
Abstraction and Production in Google Maps

The Reorganisation of Subjectivity, Materiality and Labour

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Maps can be seen as a potent symbol and the technological manifestation of the abstraction process fundamental to human practice. Cartographic abstraction grants an organising power to the way we look at the world, and hence map-makers and the institutions they serve have often worked to intensify this abstraction. Google Maps goes a step further. In addition to offering an abstracted view from above, the very materiality of the map is itself abstract. Its production and functioning necessarily involves a vast ensemble of microchips, semiconductors and all the components that make up the computing machines, which in turn run multiple layers of software, using standardised protocols to bridge world-spanning networks composed of transoceanic fibre-optic cables and military satellites. These examples are all material manifestations of the abstracting processes that extend the possibilities of social power. It is very important to critique this power, as Google Maps is used by around two billion people each

month, hence the apparatus affects the social practice of a vast number of people unevenly spread around the world.¹

In this article, I combine two critical approaches: the political economy of communication and the ‘levels of abstraction’ approach as formulated in and around the pages of Arena’s publications.² This article begins with a description of what I mean by ‘abstraction’ and how this relates to cybernetic capitalism. From this comes a discussion of Google Maps’s abstracted materiality, which looks at the codes that lie behind the apparatus’s interface. Then I look at the concept of ‘abstraction’ as it is used in computer science and connect this understanding to the previously developed concept of ideology. Thereafter, I look at how Google Maps can be considered an abstraction in three primary and intermeshed senses: as a commodity form, as software and as a complex machine.

Processes of Abstraction

The word ‘production’ is derived from the Latin meaning ‘to bring forth’, and ‘abstraction’ from ‘to draw away’. Etymologically speaking, these concepts seem to contradict one another; and yet in history’s unfolding they seem to be intimately connected. Karl Marx was a pre-eminent theorist of production, and yet he saw the process of increasing abstraction as a major tendency of capitalism: an all-encompassing trend of this mode of practice and its impact on human activity. Across his writings, he was critical of the abstraction of value from usefulness, the abstraction of work from human activity, the abstraction of people from their species-essence, as a consequence of living within class society. He wrote about how capitalism had been abstracted from living labour, becoming something of an undead machine draining away the vital forces of both workers and the soil.³ Indeed, the concept of abstraction is intimately bound up with the important Marxist concepts of both

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- 1 Google Maps announced that it had more than one billion people using its map in 2012 and has released no official figures since. Over the past five years, the number of people using the internet has more than doubled, hence coming to the vague estimate of ‘around two billion’.
 - 2 The form of political economy of communication I draw on is heavily influenced by Armand Mattelart and Raymond Williams. Significantly, my use of the concept ‘apparatus’ is drawn from this legacy, and not the more well-known version from Louis Althusser. See A. Mattelart, *The Invention of Communication*, trans. S. Emanuel, Minneapolis, University of Minnesota Press, 1996; and R. Williams, *Culture and Materialism*, London, Verso, 2005.
 - 3 K. Marx, *Capital: A Critique of Political Economy*, vol. 1, Harmondsworth, Penguin, 1976; *Economic and Philosophic Manuscripts of 1844*, Mineola, Dover, 2007.

alienation and reification, both of which have featured prominently in the legacy of critical theory.

Processes of abstraction have long historical roots, going back well before the emergence of the written record — for writing itself is an abstraction of speech, translating speech into symbols that can be embedded in an external technology, such as a clay tablet or a journal article. This fact illustrates how abstraction is a vast and multifaceted phenomenon. Indeed, as Iain McGilchrist argues:

The defining features of the human condition can all be traced to our ability to stand back from the world, from ourselves and from the immediacy of experience. This enables us to plan, to think flexibly and inventively, and, in brief, to take control of the world around us rather than simply respond to it passively.⁴

Abstraction is thus a constitutive feature of the human experience. Given the complexity of these phenomena, I have no interest in simply saying that the abstract is good or bad — although important politico-ethical questions are ever present. The point of this critique is to examine the ways in which processes of abstraction are put to the service of particular ends, and how such processes reconstitute social being. While the abstraction of enquiry can lead to genuine understanding, it can also become problematic, particularly when it is integrated into a capitalist project of rational mastery and proceeds to facilitate the domination of nature and other people. It becomes problematic when it is used to dominate other aspects of the human condition, such as the intimate and intuitive, the embodied and empathetic, the sensible and sensitive.⁵ Indeed, these kinds of abstractions are bound up with capitalism's 'quest of power by means of abstraction', to use Lewis Mumford's words.⁶

This is significant, for across human history there appears to have been an uneven increase in the forces of abstraction. The emergence of capitalism in the long sixteenth century represented an intensification of the connection between productive technique and abstraction. Different processes of abstraction advanced in a

4 I. McGilchrist, *The Master and His Emissary: The Divided Brain and the Making of the Western World*, New Haven, Yale University Press, 2012, p. 21.

5 F. Berardi, *And: Phenomenology of the End: Sensibility and Connective Mutation*, South Pasadena, Semiotext(e), 2015; H. Marcuse, *One-Dimensional Man*, London, Routledge, 2002.

6 L. Mumford, *Technics and Civilization*, New York, Harbinger Books, 1963, p. 24.

multifaceted manner, manifesting in the rise of perspective in painting, double-entry bookkeeping in accountancy, print technologies in communication, and rationalised cartographic representation in understanding landscape, to name but a few. Since the Second World War and the coming of cybernetic capitalism, the combining of processes of capitalist production and social abstraction have increased dramatically, both intensively and extensively, to the point that the quantitative intensification crosses over into qualitative change.

This long-term intensification has been analysed by McGilchrist, who sees its growing strength as being associated with the development of modernity. His study charts how the abstractions unleashed by modernity have been bringing about a world of increasing division and bureaucratisation, specialisation and *technicalisation*. This is a world conceived of as mechanistic and measurable, compartmentalised and fragmented. It is a schizoid world where humans imagine themselves as utility maximisers and where nature becomes a resource.⁷ In short, it is a world where reification reigns.

Part of this increasing abstraction can be seen in the history of cartography. The Hereford Mappa Mundi, a map from the thirteenth century, was drawn on a flayed animal's skin, and attempted to synthesise the entire Christian world view, complete with an eschatological trajectory towards the Final Judgement. This was radically different from Renaissance maps, such as Mercator's famous 1569 world map, which put abstractions into the service of a transcendental harmony connected to a cosmological order.⁸ After Mercator, Renaissance cosmographical traditions began to decline as, in the words of David Harvey, geography 'was forced to buckle down, administer empire, map and plan land use and territorial rights, and gather and analyse useful data for purposes of business and state administration'.⁹ The *instrumentalisation* and rationalisation of geography and cartography was increasing as the processes of capitalist modernity intensified.¹⁰

With that in mind, I do not problematise Google Maps because of its abstractions per se, but rather because it is a prime example

7 McGilchrist, *The Master*, pp. 428–34.

8 J. Brotton, *A History of the World in Twelve Maps*, London, Penguin, 2012.

9 D. Harvey, 'Cosmopolitanism and the Banality of Geographical Evils', *Public Culture*, vol. 12, no. 2, 2000, p. 549.

10 D. Livingstone, *The Geographical Tradition: Episodes in the History of a Contested Enterprise*, Oxford, Blackwell, 1992, pp. 216–59.

of abstraction in the service of cybernetic capitalism. This process works to further the processes of capital accumulation and control, and to extend these forces further into the lifeworlds of billions of people around the planet. In this way, Google and its maps are implicated in the appropriation, domination and exploitation of nature, people and aspects of the human condition. The abstraction inherent in mapping can enrich our understanding of space, spatial relations, practices and phenomena. This is part of the power and appeal of maps, and one of the reasons that many people are passionate about them. However, like many things in our complex universe, particularly things technological, there is a deep ambivalence here. The optimist/pessimist dichotomy — often cloaked in techno-determinism — effectively obscures the contradictions that result from technology reconstituting our mode of being in the world and reconstructing social meaning.¹¹

Norbert Wiener is an illustrative figure in this respect. The coiner of the term 'cybernetics' spent the Second World War working in the military-industrial complex designing weapons and imagining the soldiers and guns as part of the same system. After many years working in this field, Wiener went on to urge his fellow scientists to consider the ethical implications of their work and to question the motivations of 'irresponsible militarists' issuing orders.¹² Wiener was well aware of the ambiguous social potential of techno-sciences, noting in *Cybernetics* that computing machines could escape human control and impose malevolent automated processes on society.¹³ He was also aware that computing machines could be used by the state or capitalists to augment their ability to dominate. Wiener was particularly concerned by the implications of industrial automation and even spoke with union leaders to suggest how workers might combat these threats.¹⁴ Yet through it all he believed that information systems could be a source of moral good, and that their extension could help to enable a more egalitarian, democratic social order. Through advocating and fearing machines, through working for and against war, Wiener thereby embodied some of the contradictions and ambivalences that surround computing machines.

11 S. Cooper, *Technoculture and Critical Theory: In the Service of the Machine?*, London, Routledge, 2002, pp. 1–17.

12 N. Wiener, 'A Scientist Rebels', *The Atlantic Monthly*, 1947, p. 46.

13 N. Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Cambridge, MIT Press, 1948.

14 F. Turner, *From Counterculture to Cyberculture: Stewart Brand, The Whole Earth Network, and the Rise of Digital Utopianism*, Chicago, University of Chicago Press, 2006, p. 23.

In the above paragraphs, ‘abstraction’ is used in different but related ways. Indeed, it is a complex term with a diverse number of meanings, yet the image of ‘drawing away’ is common to them all. Abstraction in its full *social* sense involves drawing back from others, things and meanings, thus relating to others and understanding the world through processes of mediation and extension, as has long been critically analysed by the Arena editorial group. Avoiding a concrete/abstract dichotomy, abstraction is a subjective material process, a lived relation with the world that is shaped by patterns of social practice.¹⁵ It exhibits processes of drawing away through increases in rationalisation, commodification, codification, objectification, mediation and extension — six concepts that are bound together in an interconnected matrix of social abstraction.¹⁶ In this article, I am interested in three overlapping clusters of abstraction:

1. Abstraction in its *codifying* sense: isolating characteristics from their context, separating, classifying, generalising and so on. Cartography is a practical exemplar of this sense of abstraction, but it is decidedly not limited to it.
2. Abstraction in its *commodifying* sense: constructing commensurate relations between otherwise unrelated values, things and processes by drawing away from their particularity and embodied difference and giving them abstracted monetary values. This includes the sense, emphasised by classical Marxism, involving the separation of use and exchange value, and of living and abstract labour. It is implicated in processes of alienation and reification.¹⁷
3. Abstraction in its *mechanising* sense: coming out of the computer sciences, involving the suppression of complexity for the purpose of gaining an organising power. This sense of the term will be elaborated on below.

15 G. Sharp, ‘Constitutive Abstraction and Social Practice’, *Arena Journal*, no. 70, 1985.

16 P. James, *Globalism, Nationalism, Tribalism: Bringing Theory Back In*, London, Sage Publications, 2006, pp. 134–5.

17 Importantly, abstraction was not always destructive in Marx’s thinking. Indeed, his method of inquiry involved significant abstraction in order to critique capitalism and work towards finding a way whereby abstraction could be put into the service of society as a whole, not for one class at the expense of other classes.

which form part of a suite of web technologies sometimes called AJAX, developed during the internet expansion of the mid-1990s. These programming languages and others like them are regularly updated and standardised to ensure interoperability, which is, as Ned Rossiter notes, 'key to the political economy of software'.¹⁹

These codes that make up Google Maps are only slivers of the ensemble of programs needed for the apparatus to function. For the front end to run on someone's device, it requires a web browser to decode the machine code that makes up the map, reproducing it in a visual form that people can engage with. This browser operates on another level, being composed of different codes. Likewise, for the browser to run, it must function with an operating system, which is composed of different levels of code again. For example, in the case of my home computer, I usually use the Firefox browser and the Linux-based operating system Ubuntu. Both of these are free and open-source, which means that — if one was so inclined — it would be entirely possible to look at their respective source codes and analyse their inner abstract mechanics. Such an inspection is not possible for Google Maps, or any non-open-source program, for the code is a proprietary secret and withheld from the public. Regardless, these multiple layers of code are interwoven in the functioning of the apparatus. If one were to metaphorically go down the abstraction layers of a computing machine, all code would be ultimately composed of binary notation, a variation on a theme of ones and zeros, which represents the machine code — the lowest of the low-level programming languages for computing. It would have none of the mnemonic devices, assemblers or higher level features that virtually all programmers practically use in their work coding complex systems. The absence of these features makes binary extraordinarily difficult to deal with, as its symbolic system is so minimalist as to seem almost anti-phenomenal in its abstraction.

Nevertheless, code and software are decidedly material: they are a constructed product of human labour, embedded within networks of physical computing machines. This is part of what I refer to by the concept of *abstracted materiality*. Software is material, but drawn away from the everyday. All software is composed of a condensation of social relations and practices; in this sense, code can be imagined as aspects of society encoded. As the products of

19 N. Rossiter, *Software, Infrastructure, Labor: A Media Theory of Logistical Nightmares*, Abingdon, Routledge, 2016, p. 56.

human consciousness within creative nature, software is hence simultaneously subjective and material. The format of abstracted materiality has tremendous flexibility in terms of how it can be made to manifest. Software programs can be as diverse as Google Maps, Microsoft's Excel, the role-playing strategy game *Pillars of Eternity* and a self-replicating denial-of-service worm, the dating app Grindr and the NSA's mass surveillance program MUSCULAR. Matthew Fuller has noted that

... it is this paradox, the ability to mix the formalized with the more messy — non-mathematical formalisms, linguistic, and visual objects and codes, events occurring at every scale from the ecological to the erotic and political — which gives computing its power effects, and which folds back into software in its existence as culture.²⁰

The term 'abstraction' has a special meaning in the field of computer science. It refers to techniques for managing computer systems whereby the level at which a person interacts with a system suppresses levels of greater complexity beneath it in order to grant an organising power. For example, when someone engages Google Maps they can interact with the software's graphical interface, and the code is suppressed beneath this. Likewise, the programmers who wrote the apparatus's source code worked with the well-defined interface of machine code, which serves to suppress the complexity of the binary beneath it. Abstraction in this sense grants greater simplicity, legibility, efficiency and organisational power than if one were working on less abstract and thus more complicated levels. The classic textbook *Foundation of Computer Science* begins with a chapter called 'Computer Science: The Mechanization of Abstraction'. Combining elements of this understanding with the 'levels of abstraction' argument, I speak of this specific form as 'mechanised abstraction'. The opening paragraph of the textbook's first chapter closes with the claim that 'fundamentally, computer science is a science of abstraction' —

... abstraction in the sense we use it implies simplification, the replacement of a complex and detailed real-world situation by an understandable model within which we can solve a problem. That is, we 'abstract away' the details whose effect on the

20 M. Fuller, 'Introduction', in M. Fuller (ed.), *Software Studies: A Lexicon*, Cambridge, MIT Press, 2008, pp. 5–6.

solution to a problem is minimal or non-existent, thereby creating a model that lets us deal with the essence of the problem.²¹

At this point, one may ask: how does a computer scientist determine what the problem is? This happens at multiple levels, including the technical level stressed above, as well as a more social level. Formulating a 'problem' is a fundamentally subjective material social practice: it involves consciousness, particular perspectives and the practice of agency. It is a matter of interpretation, and hence it may also be ideological. Yet, when the process is formulated in the terms of technical problems and solutions, and applied to complex social matters, this thinking can slide into scientism. This is deeply problematic, as Horst Rittel and Melvin Webber noted in their famous article on 'wicked problems': in the social sphere, formulating a problem is intimately entangled with one's ideological perspective and also the proposed solution to the problem.²²

Putting the technical understanding within its larger social context, Google's central 'problem' could be expressed as how to generate more profit and hegemony for the company. The 'solution' to this runs as follows: provide useful services that many people will use so that data can be harvested from them, and sell this data to advertisers. Following on from this: maps can be useful, thus Google should expand into them too, for this could serve to expand the firm's hegemony, and secure more surveillance data and thus capital accumulation. This will 'make the world a better place', as Silicon Valley techno-utopians are fond of claiming. This problem/solution composite is highly ideological, welded to the capitalist dream of endless growth and control. Concerns about labour conditions, environmental consequences or meaningful democracy, among others, are considered extraneous to the problem and are 'abstracted away' in the service of cybernetic capitalism.

A parallel can be seen between mechanised abstraction and how a map-maker interprets a landscape. Software abstracts away complexity and presents a simplified model that grants an organising power directed towards a particular formulation of a

21 A. V. Aho and J. D. Ullman, *Foundations of Computer Science*, New York, W.H. Freeman, 1992, p. 3. While no longer in print, this book is still on Stanford University's InfoLab website and remains a recommended reading for an introduction to the theory of computer science. See <<http://infolab.stanford.edu/~ullman/focs.html>>.

22 H. Rittel and M. Webber, 'Dilemmas in a General Theory of Planning', *Policy Sciences*, vol. 4, 1973.

problem. This is similar to how a map-maker interprets a landscape, represents aspects of it on a map, and can thus gain an organising power from the codifying abstraction of this process. The map-maker necessarily selects, simplifies and distorts what they represent in their subjective material representation of space, which is then used for the collective creation of meaning and the political organisation of society.

For software to abstract away the extraneous details and create a model of the problem/solution complex, it requires programmers to create a particular interpretation of reality — an interpretation that is necessarily partial, simplified and distorting, since it plays out within the hermeneutic processes.²³ If this interpretation is bound up with advancing the interests of a particular group and grants an organising power over society, then this interpretation can be considered ideological. From this perspective, Google's computing machines and their programs are ideological in that they advance a particular interpretation of reality and wield an organising power in the service of cybernetic capitalism.

Drawing on the complex history bound up in the concept 'ideology',²⁴ I understand ideologies to be subjective material maps of shared social reality, which are used for the collective creation of meaning through offering a particular interpretation of the world. Ideology is a type of interpretation that relates to the political organisation of society and, like spatial maps, these interpretations are frequently made by the powerful to legitimate their order and serve their interests — yet there is always space for counter-hegemonic mapping and struggle over the fundamental indeterminacy of meaning. Like maps, ideologies necessarily select, simplify and distort the reality they represent. As with maps, this is essential and unavoidable because of the body's inability to directly perceive the phenomena outside of the representational processes of its own consciousness. Simultaneously subjective and material, ideologies are the products of human creativity — hence also the products of the creativity of nature; they are integral to the social processes of meaning-making and the political organisation of society.

23 T. Metzinger, *The Ego Tunnel: The Science of the Mind and the Myth of the Self*, New York, Basic Books, 2009; and G. Vattimo and S. Zabala, 2011, *Hermeneutic Communism: From Heidegger to Marx*, New York, Columbia University Press, 2011.

24 T. Eagleton, *Ideology: An Introduction*, London, Verso, 2007; M. Steger, *Globalisms: The Great Ideological Struggle of the Twenty-First Century*, Lanham, Rowman & Littlefield, 2009.

By virtue of making this connection between an understanding of maps, ideology and technology, I can venture a partial response to an influential claim put forward by historian of technology Melvin Kranzberg, who devised several ‘laws of technology’, which he named after himself. The first law states: ‘Technology is neither good nor bad, nor is it neutral’.²⁵ Devised as a way to emphasise the importance of historical context — a valid and important point — I wish to build upon this law, which suggests much about what technology is not, without offering anything about what it might be. My partial response to Kranzberg, then, is that while technology is not good, bad or neutral, it is *ideological*. As I have suggested above, abstraction in computing machines is a fine example of selectivity and simplification, of devising a specific problem/solution complex, and it grants an organising power that can be put into the service of cybernetic capitalism (or, for that matter, put into service for counter-hegemonic struggle).

This ideological element is one crucial aspect of computing machines, yet there is another important aspect to the mechanised abstraction that warrants fleshing out. According to John Guttag, the former head of Electrical Engineering and Computer Science at MIT:

The essence of abstraction is preserving information that is relevant in a given context, and forgetting information that is irrelevant in that context. The key to using abstraction effectively in programming is finding a notion of relevance that is appropriate both for the building of an abstraction and the potential clients of abstraction. That is the true art of programming.²⁶

As in the Aho and Ullman quote above, Guttag’s understanding of mechanised abstraction also requires interpretation to determine what is ‘relevant’ — a potentially wicked problem. Following the above logic, one could ask: who is the client of abstraction? Again, moving between the entangled technical and social levels, the ‘client of abstraction’ in the case of Google Maps is a profit-maximising corporation. Hence the abstractions tend to be made to serve this particular relevance. But there is something more here,

25 M. Kranzberg, ‘Technology and History: Kranzberg’s Laws’, *Technology and Culture*, vol. 27, 1986.

26 J. Guttag, *Introduction to Computation and Programming Using Python: With Application to Understanding Data*, 2nd edition, Cambridge, MIT Press, 2016, p. 49.

contained in the line 'the building of an abstraction'. Software, in this respect, can be seen as a layer of abstracted material that is built within social practice. This more abstracted layer reconstitutes other layers of practice in a process that can cause conflict, ambivalence and contradiction.²⁷ This part of the argument is not about who the specific 'client of abstraction' is but rather something deeper, something concerning ontology and integration.

A counter-hegemonic example may be illustrative. In 2012, the International Organization for a Participatory Society (IOPS) was formed and began to use software abstractions in an attempt to network radical struggles around the world into a revolutionary organisation. This ongoing experiment attracted several thousand members from 100 countries, yet difficulties were encountered in translation between the global, disembodied extensions afforded by the website²⁸ and the autonomous local chapters of diverse activists. In its initial iteration, IOPS was unable to bring these tensions into a generative synthesis, and the project stalled, in part due to contradictions aroused between disembodied global and embodied local relations — which is to say, between the different levels of social abstraction. This is not to suggest that the project failed utterly, or that something similar couldn't be more successful in the future. Rather, it is to make the more provisional point that the 'levels of abstraction' argument helps to understand the ontological contradictions and tensions that emerge when an abstract layer of computing engages less abstract, local and embodied practices.²⁹ This example is cited because it does not serve the 'client' of cybernetic capitalism, but nevertheless the 'building of abstraction' impacts how it plays out in society.

Mechanised abstraction extends this problem. Computing machines function as black boxes, as systems whose internal structure is unknown and usually not considered important to whatever practical purposes the machine is applied to by the vast majority of the people who use them. This black-boxing seems to be an effect of the machine's abstraction, via its software, hardware and commodity form. To give an example, comparatively few of the people who use Google Maps know how IPv6 allocates 128-bit integers to specific internet addresses in order to access the website. These specifics have been drawn away via mechanised abstraction.

27 Cooper, *Technoculture and Critical Theory*.

28 See <www.iopsociety.org>.

29 James, *Globalism, Nationalism, Tribalism*.

Of course, there are people who know this very well — IPv6 is made and administered by people — yet IPv6 is only a sliver of the ensemble required for complex computing.

The complexity of the cybernetic capitalist ensemble has reached the point that literally nobody knows how these machines function and are produced in their entirety. This could seem a bold claim, but it is a defensible one. Computing machines embody a degree of complexity many orders of magnitude above that of a comparatively simple object such as a pencil. And yet, even the production of a pencil is so complex that nobody knows all of the processes involved in making one. This point was forcefully made by Leonard Read in his 1958 polemic essay, *I, Pencil*.³⁰ As a collaborator with Friedrich Hayek, Ayn Rand and Milton Friedman, Read used this complexity as an argument against any form of democratic planning in favour of promoting faith in the ‘invisible hand’ and its supposed ability to organise capitalism to a degree of sublime perfection. Read’s reactionary conclusions notwithstanding, his essay does an excellent job of concisely teasing out the complexities involved in modern production. The production of computing machines is a hugely complex process, incorporating both the abstracted materiality of the software and the materiality of the machines themselves. The machines are produced by having many components mined and recombined into intricate lattices of circuits composed of complex conglomerates of plastics, chemicals, electricity and minerals. These products are produced by world-spanning supply chains that operate according to extractive, logistical and financial capitalist logics.³¹

Production and abstraction are bound together under cybernetic capitalism. To sketch a sense of this, consider the example of the complexity involved in the production of aluminium, an essential ingredient in all computing machines. Firstly, finding ore formations to mine is not simple, with technics ranging from

30 L. Read, *I, Pencil*, New York, Foundation for Economic Education, 2010. The dichotomy between central planning and decentralised organisation employed by the neoclassical economists’ arguments against Soviet-style socialism has become increasingly problematic since the reconstitution of capitalism in the 1970s, in part because of monopoly capital’s massive centralisations, and also because of the degree of integration between the state and corporations via public–private partnerships and revolving-door politics. It is further complicated by the shifting practices of corporations, such as Google, and their increasing incorporation of unpaid labour and social cooperation into their circuits of accumulation.

31 S. Mezzadra and B. Neilson, ‘Extraction, Logistics, Finance: Global Crisis and the Politics of Operations’, *Radical Philosophy*, no. 178, 2013, pp. 8–18.

analysing sediment in rivers to using satellites, along with gravimetric, magnetic and seismic studies, to probe beneath the earth's surface. Then, there are layers of politics in how the mine is sunk, with government regulations and investor relations being crucial. In Australia, the world's largest producer of aluminium, these mines are sunk into Aboriginal land, which raises many complex issues of colonial encounters, land rights and Indigenous sovereignty. Labour must be mobilised and exploited in order to extract the minerals from the earth, which in an Australian context may involve the use of temporary work visas designed to allow skilled workers to enter the labour market in order to facilitate capital accumulation. Once dug up, aluminium needs a lot of energy-intensive refinement before it can function in its purified state. It is smelted in a complex procedure called the Hall-Héroult process, which involves dissolving the alumina ore into molten cryolite and electrolysing it inside a molten salt-bath heated to around 940–80 degrees Celsius, a process that produces much waste and is known by the euphemism 'red mud'.

Then, for the minerals to move around the world, there must exist a complex system of logistics. This is facilitated by a layer of software for 'enterprise resource planning', logistics programs calculating efficiency and integrating production into the global market.³² On top of that are layers upon layers of insurance, stock-market fluctuations and financial speculation on the commodity futures market. All of this and much more comes together to make one extraordinarily complex ensemble that is needed to make up the materiality of the world-spanning network of computing machines.

The sheer complexity of the hardware of computing machines means that their very physicality can be considered *materially abstracted*, in contrast to the abstracted materiality of the software. The complexity embodied in a computer is suppressed by the mechanised abstraction of the software systems that move through it. One can engage Google Maps on a mobile device without having the slightest idea of how the computing machine technically functions or of the labour that went into producing it. These have all been abstracted away by the software.

The cybernetic capitalist mode of practice also serves to inject additional abstraction into the mix through its extension of

32 Rossiter, *Software*, pp. 51–76.

commodity relations and technological augmentations into more aspects of life. These abstractions have the effect of obscuring the exploitation and domination that is bound up with how the machines are built. China Labour Watch, an independent, not-for-profit workers' rights watchdog organisation, has written a series of reports that describe the various systematic abuses of workers in China's high-tech factories that produce the majority of the world's electronic devices from which Google profits so handsomely. China Labour Watch's reports describe in painful, empirical detail a whole array of dehumanising practices imposed on China's internal migrant workers whose unending drudgery is used to produce the devices that consumers just cannot live without. They describe widespread practices of child labour, forced overtime, unpaid labour, poor sanitation, gruelling productivity quotas, dangerous working conditions, cruel and authoritarian management practices, and harsh punishments. China Labour Watch found that the average working week for Samsung's factories is sixty-nine hours. Broken down to a daily rate, this comes to ten hours per day, seven days a week. These reports are eerily similar to the factory inspector reports that Frederick Engels drew on back in 1844 to write *The Condition of the Working-Class in England*.

Along with the commodity form and complexity of the machines, software itself serves to intensify the abstraction effect and to suppress (continuing) prior levels of complexity in order to gain control. The combined effects of commodified relations, complex machines and software layers serve to create a powerful black-box effect that adds to the abstracting tendency that has been technologically augmented by cybernetic capitalism.

For all the rational mastery it takes to reach this instrumental position, there are numerous contradictions. As fetishism haunts the rationality of the commodity form, likewise, the products of abstracted technology and the associated social forms mix these formalities with new forms of techno-fetishism. The black-box effect contributes towards a phenomenon described in Arthur C. Clarke's famous third law: 'Any sufficiently advanced technology is indistinguishable from magic'. In the early twenty-first century, this manifests as a simultaneous disenchantment process under the influence of abstracted computing machines, and a re-enchantment in the form of technological fetishism. This ontological contradiction comes from the interactions between different levels of

abstraction. The point to emphasise here is that the materiality with which a program like Google Maps operates is itself constitutively abstract in its production and functioning — as software, hardware and as a commodity.

Commodification and Recombinant Labour

Production and abstraction are bound together in cybernetic capitalism with respect to how labour is mined and recombined. A program like Google Maps is the product of hours upon hours of labour, work that is arranged according to the cybernetic capitalist division and multiplication of labour and put into the service of capital accumulation. It incorporates work from Google's engineers, the company's celebrated 'smart creatives', to use its corporate jargon.³³ In 2012, Google reported having 1100 full-time employees working on its map, out of a total of around 54,000 employees in over seventy offices spread over forty nations.³⁴ The labour of these workers is controlled by corporate hierarchy, guided by marketing reports and engineering specifications. All of these leave material traces,

... in corporate archives, on whiteboards and legal pads, in countless iterations of alpha versions and beta versions and patches and upgrades, in focus groups and user communities, in expense accounts, in licensing agreements, in stock options and IPOs, in carpal tunnel braces, in the Bay Area and New Delhi real-estate markets, in PowerPoint vaporware and proofs of concept binaries locked in time-stamped limbo on a server where all the user accounts but root have been disabled and the domain name is eighteen months expired.³⁵

In addition to Google's 'labour aristocracy', to use Christian Fuchs's phrase, the firm supplements the work on the map with the outsourced work of around 6000 contractors.³⁶ Google does not state what these precarious labourers do for the map, but it is likely

33 E. Schmidt and J. Rosenberg, *How Google Works*, London, John Murray, 2014.

34 N. Carlson, 'To Do What Google Does in Maps, Apple Would Have to Hire 7,000 People', *Business Insider*, 2012, <<http://www.businessinsider.com.au/to-do-what-google-does-in-maps-apple-would-have-to-hire-7000-people-2012-6>>, accessed 22 November 2016.

35 M. Kirschenbaum, *Mechanism: New Media and the Forensic Imagination*, Cambridge, MIT Press, 2008, p. 15.

36 Carlson, 'To Do What Google Does'; C. Fuchs, *Digital Labour and Karl Marx*, Abingdon, Routledge, 2014, pp. 213–32.

that many of them work as human search-quality ‘raters’, an exploitative aspect of the digital division and multiplication of labour.³⁷ Like the minerals that make up the computing machines, digital labour can be mined and recombined within cybernetic capitalism:

Capital can buy fragments of human time, recombining them through the digital network. Digitalized info-labor can be recombined in a different location, far from the one that produces it. From the standpoint of capital’s valorisation, the flow is continuous, finding its unity in the produced object. Yet from the cognitive workers’ perspective the work done has a fragmentary character: it consists in fractions of cellular time available for productive recombination. Intermittent work cells turn on and off within the large control frame of production.³⁸

This is one of the ways that the metabolic energy of the body is abstracted and put to work, with living labour’s vitality being fed into the apparatus of cybernetic capitalism. In addition to the digital labour provided by Google’s full-time employees and their precarious contractors, the company also crowdsourced some of the production of its map. In 2008, Google Map Maker launched a feature that enabled non-employees to edit and make additions to the apparatus, thereby contributing to the map’s ‘ground truth’, to use the company’s terminology. According to the map’s co-founder, Lars Rasmussen, the idea came from Google’s Bangalore office, where the team developed a system that enabled anyone to edit Google Maps as a way around the lack of official maps to licence.³⁹ Company executives often cite impressive time-lapse videos to showcase how mapping progressed from the collaborative effort of volunteer cartographers, such as those in Karachi, Pakistan.

Map Maker was modelled on the Wikipedia-inspired Open StreetMap.org (OSM), a crowdsourced, collaborative map that began in the United Kingdom in 2004. OSM uses an Open Database Licence, which enables people to freely share, modify and use its

37 P. Bilić, ‘Search Algorithms, Hidden Labour and Information Control’, *Big Data & Society*, vol. 3, no. 1, 2016.

38 F. Berardi, *The Soul at Work: From Alienation to Autonomy*, New York, Semiotext(e), 2009, p. 191.

39 L. Rasmussen, ‘On Creating Google Maps’, *ABC*, 2009, <<http://www.abc.net.au/tv/bigideas/stories/2009/07/10/2620279.htm>>, accessed 29 July 2014.

maps while allowing the same freedom for others. While much of OSM is broadly very similar to Google Maps, this makes for a fundamental difference. By contrast, Google's Map Maker approached the idea of crowdsourcing mapping data not from an open and collective perspective, but rather from something closer to outsourcing. Map Maker enabled non-employees to voluntarily contribute edits to the apparatus. Google would then take exclusive ownership of their work on the map and use their unpaid labour to further their own commercial advantage. When volunteers spent their metabolic energy to increase the accuracy of detail of Google Maps, the cybernetic capitalist firm benefitted from this by having a more detailed and accurate image of the world with which to increase its utility, keep its competitive advantage, and encourage more people to be drawn into their circuits of surveillance and commodification. The same principle applies when people report an error or send feedback to the firm.

Tensions around this distinction could be seen in 2012, when the World Bank announced that it would make Map Maker data available to the governments of poorer nations for purposes of planning, disaster management and the monitoring of public services.⁴⁰ A Google program manager claimed that the 'free, web-based mapping tool ... enables citizens to directly participate in the creation of maps by contributing their local knowledge'.⁴¹ The World Bank Vice President for the Africa Region, Obiageli Ezekwesili, said:

Today's technology can empower civil society, including the diaspora, to collaborate and support the development process. This collaboration is about shifting the emphasis from organisations to people, and empowering them to solve their own problems and develop their own solutions using maps.⁴²

The United Nations also used Map Maker in a number of crisis situations, and claims:

The future of the Google-UNOSAT cooperation looks bright as the two entities are engaging in ... additional innovation with a view to bringing more edge and efficiency to an area

⁴⁰ J. Panek, 'How Participatory Mapping Can Drive Community Empowerment: A Case Study of Koffiekraal, South Africa', *South African Geographical Journal*, vol. 97, 2015.

⁴¹ F. Lamy, 'World Bank and Google Join Forces to Empower Mapping Communities around the World', *Google.org*, 2012, <<http://blog.google.org/2012/01/world-bank-and-google-join-forces-to.html>>, accessed 25 February 2016.

⁴² Cited in Lamy, 'World Bank and Google'.

developing particularly fast but not always in adherence with the requirements of the user community.⁴³

While Google, the United Nations and the World Bank engaged in rounds of back patting and rosy rhetoric about community resilience in the face of disaster, the devil was in the detail — specifically in Google’s Terms of Service agreement. Agreeing to Map Maker’s terms and conditions — an unavoidable prerequisite for using the apparatus — effectively gave Google veto power over what tools could be used on the underlying data sets, and allowed the corporation to use the community-generated data as it saw fit.⁴⁴ The Terms of Service for Google Map Maker stated:

By submitting User Submissions to the Service, you give Google a perpetual, irrevocable, worldwide, royalty-free, and non-exclusive license to reproduce, adapt, modify, translate, publish, publicly perform, publicly display, distribute, and create derivative works of the User Submission.⁴⁵

Unlike Open Street Map (OSM) — whose license forbids it from using data for commercial purposes — Google Maps is utterly privatised. Its profit-making potential is protected by licences and legalities. As well as providing a marketing opportunity for the company to showcase its benevolent ‘responsibility to the world’, hence ideological legitimacy, these feel-good projects with the United Nations and the World Bank also serve to draw more people into Google’s circuits of exchange.

Former OSM board member Mikel Maron criticised the cyber-capitalist firm, stating that ‘Google claimed to map “the largest slum in Africa”, with “citizen cartographers”. They’re building their business by glorifying half-baked “community” mapping initiatives, promoting their brand on the back of poverty’.⁴⁶ Be that as it may, Map Maker enabled aspects of the production of the apparatus to be outsourced to the murky realms of unpaid labour. This is an

43 UNOSAT, or the United Nations Operational Satellite Applications Programme, began in the year 2000 with the mission ‘to deliver integrated satellite-based solutions for human security, peace and socio-economic development’. UNITAR stands for the United Nations Institute for Training and Research.

44 The World Bank succeeded in getting Google to change their 2011 Terms of Service agreement from giving the firm exclusive ownership over the crowd-sourced data to the more watered down presented license above — see. Panek, ‘How Participatory Mapping’, pp. 22–4.

45 Google, ‘Terms of Service for Google Map Maker’, 2016, <https://www.google.com/mapmaker/mapfiles/s/terms_mapmaker.html>, accessed 16 November 2016.

46 M. Maron, ‘We Need to Stop Google’s Exploitation of Open Communities’, *Brain Off*, 2011, <<http://brainoff.com/weblog/2011/04/11/1635>>, accessed 25 February 2016.

excellent example of how Google used Map Maker to appropriate the unpaid labour of these 'citizen cartographers'. The labour of these volunteers is joined with the other appropriated traces of people's subjective engagements with Google Maps. Simply using the apparatus puts one in the scope of Google's surveillance engines, with their searches, movements and creative actions being subject to extractive processes, as discussed in further detail below. This labour is mined and recombined in order to be commodified, thus augmenting the hegemony of the firm and of cybernetic capitalism.

A sense of an aspect of this global appropriation could have been grasped by viewing Map Maker Pulse, a feature that enabled one to see, in pseudo-real time, edits to the apparatus proposed by people using Map Maker. I watched five minutes' worth of edits that included the following: a road to the Polish town Wegrów had its name changed; a turn segment was added on King Abdullah Road in Riyadh; the name of a café in Singapore was added; a street in Mountain View, California was changed to have restricted traffic; and a theatre was added at the University of Melbourne, which happens to be only few blocks from where I was typing — and the edits would go on and on like this.

Google has now de-activated Map Maker and Map Maker Pulse. They announced that between 2008 and early 2017 the 'Google Map Maker community has edited and moderated millions of features to improve the Google Maps experience'.⁴⁷ Many of the former Map Maker features are now incorporated directly into Google Maps via their 'Local Guides' program, which is largely centred on ratings, reviews and confirming facts about businesses in order to improve commercial listings. It does this through a gamified system built on rewarding the contributions of 'power users' by allowing them to accumulate points, go up 'levels', and unlock 'badges' and early access to new Google Map features.⁴⁸

Despite the fact that it has been shut down, Map Maker Pulse offered a curious glimpse into an aspect of the apparatus's production which highlighted the constant state of flux that characterises its unfolding. The seemingly endless array of micro-edits also showed how unpaid labour is drawn into the apparatus's

47 Google, 'Google Map Maker Has Closed', 2017, <<https://support.google.com/mapmaker/answer/7195127>>, accessed 19 July 2017.

48 Google, 'Local Guides', 2017, <<https://maps.google.com/localguides/>>, accessed 19 July 2017.

abstracted materiality via a global network of computing machines. This ensemble allows the map to draw fragments of work into itself, recombining them into the representation's fine-tuned facade. Other aspects of the map could have been drawn from the work of other cartography companies that have licensed their maps to Google, some from the work of the 6000 precarious contractors, some from data harvested by Street View cars, some from aerial photographs, some from subjective traces gathered from ordinary people using the map, and some from software automations programmed by the firm's engineers. Elements extracted from these sources are recombined in the apparatus. The diversity of this list of possible contributors shows the increasing 'multiplicity of labour', to use Brett Neilson and Sandro Mezzadra's concept — the fragmenting divisions that increase the heterogeneity of labour in the early twenty-first century.⁴⁹

However, just looking at Google Maps, it is impossible to grasp the complexity and diversity of the labour that it took to produce it. The mechanised abstractions of software and commodity relations come together in a black-box effect that obscures the labour that was poured into its production. The apparatus's mechanised abstraction draws away from this, with its representation depicting a single, smooth image, a polished facade that overlays the complexity involved in its production. This is how the abstracted material (software) and materially abstract (hardware) can come together with commodity form to distance people using the map from the processes of production in which they are also involved. Taken together, this is an example of a cybernetic process between humans and technology under the conditions of late capitalism. Communication technologies facilitate the connection and exploitation of scattered 'citizen cartographers' and precarious contractors, miners and factory workers, financiers and transporters, software engineers and ordinary people moving around through space via the map. All of this creative effort is mined and is recombined into the apparatus, partially through direct human labour, partially through automated processes.

The apparatus is produced and reproduced in the global circuits of recombinant cybernetic capitalism. It is significant that while the apparatus draws labour from around the world into its recom-

49 S. Mezzadra and B. Neilson, *Border as Method: Or, The Multiplication of Labor*, Durham, Duke University Press, 2013.

binant representation, it is not 'global' in some smooth sense. Rather, these uneven processes are centred on the Googleplex, the firm's seat of empire in Silicon Valley. The corporation has the control through its centralised structures, surveillance capabilities and bureaucratic mechanisms (terms and conditions and so on); it possesses full ownership of the apparatus and uses it to maximise its own profit-making potential and hegemony within cybernetic capitalism. Hence the heterogeneous labour poured into the recombinant representation is put into the service of accumulation and control.

The Commodification of Subjectivity

Part of Marx's analysis of abstraction in capitalism looked at how exchange value was abstracted from use value, a pattern than can also be seen within Google. Simply put, Google Search's use value is its ability to allow a person to navigate the Web and locate sites of interest. It was in providing this particularly useful service that the company first excelled and through which it gained its popularity. The cybernetic capitalist corporation then abstracted this use value by subordinating it to a second-order exchange value produced through selling the audiences to advertisers. Google first surveyed cyberspace, then surveyed the people using it.⁵⁰ Both were acts of mechanised abstraction, of drawing away from prior levels of complexity. Both served particular 'clients' and granted an organising power. Both brought production and abstraction together in the service of cybernetic capitalism. The first created a map of cyberspace that simplified and selected hyperlinks and other components deemed relevant to the goal of navigation. The second abstracted away the embodied complexity of a person's subjectivity in favour of data traces of this subjectivity that could be quantified, analysed by software and, ultimately, sold to advertisers. It is to this second process that I now turn.

When people interact with the Web, they leave a number of material traces of their subjective actions in the form of data. Karl Polanyi's concept of 'fictitious commodities' may be useful here,

50 M. Pasquinelli, 'Google's PageRank Algorithm: A Diagram of Cognitive Capitalism and the Rentier of the Common Intellect', in K. Becker and F. Stalder (eds), *Deep Search: The Politics of Search Beyond Google*, London, Transaction, 2009; S. Zuboff, 'The Secrets of Surveillance Capitalism', 2016, <<http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshana-zuboff-secrets-of-surveillance-capitalism-14103616.html>>, accessed 8 April 2016.

though not in the way that he first developed the argument. He stated that while labour, land and money can be bought and sold on a capitalist market, they are not produced for sale and thus can never be fundamentally reduced to commodities:

Labor is only another name for a human activity which goes with life itself, which in its turn is not produced for sale but for entirely different reasons, nor can that activity be detached from the rest of life, be stored or mobilized; land is only another name for nature, which is not produced by man; actual money, finally, is merely a token of purchasing power which, as a rule, is not produced at all, but comes into being through the mechanism of banking or state finance. None of them is produced for sale. The commodity description of labor, land, and money is entirely fictitious.⁵¹

In this formulation, Polanyi demonstrated how capitalism appropriates basic life-building activities, drawing aspects of them into its for-profit circuits. Building on his observation, I suggest that the process of commodifying these basic activities, processes and relations can be described as a process of abstraction. Human activity can be drawn away into abstract labour, land can be enclosed and currencies can be speculated upon. In these cases, each is drawn into a more abstract frame of reference and is made commensurable with other commodities via abstraction. A more compelling argument can be made if one thinks of the process not as fictitious but as a subjective material process of abstraction.

Moving this to the present, it could be argued that the digital traces of subjectivity gathered from people's cybernetic actions are 'subjective commodities'. I use the term *subjectivity* in a three-fold sense, with analytical distinctions being made between: 1) subjectivity as meaning-making, referring to a person's conscious experience of the phenomenological world and their ability to make meaning; 2) subjectivity as agency, as a person's autonomy and ability to act; and 3) subjectivity as perspective, a person's particular and partial view of reality. From a Polanyian position, it might rightly be claimed that subjectivity was not produced for sale on the market, and is not reducible to quantifiable units and

51 K. Polanyi, *The Great Transformation: The Political and Economic Origins of Our Time*, Boston, Beacon Press, 2001, pp. 75–6.

exchange values. Indeed, subjectivity appears to be an emergent property of high-level consciousness, itself an intrinsic potentiality of social nature: it is a lived and embodied practice, a co-constitutive part of the vastly complicated nature–social processes of the material universe. However, like the other ‘fictitious commodities’, the fact that subjectivity was not made for a market does not prevent its traces from being appropriated and profited from in ways that allow for the accumulation of real power. Once again, abstraction is key.

Google makes its money from a kind of ‘surveillance-commodification complex’, which draws traces of a person’s subjective interest in something into itself for profitable resale to advertisers. This is what Vaidhyanathan had in mind when he said: ‘We — our fancies, fetishes, predilections and preferences — are what Google sells to advertisers’.⁵² Alternatively, this might be expressed by noting that people’s unpaid digital labour is exploited by capitalist structures to produce extractable surplus.⁵³ Google achieved this via an appropriation with two moments: firstly, through its survey of the Web (PageRank and so on), and secondly, through its surveillance of people engaging with the Web (AdWords and so on). In both instances, Google extracts — among other things — digital traces of the subjectivity of the people who engage with it. Significantly, Google is not unique here; many cybernetic-capitalist companies engage in similar actions, with Facebook another exemplar. The range of services that Google provides grants it many opportunities to scrape digital traces of subjectivity from people — not only when people enter words into Google Search, but also when they email friends and family (Gmail), use their phones (Android), engage with a social network (Google+), watch videos of cats (YouTube), and inquire into and move through physical space (Google Maps). Digital traces of subjectivity can be extracted at each step.

It may be illustrative to put this appropriation of subjectivity in terms of a concrete, if hypothetical, example. Suppose a traumatic event has recently caused Alex to reflect on her mortality. Her phone pings with an incoming email sound and she opens her Gmail app to receive an email from a relative attempting to comfort

52 S. Vaidhyanathan, *The Googlization of Everything: (And Why We Should Worry)*, Berkeley, University of California Press, 2011, p. 3.

53 Fuchs, *Digital Labour*, pp. 95–6.

her. The email is read by Google's automated ad-bots, which put an advertisement for a life insurance company next to the email. After reading her relative's reassuring words, an ad fills Alex's small screen with the image of a smiling white family above the line, 'ensure your loved ones are taken care of financially'. Alex taps the ad and is taken to the website, while money is transferred from the life insurance company to Google.

Alex's subjective desire to make meaning from her life in a moment of existential uncertainty is commodified by Google's sentiment analysis and advertising software before being sold to a life insurer to potentially make profit from Alex until death do them part. Alex's subjective ability to act is both enabled and constrained by the abstracted materiality of the apparatus: she can read her relative's words on a mobile device, and a global corporation can attempt to profit from this act (both of which occur on a more abstracted layer of practice). By systematically promoting advertisements, Google encourages certain kinds of subjective action — specifically, it serves to promote more consumeristic patterns of practice. Alex's subjective perspective is also implicated, for this click on a life insurance advertisement will be recorded in her profile, and now ads for life insurance may start appearing all over the Web as it is automatically customised for her. It will become a factor in future searches she makes and the kinds of results delivered, and thus may come to shape her particular and partial perspective on cyberspace.

Turning from Google in general to its map, imagine that Alex later finds herself walking through the streets of Brunswick, Melbourne, staring at her phone. She enters the word 'restaurants' into the search field and notices a nearby knife-and-fork symbol with a description overlaying the map reading: 'Funky locale for Lebanese soul food'. Clicking the link, she sees that the place has twenty reviews, a 4.4-star rating and a quote attributed to Google: 'Traditional, hearty Lebanese dishes in a bohemian hangout with mismatched furniture and a courtyard'. The apparatus also provides a panoramic photograph of the funky interior, as well as links to view the menu and to book a table. Based on this, Alex decides to send a group message proposing to meet her friends at the restaurant. Alex will 'check in' on the map upon arrival, photograph and share images of the meal when it arrives, and 'rate and review' the establishment afterwards. Such is the augmented dining experience.

This second vignette begins with the hypothetical Alex walking through urban space while paying the minimum amount of attention to her surroundings — sometimes to the detriment of other pedestrians. She focuses almost entirely on her device's representation of the embodied space she is moving through, thus changing her relationship to the urban space, both physically and socially. Meanwhile, at a greater level of abstraction, the device is focusing on her, with her location being tracked in real-time by Google's surveillance engines. The 'restaurant' search triggered an automated global auction, with the winners being displayed on the map. The 'funky locale' is (presumably) a paid-up advertiser, offering more money per click to Google for someone searching within a kilometre of the shop, and even more for someone searching between 6 pm and 9 pm, Thursday to Saturday. Alex drew on the abstracted authority of a cartographic advertisement and its anonymous reviewers. Hence her bodily need to eat and to socialise was manipulated by advertising, and she became involved in the accumulation circuits of a multinational corporation. Her social practice was augmented by a layer of disembodied integration inseparable from the regime of cybernetic capitalism. This had the effect of reconstituting her way of being in the world, her embodied relations with others and social practices.

This brief example shows how Google commodifies digital traces of subjectivity and encourages practices that are in the interests of cybernetic capitalism. Notably, Alex may never buy life insurance; she might close the website with a dismissive sneer. Google does not issue commands. Rather, it exerts a subtler form of control that is involved with the practical advantages of Google's services, along with the ideological framing, the broader political and economic context characterised by deregulation and monopoly, and the mechanised abstraction of computing machines. This ensemble of practices, meanings and technologies — both production and abstraction — are put into the service of cybernetic capitalism. The abstracted layer of disembodied cybernetic social practice is layered over other social forms and relations, processes and practice, potentially causing ontological contradictions and altogether reconstituting subjectivity, materiality and social practice in ways that are more abstract.

Hitherto unimagined areas of human activity are currently being incorporated into the circuits of cybernetic capitalism: data traces of our sociability and libidinal impulses, creativity and cultures,

expectations and disillusionment, hatreds and loneliness, attention and affection — indeed, the abstracted enclosure movement has been extended into our very souls.⁵⁴ Older iterations of this process have been variously noted by people as different as Guy Debord and Theodore Adorno. ‘This technological evolution must be, even more profoundly, a mutation of capitalism’, stated Gilles Deleuze in a brief provocative paper called ‘Postscript on the Societies of Control’.⁵⁵ He observed that we are entering into a ‘capitalism of a higher-order production’.⁵⁶ Reframing this into the terms employed in this article, I would say that cybernetic capitalism is concerned with the production of abstractions and the abstraction of production. Traces of these subjective formations are mined and recombined by abstraction apparatuses, like Google Maps, so that they can be converted into exchange values that extract profit from the commodification of subjectivity. Indeed, as Robert Heilbroner noted, ‘[m]uch of what is called “growth” in capitalist societies consists in this commodification of life’.⁵⁷

Conclusion

In this article I have only touched on a few moments of the complex life of Google Maps via considering the related processes of abstraction and production. Through drawing maps into the abstracted materiality of software and the material abstractions of hardware, Google Maps technologically augments the abstracting tendency in cartography. The processes of mechanised abstraction that computing machines enable has intensified the overarching tendency towards abstraction that has played out across capitalist modernity. The cybernetic reorganisation of capitalism since the Second World War has seen the rise of apparatuses like Google Maps, which have entered the daily lives of billions of people and begun to reconstitute their social practice on more abstract levels. The production of abstractions and abstraction of production is put into the service of cybernetic capitalism so as to grant an organisational power and project control via the structural

54 Berardi, *The Soul at Work*. The ‘soul’ that Berardi discusses has nothing to do with ‘spirit’ — rather it is thoroughly materialistic, ‘the vital breath that converts biological matter into an animated body’.

55 G. Deleuze, ‘Postscript on the Societies of Control’, *October*, vol. 59, 1992.

56 Deleuze, ‘Postscript’, p. 6.

57 R. Heilbroner, *The Nature and Logic of Capitalism*, New York, Norton & Company, 1985, p. 60.

promotion of particular patterns of consumption, and by enabling a financialised, extractive logic to be extended deeper into daily life. The intensification of these social forms, technologies and practices has seen a simultaneous 'bringing forth' of production and 'drawing away' of abstraction, a contradictory movement that is tearing at the social fabric caught in this cybernetic process.

Three-dimensional maps will be better foundation while creating multimedia maps. The multimedia maps of Samarkand region, which are in stage of planning, serve as a great source of information and knowledge, give a practical assistance to conduct research in the region. Conclusion: To create the landscape map of Samarkand region of Uzbekistan, we used GIS software program as well as formed landscape map with the landscape incision of the area. Thus leisure cannot be inferior at the backward bending part of labour supply, which proves that is not a Giffen good there. Nru hse - 2020. 9.Â 1. Production function of the firm is given by $Q = 4L + K$. The wage of labor is \$8 per hour and the rental price of capital is \$2 per hour. (a) Derive short run AC and AVC. Explain the shapes of AVC and AC. (b) Derive long run total costs and find long run average cost. This is a summary of map projections that have articles of their own on Wikipedia or that are otherwise notable. Because there is no limit to the number of possible map projections, there can be no comprehensive list. *The first known popularizer/user and not necessarily the creator. Cylindrical. In standard presentation, these map regularly-spaced meridians to equally spaced vertical lines, and parallels to horizontal lines.