uncovering the material foundations of search engine algorithms is the task of the following section.

3. Juggernauts of algorithmic capitalism: the case of Alphabet Inc.

Alphabet Inc. (Google) is at the forefront of the development of algorithmic machinery for valorising information in contemporary capitalism. Google's solutions emerged from the field of information retrieval and the algorithm for ranking online content based on the number of links the websites receive from other sources on the web.^x The company started in 1998 and six years later made its initial public offering (IPO). It sold 19 million shares and raised 1.67 billion USD in capital, setting the company market value at over 20 billion USD.^{xi} Over time, the complexity of the algorithmic solutions grew to a point where it now uses several hundred "signals" other than the number of receiving links to determine relevance and utility and to rank websites based on search queries and other criteria.^{xii}

The 2004 revenues were 3.189 billion USD with 99% of the revenue coming from advertising.^{xiii} The revenues continue to rise steadily based on the scale of global operations and dominant presence in capturing internet advertising investments worldwide. The year 2015 was a benchmark for corporate development as the name of the company changed from Google to Alphabet inc. to enable more independence of different company segments.^{xiv} Google is still one of the most important ones and algorithmic production remains the key business strategy for the company. In 2016, the recorded revenues were at 90.272 billion USD with advertising comprising an 88% share.^{xv} Market capitalisation of the company in 2017 was 661 billion USD.^{xvi} Despite enormous growth, the legitimating digital discourse (Fisher, 2010) still promotes the "rags to riches" story of corporate development.^{xvii}

Alphabet did not invent algorithms. There is a longer history within computer science and engineering, as well as a lineage within philosophy and mathematics. In contemporary capitalism, Alphabet's algorithmic model is supported by three rationalities: organizational rationality of specific management values and labour utilization; informational rationality of generating value from advertising and audience labour (Smythe, 1981; Jhally and Livant, 1986); and technological rationality increasing surplus value, reifying labour and commodity exchange.

3.1. Organizational rationality: Capital-labour-ideology

The spirit of "networked organization" drives a new type of capitalism. It smoothly installs itself into all aspects of society and manages to incorporate the heritage of 1960s "artistic and social critique" into a new style of management that includes flexibility, sub-contracting, team-working, multi-skilling, flat-management, resistance to hierarchy, etc. (Boltanski, Chiapello, 2007). Alphabet promotes such an organizational culture although it does not manage to eradicate the inherent contradictions embedded



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in the highly centralized capital accumulation strategy. The aura of the start-up, academic roots and forward-thinking insights of its founders legitimize a disproportionate distribution of wealth within the organizational structure of the company.^{xviii} The dynamic balancing act needs a steady flow of knowledge and labour to sustain corporate growth and dominance.

There is a continuous demand for new knowledge, communication and experience in the production of search algorithms. “Immaterial labour” (Lazzarato 1996) is the driving force behind the creation of the informational and cultural commodities of web search. Alphabet’s research teams are armed with skills in areas such as: security and privacy, information retrieval, machine intelligence, data mining, machine perception, human-computer interaction, education, natural language processing, speech recognition, machine translation, network architecture, distributed systems, and so on.^{xix} In addition to complex skills, an alignment with the mission of the company is necessary to perform the spirit of flexible, creative and networked management structure and ensure surplus value. Such an organizational rationality creates a “common framework of experience” and extends corporate control from the objective to the subjective world ensuring the material reproduction of society (Marcuse 1941, 56). In other words, “the argument that Google is changing the world and changing it for the better encourages employees to align their sense of personal mission with that of the company’ (Turner 2009, 80).^{xx} The organizational rationality is based on “the hegemony of knowledges, by a diffuse intellectuality, and by the driving role of the production of knowledges by means of knowledge connected to the increasingly immaterial and cognitive character of labour.” (Vercellone 2007, 16).^{xxi}

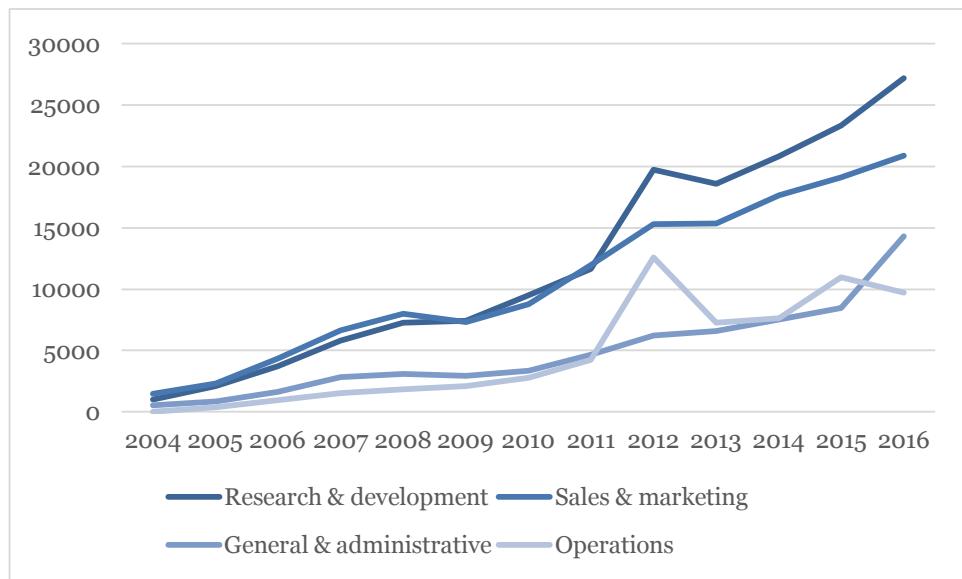


Figure 1: Labour power breakdown (2004-2016).
Source: author's analysis based on Form 10-Ks (2004-2016)

The above figure shows the change in the structure of labour power between 2004 and 2016. At the time of the Initial Public Offering (IPO), the company structure was the



following: 1.003 employees in research and development, 1.463 in sales and marketing, 555 general and administrative staff and no recorded staff in operations.^{xxii} The number of R&D staff compared to the sales and marketing staff was relatively equal up until 2012. In August 2011, Google made one of its biggest acquisitions by purchasing Motorola Mobility Holdings Inc. for a reported 12.6 billion USD.^{xxiii} The Motorola operating results and staff (16.317) were incorporated into Google's 2012 market results which is displayed as a significant increase in headcount of R&D and operations staff.^{xxiv} The purchase was made for at least three different reasons. First, to increase the highly skilled labour power. Second, to obtain a large number of intellectual property rights, especially patents owned by Motorola. Third, to expand into the rising mobile telephone market, update Google's Android OS and mobile search services, and increase capital accumulation.^{xxv} Since 2012 R&D staff continues to outnumber other organizational staff. In 2016, the R&D staff count was 27.169, followed by sales and marketing with 20.902, general and administrative with 14.287 and operations with 9.695.^{xxvi}

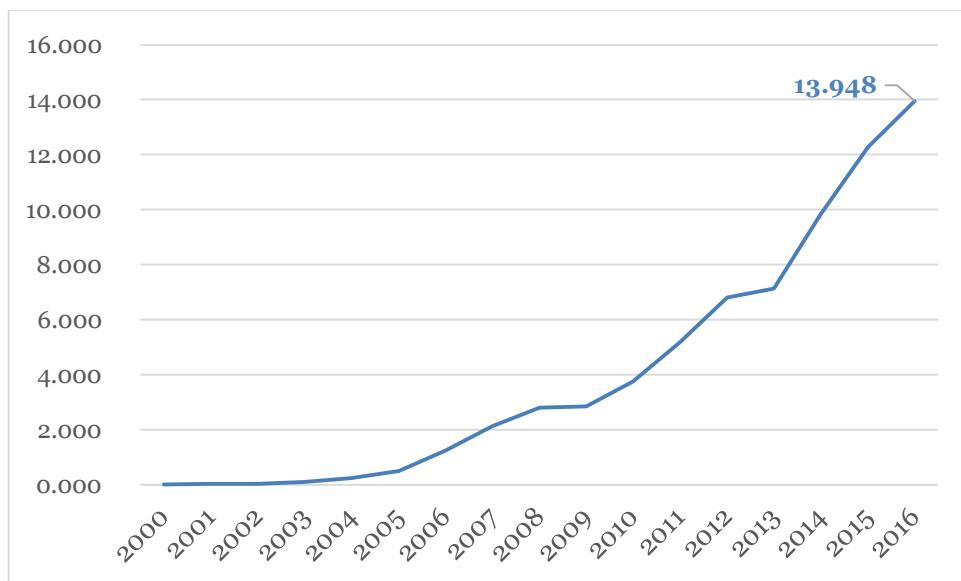


Figure 2: R&D spending (2000-2016) in billion USD.
Source: author's analysis based on Form 10-Ks (2004-2016)

The company maintains its global dominance through continuous acquisitions^{xxvii} but also through substantial internal research and development investments. In 2016, the total R&D costs were 13.948 billion USD. The main costs of R&D include compensation and related costs for personnel responsible for the research and development of new products and services, as well as significant improvements to existing products and services. The outward image Google promotes is a well known dimension of workplace creativity and innovation. It forms an integral part of the organizational rationality included in every market report since 2004. It serves to solidify the image of the “non-conventional” company (whatever that means) among its shareholders. Simultaneously, in the context of social media and the internet, there is an increase in non-wage labour contributing to the value of social media companies (Fuchs 2010, 2012; Fisher 2015). The commodities, which the company produces, create a relationship between internet users seeking information and content, and information producers seeking

users and audiences. Alphabet mediates this relationship by producing two main types of commodities discussed in the following section.

3.2. Informational rationality: commodity exchange and value

There is no lack of discussion on how the actual commodity exchange occurs on social media companies and how value is created: audience commodity (Fuchs 2010; 2012; Fisher 2015), network surplus value (Pasquinelli 2009, 2015), rent (Rigi, Prey 2015; Rigi 2015), etc. From the vantage point of Critical Theory and the rationality debate, different capital accumulation strategies have the same goal – maintaining global dominance and control over humans and nature (Marcuse 1960, 1964). Alphabet's profit-making rationality separates so-called "organic" from paid search results.^{xxviii} Free web search service remains one of the main reasons for its strong grasp over user experience. Such a position helps build consumer trust and legitimacy and allows for the accumulation of economic and cultural capital (Hillis, Petit and Jarrett 2013).

The advertising model is based on what the company calls "performance advertising" of delivering relevant ads that users will click on and engage directly with the advertisers.^{xxix} AdWords^{xxx} is the primary auction-based advertising program, which allows ads to appear on Google services and services of Google Network Members – partner websites and third-party websites across the internet. Alphabet collects a complex array of information based on search queries, geographic location, language, device (PC, mobile phone, or tablet), and other parameters that may be of interest to advertisers. As the most visited global website^{xxxi} with a highly dominant and monopolistic position in the search engine market, the incentive for advertisers to place their ads through the Google system is highly attractive. In 2016, Google held a 71.41% market share of global desktop search and 91.61% of the global mobile and tablet web search.^{xxxii} The largest share of Google's revenues (Figure 3) comes from advertising. The maintenance of a close-relation with users is the main corporate strategy for attracting advertising investments and accumulating capital. The position is evident throughout the history of the company: in the 1998 academic article by Brin and Page, 2004 IPO letter,^{xxxiii} market reports between 2004 and 2016, and current PR campaigns.^{xxxiv}



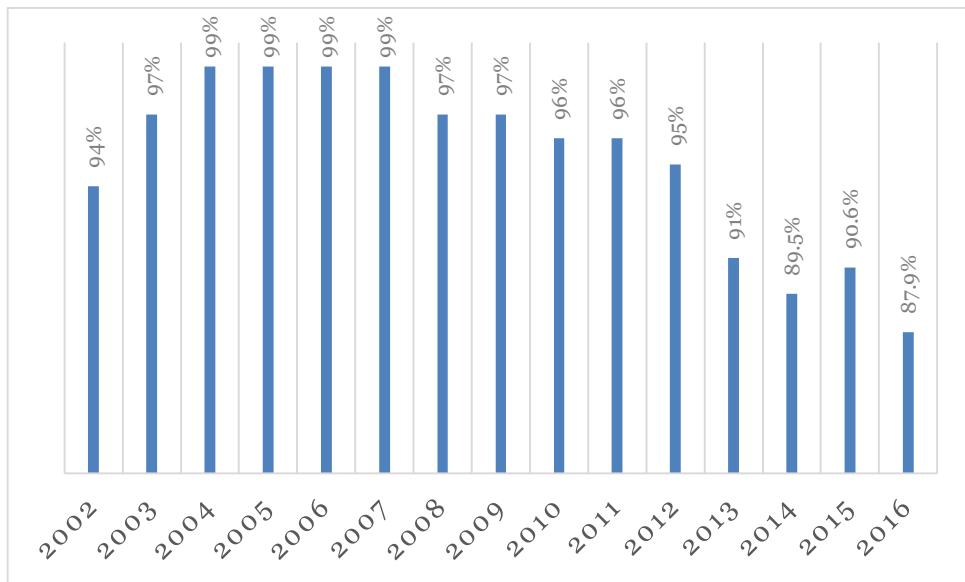


Figure 3: Share of advertising revenue within total revenue (2002-2016).
Source: author's analysis based on Form 10-K (2004-2016)

The free service strategy attracts users while the audience commodity (Fuchs, 2012, Fisher, 2015) attracts advertisers. This social relationship would not be possible without automated machines that process information input/output. I argue there are two main types of commodities that Alphabet produces. First, the audience commodity for the online advertising market. Second, the algorithmic machine for the search engine market. Intellectual property rights (IPR) ensure the scarcity of search services in the market. In July 2017, there were 15.073 patents assigned under the old company name Google and additional 18 under the new company name Alphabet.^{xxxv} Paid labour of company engineers as well as continuous usage and unpaid labour by internet users produce the machine. Paid and unpaid labour create the audience commodity and algorithmic commodity. The first is profitable through its exchange value in the advertising market; the second is profitable through stock trading and financial capital. The first commodity is the source of control over nature and humans, audiences and their labour. The second commodity is the source of control over information through IPR.^{xxxvi}

3.3. Algorithmic machinery: “the great vehicle of reification”

Marcuse (1964, 172) argued that technology becomes “the great vehicle of reification” in advanced industrial societies: “[t]he social position of the individual and his relation to others appear not only to be determined by objective qualities and laws, but these qualities seem to lose their mysterious and uncontrollable character; they appear as calculable manifestations of (scientific) rationality”. Algorithms, engineered calculations and estimates of human needs increasingly determine the relations between humans in algorithmic capitalism. The more people use social media and the internet, the more meta-data of their online presence circulates for surveillance and commodity exchange purposes. Smooth interfaces, and free-of-charge online services blur the awareness of data gathering practices: “[t]echnology serves to institute new, more effective,

and more pleasant forms of social control and social cohesion” (Marcuse 1964, xlvi). Reification blurs the consciousness of contradictions embedded in corporate technologies, as well as the relations of production necessary for their maintenance and commodity exchange within the political economy of algorithmic capitalism.

Google’s search engine is dominant worldwide. More usage creates more audience commodities and improves the algorithmic machine. Localisation, languages and geographical barriers are no match for the adaptability and global information control of the algorithm. The machine captures “living time and living labour time and transforms the *common intellect* into network value” (Pasquinelli 2009). The machine does not produce surplus value but serves to accumulate and augment surplus value based on the exploitation of the general intellect (Pasquinelli 2015). Google’s search algorithm provides and captures information flows and controls relevant information. Moreover, by providing dominant solutions to web search Alphabet routinizes the process of information dependence and steers the development of human needs and capacities. It closes alternatives to the availability of information and situates itself in a position of great power to define contemporary social reality.^{xxxvii} The table below shows what Alphabet values most in terms of searchable web content.

March 28 2016	March 14 2017
Shopping or financial transaction pages: webpages which allow users to make purchases, transfer money, pay bills, etc. online (such as online stores and online banking pages).	Shopping or financial transaction pages: webpages which allow users to make purchases, transfer money, pay bills, etc. online (such as online stores and online banking pages).
Financial information pages: webpages which provide advice or information about investments, taxes, retirement planning, home purchase, paying for college, buying insurance, etc.	Financial information pages : webpages which provide advice or information about investments, taxes, retirement planning, home purchase, paying for college, buying insurance, etc.
Medical information pages: webpages which provide advice or information about health, drugs, specific diseases or conditions, mental health, nutrition, etc.	Medical information pages : webpages which provide advice or information about health, drugs, specific diseases or conditions, mental health, nutrition, etc.
Legal information pages: webpages which provide legal advice or information on topics such as divorce, child custody, creating a will, becoming a citizen, etc.	Legal information pages : webpages which provide legal advice or information on topics such as divorce, child custody, creating a will, becoming a citizen, etc.
Other: there are many other topics which you may consider YMLY, such as child adoption, car safety information, etc.	Other: there are many other topics which you may consider YMLY, such as child adoption, car safety information, etc.
	News articles or public/official information pages: webpages, which are important for maintaining an informed citizenry, including information about local/state/national government processes, people, and laws, disaster response services, government programs and social services, news about important topics such as international events, business, politics, science, and technology.

Table 1: changing search quality standards (2016-2017).
Source: Google’s Search Quality Rating Guidelines (SQRG)



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Alphabet uses worldwide search quality tests (Bilić 2016) to determine if search algorithms actually find what the company defines as local search relevance and utility. The highest quality standards are set for the so-called Your Money or Your Life (YMLY) websites.^{xxxviii} The above table shows that Google systematically favoured exchange-value of information over use-value of information. Shopping, financial transactions, financial information pages, health and legal information are a high priority in these guidelines. Businesses running such websites often invest heavily in online advertising.^{xxxix} Only after the outbreak of fake news in 2016 and the subsequent public outrage did the company introduce “news articles or public/official information pages”.^{xl} There is a broader use-value of information in contemporary society outside commercial content and exchange-value of information. The news operate within the market but, ideally, offer positive market externalities in the form of quality news, professional journalistic standards for fostering democratic processes and informed citizenry—issues previously low on the agenda of information processing algorithmic machinery of Google.

Changes to algorithmic relevance also show the limits of technical solutions for interpreting nuances of human behaviour. Nonetheless, after the breakout of fake news, search engine usage and audience labour, transformed the algorithm into a more efficient machine. Algorithms are reified objects in a double sense. First, they hide the labour process necessary for their production. Second, algorithms hide the exchange value of the audience commodity (Fuchs 2012; Fisher 2015) as well as surplus value accumulation of the exploited labour of the general intellect (Pasquinelli 2009, 2015). The algorithmic machinery becomes a mediating factor between labour, value and surplus value in algorithmic capitalism. Labour power and audience labour produce the audience commodity and the algorithmic machine, while the algorithmic machine accumulates surplus value for company owners.

4. Pathologies of algorithmic capitalism

There is a growing global case for an argument that algorithmic capitalism delivers a 21st century “pathology of reason” (Honneth 2006). Take, for example, such issues as surveillance, privacy violations, algorithmic bias, fake news, exploitation of paid and unpaid labour, technological unemployment, automated consumerism, commodification of knowledge, energy expenditure of server maintenance, electronic waste, and so on. In a 2017 survey of the “algorithm age”, the Pew Research Centre gathered the opinions of more than 1300 technology experts, scholars, corporate practitioners and government leaders. There were seven main topics cutting across different opinions: algorithms will spread everywhere; good things lie ahead; humanity and human judgment are lost when data and predictive modelling become paramount; biases exist in algorithmically organized systems; algorithmic categorizations deepen divides; unemployment will rise; the need grows for algorithmic literacy, transparency and oversight.^{xli} In contrast to corporate power in algorithmic capitalism, an elaborate notion of what humanity and human judgment under threat from the totalizing technological



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rationality imply, is largely missing in academic and policy debates. Class divisions or international relations do not form the only struggles against technological rationality. Efficient, calculated and largely automated systems of technology, markets, and administration affect humanity as a whole.

4.1. How to establish counter-control: policy, practice and *praxis*

Marcuse's dialectic^{xlii} position was a critique of corporate and administrative technological rationality from the position of human values, judgment, and liberation. The repressive, one-dimensional, technological rationality can be overthrown by way of the "Great Refusal"—"the protest against that which is" (Marcuse 1964, 66). For Marcuse (1962, 290), humanity implies a certain intelligence to understand and transform the human condition. An individual cannot develop free and autonomous thinking on his/her own: "[t]his is an historical and social responsibility which civilization can, or at least should, carry out against raw nature and against all repressive social and intellectual forces." Marcuse's understanding of humanity is a valuable reminder of its ethical and normative ideal. However, we still need concrete steps and ways of promoting such advancements in our socio-historical configuration. Various authors have proposed solutions to deal with corporate accumulation and commodification of information on the internet and through Google's search engine: re-appropriating network value (Pasquinelli 2009), expropriating and transforming it into a public, non-profit, non-commercial organization (Fuchs 2011), breaking out of the core network dynamics by not using such services (Mager 2012).

I argue for a combination of policy, practice and *praxis*, to alleviate some of the irrationalities of rationally devised machinery in algorithmic capitalism. First, policy and regulatory responses have been gaining pace. Most prominently, the European Commission opened several anti-trust investigations against Google (Alphabet) because of its dominant position that stifles market competition in the European Economic Area. The European Commission fined Alphabet 2.42 billion EUR in June 2017 for favouring its own comparison shopping service in its search results.^{xliii} Other investigations are ongoing. Second, a changed practice of internet users could have an adverse effect on the corporate behaviour of the company. As shown throughout this paper, Google is heavily reliant on user input for the production of the audience commodity and algorithmic machinery. Furthermore, scientific practice of computer science and engineering needs to embrace a stronger understanding of social dynamics and human conditions.^{xliv} Finally, the contradictions within algorithmic capitalism need to reach a level of societal consciousness to enable socially and democratically meaningful action. The unity of thinking and doing, the *praxis*, requires a raised consciousness within the current conditions before any change can be made into a historical reality.



5. Conclusion

Drawing on Marcuse (1941; 1960; 1964), algorithms can be conceived as a product of human society and social conditions. In addition, the objectified existence of algorithms exerts influence over behaviour and consciousness of humans. Alphabet's algorithmic model is supported by three rationalities: organizational rationality of flexible management values and labour utilization; informational rationality of generating value from advertising and audience labour (Smythe 1981; Jhally and Livant 1986); and technological rationality increasing surplus value, reifying labour and commodity exchange. The company produces two main types of commodities. First, the audience commodity (Fuchs 2010; 2012; Fisher 2015) for the advertising market. Second, the algorithmic machine for the search engine market. Company engineers and internet users produce the audience commodity and the algorithmic commodity. Reification (Lukács 1929; Marcuse 1964) blurs the consciousness of contradictions embedded in algorithms, as well as the relations of production necessary for their maintenance and commodity exchange in the market. The algorithmic machinery mediates labour, value and surplus value. Labour power and audience labour produce the audience commodity and the algorithmic machine, while the algorithmic machine accumulates surplus value (Pasquinelli 2009; 2015) for company owners. Re-claiming algorithms under social and democratic control requires a combination of policy, practice and *praxis*—a raised consciousness of the contradictions and struggles embedded within corporate technologies. Algorithms will continue to expand in multiple areas and continue to create struggles and contradictions between human values, judgements and corporate control and dominance. It is important to remember that technologies are not neutral or objective (Marcuse 1965)—they are either good or bad for humanity depending on who is in control.

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About the Author

Paško Bilić

Paško Bilić is a Research Associate at the Department for Culture and Communication, Institute for Development and International Relations in Zagreb, Croatia. He worked on research projects funded by the European Commission, COST, Seventh Framework Programme (FP7) and Croatian Science Foundation. He is co-editing the forthcoming book *Technologies of Labour and the Politics of Contradiction* (Palgrave Macmillan, 2018). His main research interest is a critical analysis of social relations mediated through digital technologies, public policies and markets.

ⁱ First, automation could lead to the creation of an “automation hierarchy” and a new social and economic “elite”. The elite would gain power from being able to implement and control technical management processes within industry settings. Second, increased productivity can lead to an overabundance of products in the market as well as an artificial increase of consumption which can ultimately lead to economic crises. Third, checks and balances from trade unions and government policy are needed to reduce technological unemployment.

ⁱⁱ See for example *Artificial intelligence, automation, and the economy* (2016). Available at <https://obamawhitehouse.archives.gov/blog/2016/12/20/artificial-intelligence-automation-and-economy>

ⁱⁱⁱ Simultaneously, there are reports by consultancy firms and research institutions that offer opinions and research on the effects of algorithms and automation on contemporary economy and society. In a report published by the McKinsey Global Institute in May 2017 titled *What's now and next in AI, analytics and automation* it is stated that about a half of the current work activities have the potential to be automated. It also states: “[a]t a macroeconomic level, based on our scenario modelling, we estimate automation alone could raise productivity growth on a global basis by 0.8 to 1.4 percent annually. In short, businesses and the economy need the productivity boost from automation.” Available at <http://www.mckinsey.com/global-themes/digital-disruption/whats-now-and-next-in-analytics-ai-and-automation>.

^{iv} As stated in one of Alphabet Inc. market reports: “We've been building the best AI team and tools for years, and recent breakthroughs will allow us to do even more. This past March, DeepMind's AlphaGo took on Lee Sedol, a legendary Go master, becoming the first program to beat a professional at the most complex game mankind ever devised. The implications for this victory are, literally, game changing—and the ultimate winner is humanity. This is another important step toward creating artificial intelligence that can help us in everything from accomplishing our daily tasks and travels, to eventually tackling even bigger challenges like climate change and cancer diagnosis.” Available at <https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s8185F9802022EB31082B6542DD4F73>

^v Take for example the letter written by the founders of Google, Larry Page and Sergey Brin, from 2004 at the time when the company made its Initial Public Offering: “Google is not a conventional company. We do not intend to become one. Throughout Google's evolution as a privately held company, we have managed Google differently. We have also emphasized an atmosphere of creativity and challenge, which has helped us provide unbiased, accurate and free access to information for those who rely on us around the world.” Available at <https://abc.xyz/investor/founders-letters/2004/ipo-letter.html>



^{vi} Top five US companies in terms of market capitalisation (in b USD) in July 2017 were Apple (777), Alphabet (661), Microsoft (561), Amazon (478) and Facebook (463). Available at <http://www.nasdaq.com/screening/companies-by-industry.aspx?region=North+America&country=United%20States&marketcap=Mega-cap>

^{vii} Elsewhere (Bilić, 2018), I argued that the ideas developed by Herbert Marcuse can be useful for the analysis of algorithmic capitalism from at least four different standpoints. First, he offers a critique of commodification and consumer culture. Second, Marcuse develops a dialectical relation between technological domination and human values, interests and liberation. He is not dismissive of technology in itself, only about technological control and domination within the capitalist system. Third, algorithms can be conceived as the expression of the Enlightenment project with the goal of rationalization, calculability, neutrality, objectivity and effectiveness in handling social affairs. They are reified forms of socially established technological control (Marcuse, 1964). Finally, algorithms can be analysed as tools for global dominance and control embedded in the labour intensive production process within the global division of search engine labour.

^{viii} See for example the Quantified Self movement: <http://quantifiedself.com/>

^{ix} See for example a list of Critical Algorithm Studies: <https://socialmediacollective.org/reading-lists/critical-algorithm-studies/>

^x See Brin and Page (1998). Available at <http://infolab.stanford.edu/~backrub/google.html>

^{xi} Available at www.edition.cnn.com/2004/BUSINESS/08/19/google.ipo/

^{xii} See a list of major algorithmic changes here <https://moz.com/google-algorithm-change>

^{xiii} Available at

https://www.sec.gov/Archives/edgar/data/1288776/000119312505065298/d10k.htm#toc10062_2

^{xiv} “What is Alphabet? Alphabet is mostly a collection of companies. The largest of which, of course, is Google. This newer Google is a bit slimmed down, with the companies that are pretty far afield of our main internet products contained in Alphabet instead. What do we mean by far afield? Good examples are our health efforts: Life Sciences (that works on the glucose-sensing contact lens), and [Calico](#) (focused on longevity). Fundamentally, we believe this allows us more management scale, as we can run things independently that aren’t very related.” Available at <https://abc.xyz/investor/founders-letters/2015/index.html#2015-larry-alphabet-letter>

^{xv} Available at

<https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xvi} Available at <http://www.nasdaq.com/screening/companies-by-industry.aspx?region=North+America&country=United%20States&marketcap=Mega-cap>

^{xvii} “Despite our rapid growth, we still cherish our roots as a startup and wherever possible empower employees to act on great ideas regardless of their role or function within the company. We strive to hire great employees, with backgrounds and perspectives as diverse as those of our global users. We work to provide an environment where these talented people can have fulfilling careers addressing some of the biggest challenges in technology and society.” Available at <https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xviii} Sergey Brin, Larry Page and Eric Schmidt hold significant control over Alphabet operations. As of December 31, 2016, Larry, Sergey, and Eric beneficially owned approximately 92.4% of Alphabet’s outstanding Class B common stock, which represented approximately 56.8% of the voting power of outstanding capital stock. Larry, Sergey, and Eric therefore have significant influence over management and affairs and over all matters requiring stockholder approval, including the election of directors and significant corporate transactions, such as a merger or sale of company or assets. See 2016 Form 10-K for more details:

<https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xix} Available at <https://research.google.com/workatgoogle.html>

^{xx} Here the concept of living labour capacity is also essential: “Just as the dialectical pairing of use-value and exchange-value forms the dualistic character of goods, *labouring capacity* and labour power are the dialectical expressions of the dualistic character of the subjects that offer their labour power in the marketplace. The dialectical juxtaposition of *labouring capacity* and labour power connects it to the ‘political economy of labour power’: Namely, through the contrast of subjective production of labour power on the one hand and its objectification as a function of the wage labour process on the other.” (Pfeiffer, 2014)

^{xxi} Vercellone (2007: 32, 33) further explains: “we pass from the static management of resources to the dynamic management of knowledges. Productive science is no longer “encapsulated” in the rigid



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logic incorporated in machines.' On the other hand, inside the enterprise just as in society, the mobilisation and the co-operation of collective knowledges is increasingly fundamental, the only elements able to release and to control a dynamic of accelerated change."

^{xxii} Available at https://www.sec.gov/Archives/edgar/data/1288776/000119312505065298/d10k.htm#toc10062_2

^{xxiii} Available at https://www.sec.gov/Archives/edgar/data/1288776/000119312512025336/d260164d10k.htm#toc260164_2

^{xxiv} Available at https://www.sec.gov/Archives/edgar/data/1288776/000119312513028362/d452134d10k.htm#toc1452134_2

^{xxv} The cognitive capitalism perspective is useful for explaining this acquisition: "In cognitive-labour-producing knowledge, the result of labour remains incorporated in the brain of the worker and is thus inseparable from her person. That helps explain, together with other factors, the pressure exercised by enterprises in order to attain a strengthening of the rights of intellectual property and to re-enclose, in a new phase of the primitive accumulation of capital, the social mechanisms at the base of the circulation of knowledge." (Vercellone, 2007: 33)

^{xxvi} Available at <https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xxvii} See a list of major acquisitions made by 2015 here <http://www.businessinsider.com/googles-ten-biggest-acquisitions-2015-1>

^{xxviii} "In general, it could be argued from the consumer point of view that the better the search engine is, the fewer advertisements will be needed for the consumer to find what they want. This of course erodes the advertising supported business model of the existing search engines. However, there will always be money from advertisers who want a customer to switch products, or have something that is genuinely new. But we believe the issue of advertising causes enough mixed incentives that it is crucial to have a competitive search engine that is transparent and in the academic realm." (Brin and Page, 1998)

^{xxix} Available at <https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xxx} Available at https://adwords.google.com/intl/en_au/home/#?modal_active=none

^{xxxi} Available at <http://www.alexa.com/topsites>

^{xxxii} Available at <https://www.netmarketshare.com/search-engine-market-share.aspx?qprid=4&qpsp=2016&qpnp=1&qptimeframe=Y&qpcustomd=1>

^{xxxiii} Available at <https://abc.xyz/investor/founders-letters/2004/ipo-letter.html>

^{xxxiv} Available at <https://www.google.com/search/howsearchworks/mission/web-users/>

^{xxxv} Available at <http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetacgi%2FPTO%2Fsearch-bool.html&r=o&f=S&l=50&TERM1=Google&FIELD1=ASNM&co1=AND&TERM2=&FIELD2=&d=PTXT>

^{xxxvi} IPR protection has a prominent position in all market reports between 2004 and 2016. Alphabet is under a continuous legal struggle to maintain its dominant position. From the 2016 market report: "We rely on various intellectual property laws, confidentiality procedures and contractual provisions to protect our proprietary technology and our brand. We have registered, and applied for the registration of, U.S. and international trademarks service marks, domain names and copyrights. We have also filed patent applications in the U.S. and foreign countries covering certain of our technology, and acquired patent assets to supplement our portfolio." In another example: "Our patents, trademarks, trade secrets, copyrights, and other intellectual property rights are important assets for us. Various events outside of our control pose a threat to our intellectual property rights, as well as to our products, services and technologies." Available at <https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm#s9FFFC4C562B4028925242B6543354A33>

^{xxxvii} "...the machine process imposes upon men the patterns of mechanical behaviour, and the standards of competitive efficiency are the more enforced from outside the less independent the individual competitor becomes. But man does not experience this loss of his freedom as the work of some hostile and foreign force; he relinquishes his liberty to the dictum of reason itself. The point is that today the apparatus to which the individual is to adjust and adapt himself is so rational that individual protest and liberation appear not only as hopeless but as utterly irrational" (Marcuse 1941, 48).

^{xxxviii} The latest version of search quality rating guidelines is available here

<https://www.google.com/insidesearch/howsearchworks/assets/searchqualityevaluatorguidelines.pdf>



xxxix Top industries contributing to Internet advertising in 2015 and 2016 were retail, financial services, automobile industry, telecom industry, leisure and travel, consumer packaged goods, consumer electronics and computers, pharmacy and healthcare and so on. Available at <https://www.iab.com/insights/iab-internet-advertising-revenue-report-conducted-by-pricewaterhousecoopers-pwc-2/>

xl See an article about the process of re-writing the algorithm to combat fake news

<https://www.bloomberg.com/news/articles/2017-04-25/google-rewrites-its-powerful-search-rankings-to-bury-fake-news>

xli Available at <http://www.pewinternet.org/2017/02/08/code-dependent-pros-and-cons-of-the-algorithm-age/>

xlii Fuchs (2016, 121) argues that Marcuse understood Hegelian dialectics as a) the dialectic between the subject and the object, b) the dialectic of the individual and society, c) the dialectic of the subjective and the objective dialectics of capitalism, d) the dialectic of chance and necessity, e) the dialectic of essence and appearance, f) the dialectic of essence and existence.

xliii Available at http://europa.eu/rapid/press-release_IP-17-1784_en.htm

xliv For example, the Association of Computer Machinery (ACM) recently issued a statement on algorithmic transparency and accountability. Available at: <https://techpolicy.acm.org/?p=6156>



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