Towards a Rhizomatic Technical History of Control

Andrew Goffey

Abstract Gilles Deleuze's *Postscript on Control Societies* lends itself readily - too readily, perhaps - to historical interpretations of control that accept the universalising claims of techno-science. Critical social and cultural theory tacitly confirms the terms of reference of techno-scientific concepts at the risk of sanctioning the speculative claims of a notional physics of the cultural world which makes it difficult to develop a critical reading of the emergence of the socio-technical mechanisms of control. This essay addresses that problem and points towards the importance of considering the history of engineering, particularly in its complex relations to management and to bureaucracy, for an account of the present. Understanding the incidence of these practices on the environment within which computing emerged helps provide a corrective to idealised readings of the history of digital technology and points in turn to crucial aspects of the relationship between control and governmentality, relating in particular to the important Deleuzoguattarian concept of machinic enslavement.

Keywords Deleuze, Rhizomatic, Techno-science, Cybernetics, Machinic Enslavement, Governmentality

INTRODUCTION

Written some years before the collapse of global finance, the practical ubiquity in the global north, of networked computing infrastructures, state/tech-giant connivance in the monitoring of populations, drone warfare and so on, Gilles Deleuze's 'Postscript on Control Societies'[1] stands as a powerfully suggestive but frustratingly abbreviated piece of writing. Outlining, in a manner that is both strangely programmatic and obscurely prophetic, a shift in the organisation of power which, considered at nearly a quarter of a century's distance, has acquired increasingly ominous dimensions in the brutal reterritorialising strategies of post-crash economic slump, with the further promotion of AI solutions to labour costs, the intensification of speculative investments in data, more 'virtual migration', and so on, the precise lineaments of control are as unclear as its mechanisms seem efficacious. For both the diagnostic acuity *and* the opacity of the Postscript, Deleuze's comments about Kafka and the 'diabolic powers knocking at the door' seem appropriate. Although the exact status of the claims made by Deleuze in his essay - in terms of the broader economy

of his work, his reading of Foucault, and so on - are open to considerable, and fruitful, debate, there is nevertheless no doubting the thought provoking quality of his crucial claim, that with the waning importance of disciplinary societies, concomitant with a generalised 'crisis of institutions', a new regime of domination is coming into being, one which no longer relies on the closed milieus of disciplinary power-knowledge configurations.

However, given its programmatic abbreviation, evaluating Deleuze's claims about control societies is less than straightforward. It is difficult to develop a considered refutation of a set of claims presented in such a cursory manner. Pointing to headline-grabbing events and the 'revenge' of history as, say, a de facto refutation of the transformation of power implicit in the idea of control (it's the economy, stupid), for example, would be to miss the tacit critique of totalising claims in Deleuze's work. Indeed, given the quasi-Foucauldian grain of the Postscript and the kinds of *singular* histories this calls on, *any* reading of control that explicitly or implicitly transforms the idea in terms of a logic of generality would fall at the first hurdle, and it would betray what is perhaps better understood as the *problematising* intent of Deleuze's essay to think that the question of what control is, or might be said to be, is a settled matter. Considered in terms of the need to problematize what we are, or think we are,[2] it is perhaps both theoretically and practically of more value to consider the control essay as a starting point for trying to explore the emergence of a new logic out of what are in all likelihood a series of historically well-sedimented, if contingent, shifts.

It seems fairly clear from the way that the Postscript is written, that Deleuze doesn't really know in any detail how control societies operate, even if across six pages of text he offers some obviously intriguing and suggestive pointers. Indeed his rather modest call, towards the end of the essay, for the socio-technical study of control mechanisms really only underlines this point. In what follows then, the aim is to ask some critical questions about what we should be looking at when we explore the emergence of control and what can learned from placing control in a broader historical context. It focuses in particular on what might be called the 'technical' history of control and considers what can be learned from taking the technical elements of that history, specifically in their convergence in the apparatuses of computation, seriously.

A HYPOTHESIS ABOUT CYBERNETICS

What would be an appropriate set of historical coordinates for getting a more precise understanding of control? The term itself is hardly unfamiliar. Indeed, given its presence in the C3i strategies of the post-second world war US military-industrial complex, its presence in well-known work by Norbert Wiener (amongst others), not to mention in a number of relatively recent historical accounts, the cybernetic resonances of the term are readily evident. Even with Deleuze's first point of reference, William Burroughs, literary

2. See the comments on problematisation and interviews in the editorial introduction to this issue.

though that reference is, the cybernetics is never far away. Burroughs was obviously an attentive reader of the putative science of control. Quite aside from references to 'feedback' in *The Electronic Revolution*, and to the problem of steering in his essay on 'The Limits of Control', references to post-hypnotic suggestion, psychotropic drugs, brain surgery, amongst other things, whilst not cybernetic per se resonate powerfully with the psychiatric interests of cyberneticians. Indeed it is difficult not to hear echoes of Grey Walter's *The Living Brain* in Burroughs' *Naked Lunch*, for example.[3] Thinking sociotechnical mechanisms of control cybernetically is obviously a tempting move and one suggested in the first place by cybernetics itself.

Cybernetics peppers scholarly and polemical work alike, tacitly in, say, Mirowski's readings of neoliberal economics, quite explicitly in the work of The Invisible Committee, into whose cybernetic 'hypothesis' with regard to politics it is difficult not to read a Deleuzean inspiration. And there would be some value - and historical justification - to making the link between Deleuze's philosophy and cybernetic thinking as evidence in support of this reading. Deleuze himself encourages it at several points in his work (referring, for example, to cybernetics and information technology in the appendix to his book on Foucault[4]), and a conceptual familiarity with cybernetics seems to have been almost a given of some forms of critical theorising in the post-war era. The rather pervasive presence of discourses associated with cybernetics in French intellectual culture in the post-war period is a matter of record. Along with information theory it was an important reference point in the 1960s and 1970s structuralist current of thinking in and against which Deleuze's work can be and is situated, having proved significant for Jakobson, Lévi-Strauss, Lacan, and others.[5] It was, of course, also a significant point of reference for Heidegger in his ruminations on technology.[6]

But it is not clear what kind of an understanding of control is gained from making these connections between French intellectual culture and cybernetics, any more than reading the latter back into its prehistory, as James Beniger seems to do.[7] A cybernetic reading of control would have to acknowledge that there is perhaps more to the events surrounding the emergence and development of the science than meets the eye - a point that is suggested by the interesting work by Andrew Pickering on British cyberneticians and by Eden Medina on the politics of cybernetics in Chile, for example.[8] And whilst the close historical links between the development of cybernetics and the highly centralised C3i systems implemented in the US post-second world war is particularly suggestive about changing power-knowledge relations, analysing the microphysics of shifting apparatuses of power is not necessarily facilitated by taking the theoretical claims of cybernetic discourse at face value. Indeed, given the universalising strategies adopted by cybernetics in its bid for legitimacy, to propose a reading of control in the cybernetic sense as a description of the contemporary organisation of power, is precisely to accept its terms of reference.

3. Andrew Pickering, *The Cybernetic Brain*, Chicago University Press, Chicago 2010, p11 and the footnote on p418

4. Gilles Deleuze, *Foucault* trans. Seàn Hand, Athlone, London 1988.

5. Bernard Dionysius Geoghegan 'From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus' *Critical Inquiry* 38, Autumn 2011. http://doi.org/cdtsjq

6. One should not underestimate the importance of Heidegger as a reference point for Deleuze's work. But one should also not misunderstand the way that Heidegger mattered for Deleuze - as someone whose reading of the history of philosophy as the history of being precluded an engagement with the politics of thought.

7. James Beniger, *The Control Revolution*, Harvard University Press, Cambridge MA 1989.

8. Pickering, *The Cybernetic Brain* op. cit.; Eden Medina Eden Medina *Cybernetic Revolutionaries. Technology and Politics in Allende's Chile*, MIT Press, Cambridge MA 2011.

The claim that society is cybernetic was one made first of all by the cyberneticians themselves. As Bowker has cannily noted, its strategy was, unlike other sciences, not one of maintaining a strict distinction between what happens in science in the laboratory, and what happens outside, in society. 'Where traditional sciences operated behind the walls of the laboratory, cybernetics was everywhere you went. Where traditional sciences repudiated all possible mention of society, cybernetics proclaimed that it could produce the best possible description thereof, and that its universal truth was immediately tied to this historical conjuncture. In place of the obligatory passage point, this was the strategy of the "distributed passage point".'[9] To essay a critique of power on the basis of the terms in which cybernetics frames society and culture runs the risk of operating unproblematically within the universalising terms that it set for itself. Deleuze's own 'appropriation' of terms drawn from cybernetics tends to suggest that far from endorsing cybernetic thinking and its claims as a descriptively adequate starting point for understanding control, or, indeed, other phenomena (such as information theory for understanding the operations of language and culture, as was the case with Jakobson, Lévi-Strauss and so on), these kinds of sciences and the claims they make would themselves be better understood only as *part* of a set of technologies of power that Deleuze thinks we need to free ourselves from, and certainly not as offering unqualified *diagram* of power.

Yet it is difficult to avoid the developments of command, communication, and control with which cybernetics is associated. After all, Deleuze and Guattari's reference to the 'automatisation and automation of the war machine' in *A Thousand Plateaus*[10] points us in precisely this direction. But there are historically significant epistemological questions to be asked when one endeavours to explore control in this way, having to do in particular with the abstracted nature of techno-scientific claims that often form the starting point for critical cultural theoretical work addressing the present. This is the case with arguments that revolve around 'cognitive capitalism' and its variants, especially when they claim to find significant political potentialities in precisely the kinds of technologies that we might reasonably think are encompassed within a Deleuzean understanding of control. But in what conceptually, technically, and historically adequate way should such issues be addressed?

ALGORITHMS AND INFORMATION

Current critical interest in *algorithms* and in *information* are particularly illustrative of the kind of difficulties that attend what might be thought of as the techno-scientific appraisal of control. Always a rather polysemic term, one need not look far in order to find laudatory views regarding information and its supposedly revolutionary virtues. From popular science and journalism through social scientific research to the life and exact sciences, information

9. Geof Bowker, 'How to Be Universal: Some Cybernetic Strategies, 1943-70' in *Social Studies of Science* 23/1, February 1993, p123. http://doi.org/fbnhd3

10. Gilles Deleuze and Félix Guattari, *A Thousand Plateaus* trans. Brian Massumi, University of Minnesota Press, Minneapolis MN 1987, p467. But note that it is the *effect* of automatisation and automation that Deleuze and Guattari are discussing in relationship to the post-war situation.

11. James Gleick *The Information*, Fourth Estate, London 2012, p8.

12. Phillip Mirowski, *Machine Dreams. Economics Becomes a Cyborg Science*, Cambridge University Press, Cambridge 2002.

13. On biopolitics understood in this way see Melinda Cooper, *Life as Surplus. Biotechnology and Capitalism in the Neoliberal Era*, University of Washington Press, Washington 2008; Frédérique Gros, *Le Principe Sécurité*, Gallimard, Paris 2012.

14. Herbert Simon *Administrative Behaviour: A Study of Decision-Making Processes in Administrative Organisation*, Macmillan, New York, 1947.

15. See for example Jean-François Blanchette 'A material history of bits' in *Journal of the American Society for Information Science and Technology* 62/6 1042-1057, June 2011. http://doi.org/dt58qv

16. Matthew Kirschenbaum *Mechanisms. New Media and the Forensic Imagination*, MIT Press, Cambridge MA 2012.

and its technologies becomes practically 'paradigmatic' for a techno-scientific world view, linking together Richard Dawkins telling us that if we want to understand life, we shouldn't think about 'vibrant throbbing gels and oozes', we 'should think about information technology'[11] with the monopolistic operations of Google (confusing 'democratisation' and the corporate organisation of 'all the world's information'), and/or the dismantling of the institutions of the welfare state, as in the UK government's Health and Social Care Act and its link with an 'information revolution in the NHS.' Similarly, there are interesting connections between neoclassical economics and information (although Hayek's conception of what information was seems to owe little to the computational developments[12]) that offer a fruitful line of enquiry for trying to address questions about the links between Deleuze's conception of control and the epistemic shifts we can presume it to signal in the field of the human sciences. Indeed, a critical focus on, and problematisation of, information is certainly of some relevance to exploring control. Following the historical thread provided by, say, Schrödinger, the informational overhaul of life that he proposes would offer a pertinent starting point for addressing the securitarian biopolitics that links a central investment in life itself to broader risk management strategies.[13] Similarly, information theoretical concepts of organisation have been of demonstrable importance to several decades of work rethinking institutions as input-output devices, as the popularity of Herbert Simon's work on administrative behavior suggests.[14] But at the same time, it's important not to forget that Shannon's mathematical theorisation of information arises out of an engineering problematic within telecommunications, a practical context that may in fact be of much greater significance than any ontology of information that people have subsequently abstracted from his writings. But more of engineering in due course.

As with the universality of cybernetic claims, where researchers *have* tried to problematise the notion of information, as a prerequisite to understanding better the power-knowledge mutations of which it is a part, they tend to have done so through a prima facie acceptance of the broad epistemic claims of unlimited application that its theorists make. Whilst quite correctly questioning the association of ideas of information with *immateriality*, for example, researchers[15] nevertheless tend to return to an unproblematic physics of the ultimate 'stuff' of which the world is made, thereby restricting any effective problematisation of information to the terms set by some notional idea of physics. Kirschenbaum, for example, has rightly pointed out that ignoring the materiality of information, its indissociability from the hardware, the 'pipes', devices, through which it circulates, makes it easy to ignore the ways in which information is bound up in a problematic of *abstraction* that should be pertinent for critical accounts of culture.[16] Yet in his own analysis, he is happy to ignore the ways in which information technologies emerge out of contexts in which they developed to act as substitutes for human practices, as if the abstracted relationship of duly materialised informational 'models'

of social and cultural practices to those practices need not be questioned. It is easy to lose sight of the fact that in its immateriality, information is not just an abstraction from hardware, from the circuits of chips, drives and so on, as digital humanities scholars sensibly remind us. It is *also* - and not incidentally - an abstraction from the processes that computation seeks to model, an abstraction that the historically close links between information theory and concepts drawn from physics (such as entropy) should not allow us to forget.

It seems here that whilst the historical links of information as a *technical* entity with cybernetics, computing, and communication need little explanation, the *social* qualities of information - and hence its intimate connection with control more broadly - are perhaps less well understood. And this is potentially problematic given the fact that ideas about and theorisations of information have been critical to significant shifts in questions of political economy over the last half-century or more - in particular, with the question of *value* and how that notion is understood. It is not just, as already indicated, that some understanding of information has always been important for neoclassical economics but that a conceptualisation of information is tacit to the claims made in contemporary arguments about the revolutionary virtues of networked peer production, as in the work of Yochai Benkler. Here ignoring the implication of information within the processes of *real* abstraction that emerge as part of a specific set of power-knowledge arrangements compromises the claims to political virtue made on behalf of network-based economic arrangements. A critique of the political economy of networked production that proceeds *without* considering the processes of abstraction of which information is a part, and hence in the absence of any addressing of the implication of those processes in the construction, maintenance, and transformation of power relations, is clearly problematic.[17]

The one-sidedly techno-scientific understanding of information in much social and cultural theory extends into critical employment of the concept of the *algorithm* as a term to characterise contemporary operations of power. There is little doubting the increasingly important role that algorithms play in many areas of contemporary social, economic, cultural, and political life - from their invisible operation within the 'code/spaces' of contemporary infrastructures (cashpoints, car insurance, transport networks[18]) - through the extraordinarily ramified links of outsourced labour practices, supply chain logistics, and high-speed finance, the operations of social media and the ubiquitous data-gathering practices of government intelligence agencies, public bodies, and large corporations. Algorithms have a peculiar salience to understanding the operational practices of contemporary security and securitisation - Louise Amoore's work on 'algorithmic war' offers an excellent example of this, as does the work of Antoinette Rouvroy[19], and may itself be interpreted more broadly as a description of the bio-securitarian logic of the dividual that Deleuze points towards in the Postscript.[20] And the importance of algorithms has of course not

17. An extensive parenthesis here perhaps could and should be opened with regard to the historiography of information but it might take us a little too far away from control. Geoghegan has offered some helpful commentary on this issue that merits reading in the context of Deleuze's own admittedly scant references to 'information' in his work. See Bernard Dionysius Geoghegan, 'The Historiographic Conceptualisation of Information: A Critical Survey' in *IEEE Annals of the History of Computing* 30/1, 2008, pp66-81.

18. Rob Kitchin and Martin Dodge, *Code/ Space. Software and Everyday Life*, MIT Press, Cambridge MA 2011. http://doi. org/7d6

19. Louise Amoore, 'Algorithmic war: everyday geographies of the war on terror' in *Antipode: A Radical Journal of Geography* 41, 2009; Antoinette Rouvroy and Thomas Berns, 'Gouvernementalité algorithmique et perspectives d'émancipation: le disparate comme condition d'individuation par la relation?' in *Reseaux* 13/177, special issue on 'Politique des algorithmes. Les métriques du web', pp163-196.

20. In addition to the text by Gros, *Le Principe Sécurité*, already mentioned, see Alain Joxe, *Les guerres de l'empire global*, La Découverte, Paris 2012.

21. In addition to the more scholarly work of Scott Lash, 'Intensive Media - Modernity and Algorithm' online at http://roundtable.kein.org/node/125, or Paolo Totaro and Domenico Ninno 'The Concept of Algorithm as an Interpretative Key of Modern Rationality' *Theory, Culture, and Society* 31/4,2014,pp29-49, there is the growing body of semi-informed journal-ism. See for an example of the latter George Dvorsky 'The Ten Algorithms That Dominate our World' online at http://io9.com/the-10-algorithms-that-dominate-our-world-1580110464.

22. Quoted in Friedrich Kittler, *Literature, Media, Information Systems*, Routledge, London 1997, p188, fn.68.

23. Michael Ma-honey 'The History of Computing in the History of Technol-ogy' *Annals of the History of Computing* 10, 1988, pp113-125. http://doi.org/fpcpks

been lost on critical social and cultural theorists more generally.[21]

Yet as with its sibling, 'information', there are significant problems entailed by focusing on the algorithm, particularly when endeavouring to conceptualise contemporary power. Whilst addressing the algorithm may helpfully draw attention to important aspects of the epistemic shifts that are characteristic of power-knowledge formations central to the emergence of control (without algorithms, dataveillance practices would be impossible, for example), it is far from clear what focusing on algorithms entails from the point of view of problematising control, not least because the concept of the algorithm presupposes some understanding of control. The computer scientist Robert Kowalksi expressed this in his pithy formula 'algorithm = logic + control', that is to say in a formula that associates both some sort of element of knowledge brought to bear on solving a problem, and some sort of element that determines how that knowledge gets used.[22]

The notion of the algorithm provides a theoretically intriguing focus for studying questions about the mutations of power associated with computation. However, informed here by Deleuzean empiricism, it is, once again, important to acknowledge that the algorithm, represented by computer scientists as 'the' central entity of their enquiries - like the self-regulating mechanisms explored by cybernetics - offers a decidedly selective starting point from which to explore and understand the complex machinery of computation. Focusing on it, evident as much in pop scientific headlines about the 'algorithms that rule our lives' as in more sophisticated accounts of 'algorithmic culture' presupposes a decision to follow the rationalist epistemic reading of digital technology favoured within university-based computer science. This is a reading that ignores the much more mundane and bureaucratic aspect of computing, the less academically respectable but, in fact, predominant involvement of computing in electronic data processing. It is one thing to acknowledge that there cannot be computation without algorithms, but it would be quite another to start from there as a way of endeavouring to understand the role of the assemblages of digital technology in contemporary power formations.

The historian of software, Michael Mahoney, has argued that there are only the loosest of connections between the formalistic representation of computing proposed by computer science and the actual operations of computing in general.[23] The highly mathematical formalism that has grown up in university research environments and its apparatus overlooks the more complex history of bureaucracy, of technocracy, and of already highly routinised contexts in which the algorithmic operations of computing as information processors were put to work. More pointedly - and this will be an issue for more detailed exploration in the next section of this paper - focusing on high-level epistemic issues in the sciences of control that emerged in the postwar period, whilst having a satisfying resonance with the cursory periodisation that Deleuze offers for the emergence of societies of control (the generalised 'crisis of institutions' post-World War II) risks overstating the

power of the technologies with which they are associated: the digital code of information theory acquires the status of a cultural-historical condition, 'digitality', or the organisation of power is re-read in computational terms as algorithmic, and so on. It's not that feedback mechanisms, the immateriality of digital information, or the intensive employment of algorithms within digital technologies don't matter or aren't pertinent for an understanding of control (far from it). In the context of the history of control, it is important both to question the epistemic credentials of techno-scientific concepts and to acknowledge that there is a much greyer prior history of routinisation, bureaucratisation, calibration and technical tinkering that precedes the more obvious dimensions of the epistemological and technological innovations of the middle of the last century. This is a history, or a set of histories, that takes us away from the dubious glamour of the cyber and obliges us to consider other lines of descent into the present.

ENGINEERING CONTROL

Historiographic and conceptual considerations with regard to control, addressed from a point of view which eschews techno-scientific naivety, then, complicate some of our more well-entrenched assumptions about what kinds of elements of the past we need to be looking at when trying to understand how the changing spaces and practices that Deleuze associates with control, have come into being.

Both in the rather broad sense associated with the servo-mechanisms and feedback loops of cybernetics, as well as in the much more specific sense associated with the programming practices of computation, the history of control is one that extends well beyond the selective memory of scientists, and is as much about engineering as it is about scientific development.[24] Whilst one need not accept their broader historical speculations, the writings of Otto Mayr and Stuart Bennett offer interesting food for thought for any consideration of the development of logics of control.[25] Both speculate about the links between political-economic liberalism and the flourishing of control mechanisms in industrial England for example, in a way that complicates claims for say a qualitative difference between a liberal and a cybernetic society (for Mayr this is connected to a British aversion to the clock![26]), but both also underline the fact that the kinds of control mechanisms that are given an abstract mathematical formulation in cybernetics have a lengthy prehistory in a range of engineering developments (which Bennett traces over 150 years from 1790 to 1940). And whilst the concern expressed in say Maxwell's well known 1868 paper 'On Governors' with finding a mathematically generalisable solution to the problem of dynamic stability might seem a rather spurious starting point for problematising control, it does have the signal virtue of bringing into play a field of discourse - that of engineering - whose importance when endeavouring to understand the socio-technical qualities

24. A dissatisfaction with the rather exclusive focus on scientific theory in the understanding of control is central to the work of David Mindell. See his *Between Humans and Machines*, Johns Hopkins University Press, Baltimore MD 2002.

25. Otto Mayr, *The Origins of Feedback Control*, MIT Press, Cambridge MA 1971; Stuart Bennett *A History of Control Engineering*, IET/ Peter Pergrinus, Stevenage 1993.

26. Discussed in Otto Mayr, *Authority, Liberty, and Automatic Machinery in Early Modern Europe*, Johns Hopkins University Press, Baltimore MD 1986.

of the present, cannot be underestimated.

Indeed, the fact that much of the engineering discourse associated both with the emergence of computation as well as with pre-cybernetic technologies of control, of the kind examined by Bennett and by Mayr, has nothing directly to do with humans as subjects or objects is of crucial importance here. Engineering discourses are in this respect concerned with ways to ensure that *devices* function correctly, and are only indirectly formulated in terms of the more obvious human science/governmental discursive problematisation of who or what 'we' are. Indeed, to the extent that the emergent practices of software production were themselves engineering practices frequently organised around questions about how to address computational devices, typically to the exclusion of any consideration of how such devices addressed humans in turn (and as what?), is precisely what matters here, because it is the possibility of abstracting a set of mathematical descriptions that might then be generalised to human behavior that such discourses make possible (engineers don't normally abstract mathematical descriptions from humans and then generalise them to machines). Technical discourses around engineering can, in this way, factor humans into the operations of infrastructures in ways that it is perhaps rather easy to ignore.

The implication of engineering within the operations of power more broadly, was not something Deleuze was unaware of - and one can find a specific acknowledgement of the *ambiguity* of engineering at numerous points in *A Thousand Plateaus*, particularly in relation to the figure of the engineer. A number of other researchers have developed more detailed accounts of the figure of the engineer and of engineering discourses in the organisation of state power, and the critique of technocratic rationality has been present in other more familiar figures from the history of political philosophy (it is noteworthy that Carl Schmitt, a key reference for numerous endeavours to think politics today, tended to assimilate political liberalism and technocratic functioning in a way that has gone largely uncommented in some of the more high profile political philosophical accounts of his work.[27]) If the importance of the rapprochement being suggested here in the mutation of power, between the history of servo-mechanisms in engineering and the kinds of self-regulating cybernetic functioning that one can see Deleuze pointing towards, has not been immediately evident, the intensely *political* role of engineering in the kind of dynamic developments that are generally associated with modernity have not gone completely unnoticed.

In this regard, there are a number of interesting studies - those of David Noble, Yehouda Shenhav, and to a lesser extent JoAnn Yates - that have provided detailed accounts of the socially, culturally, and politically problematic position of engineering in shaping the dynamic developments of modernity. In Noble's account the figure of the engineer is central to the emergence of 'technology of social production' constituted by modern management, playing a double role. 'As engineers in a capitalist system, they

27. John P McCormick, *Carl Schmitt's Critique of Liberalism: Against Politics as Technology*, Cambridge University Press, Cambridge 1997. By high-profile, I am thinking of Agamben, for example.

were professionally charged with the profit-maximising advance of scientific technology. And as corporate functionaries, they assumed the responsibility for coordinating the human elements of the technological enterprise', a task they pursued, Noble underlines, *as* an engineering project.[28] For Shenhav, studying fifty years in the development of the US economy, between 1880 and 1932, engineering has a particularly significant role to play in pushing for not just the systematisation of practices that enabled the abstraction of mechanisms of managerial control, but also for the development of standardisation practices. We are perhaps to a large extent inclined today to think of standardisation as a neutral set of processes, and neutral *because* technical, and yet historically of course this is very far from being the case.[29] Shenhav points out that the standardisation of instrumentation, which late nineteenth century engineers in the US pushed for, extended directly into the standardisation of workers that we are more familiar with from Taylorist discourses of scientific management. Indeed, in the early decades of the twentieth century, the growing power of mechanical engineering was central to a reconceptualisation of society itself as a technical system and marked a 'translation' of engineering into management.[30] 'Systems' thinking, parlaying organisations into wholes, the rationality of which extended beyond the bounded rationality of individuals, was not an invention of the Cold War C3i thinking but can be traced back to the end of the nineteenth century and it points towards an epistemic shift that has become well sedimented in the lineaments of the present.[31] Yet it has taken movements such as the A2K movement to create a sensibility towards the problematic qualities of such a central feature of engineering as technocratic practice.

JoAnn Yates's study of the ways in which systemic management in late nineteenth and early twentieth century US capitalism took charge of the processes of internal communication in organisations, outlines another interesting set of precedents for the post-second world war rise of systems analysis and the burgeoning role of computational practices in the re-shaping of the economy. As she points out, in all three of the organisations her study examines, the crucial transformation was one in which a *formal* communication system emerged, facilitating significant developments in hierarchised control. 'Procedures, rules, and financial and operational information were documented at all levels, making organisational rather than individual memory the repository of knowledge'. Critically, there is a transformation in the conduct of discourse, which goes from being 'idiosyncratic, word-of-mouth management' to taking the form of 'impersonal management systems - embodied in forms, circular letters, and manuals'[32], a series of developments that, it is not difficult to understand, alter the characteristics of enunciation in the workplace and, shift the locus of initiative for transforming the discursive dimensions of the organisation.

Yates's account of the development of internal communication and the emergence of managerial systems dovetails well with the work of Shenhav

28. David Noble, *America by Design*, Alfred A. Knopf, New York 1979, p258.

29. On neutrality, Carl Schmitt's 1929 essay 'The Age of Neutralisations and Depoliticisations', *Telos* 96, 1993, pp30-142, offers an interesting point of contrast, in this regard.

30. Yehouda Shenhav, *Manufacturing Rationality. The Engineering Foundations of the Managerial Revolution*, Oxford University Press, Oxford 1999, p75.

31. Note that systems or "systematic" management is not quite the same thing as the scientific management associated with Taylor. The latter was marked by its rather exclusive focus on the shop-floor, whereas systems management displayed much more of a concern with organisations as a whole.

32. JoAnn Yates, *Control through Communication. The Rise of System in American Management*, Johns Hopkins University Press, Baltimore 1989, p271.

33. Jon Agar, *The Government Machine. A Revolutionary History of the Computer,* MIT Press, Cambridge MA 2003); *Turing and the Universal Machine: The Making of the Modern Computer,* Icon, Cambridge 2001.

34. Agar *Turing and the Universal Machine* op. cit. p.143

and Noble. And its emphasis on the way in which forms of communication changed in the late nineteenth and early twentieth century, becoming an impersonal element of organisation processes, may be usefully linked to Jon Agar's arguments about Turing,[33] which point quite clearly to the highly routinised organisation of the British Civil Service as a pre-condition for the conceptual emergence of the automatic process thinking characteristically associated with the computer. As he puts it 'by 1900, if you searched Britain for a general purpose machine of universal application you would be led to the civil service'.[34]

Exploring the history of engineering practices and their incidence in management practice may seem only loosely connected to the present, and at first glance seems not to support the control argument, not in the least because in many respects - as the Taylorist movement suggests - it was with discipline in the workplace that engineering was concerned. However, it is important to note that it is precisely in terms of the more or less technocratic practices of engineering that more recent historical developments have taken place. What happened during the second world war, with the events that led to the material realisation of computing (and C3i technologies more generally) was a more sustained set of contacts developing between engineers, mathematicians and physicists. The bulk of subsequent developments in ICT have taken place under the aegis of 'engineering' - cybernetics in its close association with electrical engineering, the introduction of the idea of software engineering in the late 1960s, with its concern to places the practices of software production on the kind of solidly 'scientific' basis imputed to engineering, and so on. It is also important to note that in the Cold War era, when operations researchers and systems analysts set to work (the latter having a particularly important role in the development of computer programming *as* software engineering and in the producing what business historian James Cortada refers to as the 'digital hand'[35]), it is important to understand that they did not do so through the magical application of techno-scientific theory to somehow unformed human content. Where they did - as with MacNamara and the Vietnam War application of systems analysis, the results were as devastating as the application was stupid. It was in the context of already well established, highly rationalised work processes, that digital technological systems of control sedimented, operating through data processing practices as a continuation of systematic management in its bid to abstract and automate work into the computer systems that now operate in miniature on personal computers, laptops, smart phones and so on. Perhaps the key difference that the kinds of shifts that are usually imputed to cybernetics, information theory, computer science make - and this is what can help us understand how the seeds of control are already present in discipline - has to do with the more profoundly abstracted nature of the materialisation of control when expressed in the kinds of numerical languages that digital technologies operate through. And it is to language that we now turn in order to complete the account that has been presented here.

35. James Cortada, *The Digital Hand,* Oxford University Press, Oxford 2003.

GOVERNANCE THROUGH MACHINIC ENSLAVEMENT

Bringing engineering, management, and bureaucracy into the historical outline of the emergence of control in the way that has been done here is a reminder that one cannot take techno-scientific concepts as self-evident when exploring the historical genesis of control. But equally, one cannot - and Deleuze himself reminds us of this - simply take the machine as explanatory of broader social and economic shifts, a temptation that has proved difficult to resist, particularly with regard to critical endeavours to theorise the place of technical machinery in contemporary culture. That efforts to do this have revolved around the concept of the Turing Machine should not be any surprise. For George Caffentzis, reading the specific configurations of the replicable patterns essential to commodification into the logic of the Turing Machine[36], Friedrich Kittler, reading into the same an unavoidable mutation in the medial organisation of discourse networks[37], or Christian Marazzi the key to the contemporary centrality of language to production[38], the formal logic of computational machinery seems to be central to reading contemporary social and cultural formations. But as the foregoing discussion has suggested, whilst getting to grips with the very specific functioning of digital technologies and their emergence must indeed form a component part in a historically - and historiographically - adequate account of control, doing so is far from straightforward. In the case of the arguments of Caffentzis, Kittler, and Marazzi, there is probably a grain of truth to what all have to say, albeit at the cost both of some exaggeration and of conflating a theoretical innovation in mathematics with a considerably more complex social and technical reality (for which the Turing Machine provides only a loose and highly formalised approximation). Yet it is precisely in so far as we can associate it with the emergence of the formal-material syntax of computation that Turing's conceptual invention, linked as already noted to the routinised bureaucratic structures of the British civil service, stands as a suggestive way of historicising one of the few concepts in Deleuze's work that are indeed suggestive of a 'cybernetic' reading of his understanding of control. The concept of 'machinic enslavement', in its original French formulation - 'asservissement machinique' - has unmistakeable resonances in discourses of control, whether cybernetic or, more distantly, in the engineering background to it (in 1873, Joseph Farcot published a book on what we would now recognise as a servomechanism - the mechanics of steering engines on ships - entitled le servo-moteur or moteur asservi, which might be translated as 'the servo-motor or enslaved motor', if one wanted to make the links plain). But it's not so much the cybernetic resonances of the term that are of interest. The concept of machinic enslavement points towards an aspect of contemporary political functioning that cannot be easily assimilated to the operations of discourse and the kinds of processes of subjection, such as interpellation, that are associated with it.

Of recent commentators, Maurizio Lazzarato has perhaps gone furthest

36. George Caffentzis, *In Letters of Blood and Fire. Work, Machines, and the Crisis of Capitalism,* PM Press, San Francisco 2013,esp. Section II.

37. Friedrich Kittler, *Literature, Media, Information Systems,* G+B Arts, Amsterdam 1997, especially the final three essays.

38. Christian Marazzi, *Capital and Affects. The Politics of the Language Economy* trans. Giuseppe Mecchia, Semiotext(e), Los Angeles 2011.

in highlighting the importance of this concept in Deleuze's thinking. And what is perhaps most interesting here about Lazzarato's readings of machinic enslavement is the way in which he links it to the problem of *governmentality*. Drawing particular attention to the links between machinic enslavement and the broader dynamic of *desubjectification* in contemporary capitalism, Lazzarato insists in his analysis on the links between social and technical machines and subjectivity, with the *production* of subjectivity, a set of links without which that governmentality cannot be understood.[39] The social and technical machine-subjectivity-governmentality nexus that he insists on, tallies well with the broader historical contextualisation we have been considering here for understanding the genesis of control. Indeed, the desubjectifying logic of machinic enslavement makes the most sense precisely when thought through in terms of the way that the digital technologies of the present operate to produce subjectivity at an oddly abstracted material *infrastructural* level. The progressively deeper and deeper implication of humans within computational networks occurs through their initial desubjectifying treatment simply as input-output devices, in which human interactions are parsed into something machines can understand, into a 'language' that abstracts out from the enunciative qualities of discourse that might otherwise allow us to speak of subjection. From an infrastructural point of view, the enunciative capacities of individuals are simply either *data* or *commands* (from the machine's point of view, we are all programmers, of a sort) and they are generated not through the sensory, physiological complexities of phonation, say, but through pointing, clicking, swiping, scrolling movements, as well as through the gestures of quasi-discourse production (completing forms, selecting options, ticking boxes, and so on), processed in a modular manner. The relations of individuals to machines, in this respect, is only secondarily one of subjection, in the classic Althusserian sense of interpellation (call it 'personalising your desktop', for example), because the operations of such machines are shaped through formal-technical languages that abstract out from the natural languages that are presupposed in understandings of discourse. There is no subject presupposed in the syntax of the execution of programs, although this should not be read to mean that the processes within which technologies are involved don't have determinate relations to subjectivity.

Computational processes could not have been assimilated - more or less - into everyday life without, on the one hand, the desubjectifying enfolding of human capacities into digital technology, and on the other the extension of the crude syntax and modular arrangement of these machinisms into spaces that can, somewhat misleadingly, be called 'natively' digital. It is in such spaces (broadly speaking 'cyberspace') that we can see particularly clearly the forms of governmentality that Lazzarato insists on linking to technical machines (and we can see them clearly here precisely because such spaces were not designed to blend in to pre-existing organizational structures). In fact, it is precisely in terms of governmentality understood through machinic enslavement that we should interpret - and correct - Lawrence Lessig's well-known arguments concerning

39. See in particular Maurizio Lazzarato *Governing by Debt* trans. Joshua David Jordan, Semiotext(e), Los Angeles 2015, esp. ch.5.

the regulatory qualities of computer software, which he encapsulates in the idea that 'code is law'.[40] Lessig's view, which helps make plain what is problematic about the kinds of 'technical' decisions programmers make with regard to say the privacy settings of a piece of software, which settings then come to regulate the behavior of users, is framed in classically liberal terms. This means he sees code regulating the behavior of pre-existing individuals in domains that would and perhaps should be the province of government legislation. Extending the possessive individualism of US law into his understanding of what is politically problematic about digital technology means he ignores precisely the emergence of the syntax of action that produces humans as component elements - input-output devices - of the infrastructures of digital technology more generally in the first place, as if the relationship between individuals and technologies was simply one of means to ends, with no impact of the former on the latter. But from the Deleuzean point of view of machinic enslavement, the 'governmental' problem is a different one because it is precisely in terms of this broader transformation of subjectivity through the formal-material syntax of computation and its machine-corporeal tropisms that we need to understand the specific contribution of digital technologies to contemporary shifts in social relations.

The reading of the concept of machinic enslavement that has been suggested here, albeit in a somewhat cursory manner, raises a delicate question with regard to the politics of control more generally. In conversation with Toni Negri, Deleuze is rather hesitant when it comes to endorsing the post-Autonomist stance on the 'Fragment on Machines' in Marx's *Grundrisse*, which Negri tacitly reads in their discussion as implying that there is some sort of redemptive possibility implied in capitalist technical machinery. 'You ask if societies of control or communication will not provoke forms of resistance capable of giving back to communism, conceived as a "transversal organisation of free individuals" a chance. I don't know, perhaps.' Indeed, what seems to matter here, for Deleuze, is less the general intellect presupposed in the techno-scientific organisation of communication, than piracy and viruses, the contemporary correlate of the strikes and sabotage of resistance to domination in the nineteenth century. If the argument presented here about machinic enslavement and the syntax of computational machinisms is correct, if it is indeed the case that control and the forms of enslavement connected with it operate at this infrastructural level, then resisting control effectively - and developing an account of what might count, in Deleuze's terms, as 'vacuoles of non-communication' or 'interrupters' - suggests the need for a more qualified stance towards technical machines. It suggests the importance of looking at the limits of the syntax of the machinic enslavement accomplished through digital technology - not just the more obvious heroics of hackers and their accelerationist avatars but in the mundanity of the everyday, where the techno-scientific fantasy of smooth, friction-free communication evidently runs up against the jittery, error-prone, bugginess of the 'systems' on which it depends. Here, perhaps, we would find much to support a view of the

digital 'enhancement' of contemporary capitalism as dependent on qualities of technology that are decidedly sedentary and territorialised.

CONCLUSION

This essay began with a qualified criticism of some of the points of reference for what might figure as a 'techno-scientific' reading of control. But that criticism was qualified not because considering control in terms of technology is wrong, necessarily, but because the technology that it makes most obvious sense to link to control, cannot be understood in terms of the conceptual abstractions most routinely associated with it. The broader argument here is that the control societies essay and the shifts it points towards call for a productive critique of the self-evidences of the givens of the digital technologies that form the infrastructures of contemporary capitalism. In any event - and regardless of the ultimate verdict on Deleuze's views regarding control societies - a more convincingly materialist analysis of the apparatuses of digital technology seems important as a way of avoiding the residual idealism of theorisations of information, algorithms or cybernetics. A closer inspection of the historical background to cybernetics, information technology, and computation indicates the central importance of engineering in its impact on management, and bureaucracy. And the practices associated with engineering, with its refiguring of organisations as systems, and with bureaucracy and its mechanically routinised processes of action, form a crucial set of material presuppositions for the successful development of computational technologies as technologies of abstraction. With that contextualisation in mind, it was then possible to go back to the logic of computation and see how it could helpfully be understood in terms of machinic enslavement.

But where does a focus on computation leave us with regard to control? Haven't we simply reinstated a techno-scientific reading of Deleuze, one which negates social and cultural formations, and doesn't that ultimately lead to a form of technological determinism? The first point to make here is that exploring some of the broader shifts in the configurations of knowledge necessary to the emergence of cybernetics and computation as important elements of control societies does not entail a reduction of control to what these post-war discourses made possible. This is partly an issue of selection - cognitive science, closely associated with both cybernetics and computation is an obvious omission - in relation to the shifts we have been looking at, and a significant element in shifts that we could observe in other fields. But it is also an issue concerning the relation with other aspects of society and culture. Those institutions singled out by Deleuze for studies of the kinds of transformation he is interested in (school, the family, the army, work) will obviously have experienced specific power-knowledge transformations. But that doesn't negate the importance of a consideration of the specific role of computation in reshaping both the semiotic and the material aspects of contemporary social relations, any more than it precludes a consideration of the precise way in which computation has

been involved in those institution-specific transformations.

What *does* matter, at least if we want to heed Deleuze's advice and accept that effective criticism means not relying on abstractions that are big 'like hollow teeth', is to avoid thinking we can get an adequate theoretical and practical hold on the technological components of control without exploring the specificity of their operations. It is only by ignoring that specificity that technologically determinist claims become a risk: when theorists forget the difference between the rationalist conceptual formulation of computing in terms of the Turing Machine, and the complex social and technical reality of digital technology, it may indeed make sense to say, as Kittler does, that 'meanings come down to sentences, sentences to words, and words to letters' and thus that all 'code operations' can be considered 'signifiers of voltage differences.'[41] So, oddly, it is actually by taking some of the material complexities of the technological assemblages more seriously that one can avoid some of the more disabling deterministic stupidities of theory. In fact, it is through exploring some of these complexities that we can perhaps make the value of developing a 'Deleuzean' approach to the history of control felt. Deleuze is not generally considered to be an historical thinker[42] and the rather cursory periodisation that he seems to propose of control societies won't do much to correct that impression. Yet his work is consistently engaged in endeavouring to extract something from history, thinking the past, against the present, so as to resist the present. Problematising control, in the empiricist manner that has been proposed here, exploring elements of its epistemo-technical genealogy, as part of the process of understanding the nature of its implication in the material infrastructures of the present, points towards the possibility of constructing a different relationship to the technical history or histories that give shape to that present. It is a matter of insisting that in its relationship to the present the past is never a completely settled matter, that one need not feel - as Kittler clearly does - that one has to double the claims of techno-scientific reduction (his assimilation of all code operations to signifier of voltage differences) with an apology on its behalf, or, like Caffentzis to see something that is almost worth celebrating in the implication of computational technologies in disabusing people of their illusions. A more historically expansive consideration of the processes or practices that are required to make the technologies implicated in control today possible doesn't resolve the problem of how to escape its machinations, but it might make it possible to avoid the risk of lauding its technologies for a power that they do not possess in the way that their apologists claim.

Andrew Goffey works at the University of Nottingham. He is co-author, with Matthew Fuller, of *Evil Media*; and co-editor, with Éric Alliez, of *The Guattari Effect*; and with Roland Faber, of *The Allure of Things*. He is the translator of Isabelle Stengers' and Philippe Pignarre's *Capitalist Sorcery*, and of Félix Guattari's *Schizoanalytic Cartographies* and *Lines of Flight*; he is currently writing books on Guattari and on the micropolitics of software.

41. Kittler, *Literature, Media, Information Systems*, op. cit., p150.

42. Although cf Jay Lampert, *Deleuze and Guattari's Philosophy of History*, Continuum, London 2006.