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Service Orientations: Data, Institutions, Labor

Liam Magee and Ned Rossiter

Our central interest in this essay is to consider the role of the database as a technology of governance and the scramble of power as it relates to a capacity to model the world and exert influence upon it. We argue Software as a Service is more than a new vogue term of the IT industry, constituting a longer temporal horizon and more complex rearrangement of relations between data and labor to which the database and its entailments remain critical.

Arguably the *relational database* has had greater impact on the transformation of organizational cultures and the world economy than the Internet. The analytic potential of computational databases coupled with the materiality of data centers has produced models of this world without historical precedent. Key here is the question of scale and the ubiquity of data capture. The structuring of data has a genealogy. The knowledge once derived from the transitional technologies of cabinets of curiosities (*Wunderkammer*), demographic registries and Foucault's "great tables" in the 17th and 18th centuries—later systematized into various epistemic instruments that included Diderot's encyclopaedia, the periodic table, the museum and Linnaeus' taxonomies—were all coincident with the rise of populations governed as statistical subjects. The Cartesian grid, a two-dimensional space for organization and arrangement, provided an abstract template for subsequent techniques to employ in the structuring and querying of data. Such instruments can today be understood as proto-databases, foreshadowing what Gernot Böhme has called our present era of "invasive technification" (Böhme 2012).

Critique and judgement become hoodwinked by the seemingly irrefutable authority of statistics and visualizations of the incomprehensible. Decisions are made on the basis of a misrecognition between data and the material world. Cognition is now outsourced to the machine. Leibniz's dream of a *mathesis universalis* becomes in this incarnation a nightmarish inversion—from being at the center of the modern epistemological enterprise, humans are now peripheral data collectors and, increasingly, just data. Structurally oblivious to their function in the reproduction of value within an economy of data, the human has entered a new period of machinic arrangement whose operation is abstracted into the realm of semiotic capitalism (Lazzarato 2014). An imaginary of cooperation, sharing and participation provides a powerful narrative for the entrepreneurial-self whose capacity to organize collective forms of refusal is consistently undermined by

the disaggregating effects of value extraction derived from the computational logic of recombination hidden within the vaults of algorithmic architectures (Scholz 2014; Terranova 2014).

The advent of the relational database in the early seventies marks a critical transition in the ductility and malleability of knowledge of people and populations. Edgar Codd, an IBM employee, first introduced the relational model as an alternative to existing network and hierarchical database systems. The relational database differs by formalizing the relationships between the logical elements contained in distinct sets; one of its advantageous effects was to separate the operations of manipulating and querying data from its physical location on hard drives (Codd 1970). The cost and time involved in changing how programs work with data is accordingly reduced. The interrogation of subjects soon after becomes literalised with the advent of the *Structured English Query Language*, or SEQUEL (and later SQL), in a paper by Chamberlin and Boyce, also IBM employees, in 1974. Already the human subject is captured in specific "relations" of labor and commodities. Chamberlain and Boyce's very first example consists of a "relation describing employees," featuring the barely fictional cast of familiar surnames: "Jones," "Smith" and "Lee" (1974, 250). A further example of query references equally familiar brands: "Find those items which are supplied by Levi and sold in the men's department" (253). These examples also betray the spatial and cultural centers of the fledgling IT industry.

With the advent of the relational model and SQL, information becomes in a new sense purely programmable as data and available for, among other things, forms of *ad hoc* knowledge production. It opens up entirely new scientific fields of informatics. Data mining, business intelligence, real-time analytics, customer relationship management (CRM) and enterprise resource planning (ERP) are unthinkable without the modern database. This in turn has led to a technological shift in the processing and logistical operations of modern institutions, with transformative effects in the apparently mundane fields of

report writing, insurance assessment, credit checks and policy development. What were once specialized arts become template-driven and eminently replicable institutional processes.

Here, knowledge rubs up against the politics of parameters. New uses of data became a constant in the social life of institutional settings, laden with a politics that remains for the most part implicit as it is pervasive. As Codd noted presciently, though without apparent concern for its political implications, "future users of large data banks must be protected from having to know how the data is organized in the machine" (Codd 1970, 377). Implied here is a system operating in "protected mode," a form of prophylactic for organizers of the data as well as for those "future users" at risk of going crazy (Kittler 2013). As Friedrich Kittler observes, the power of the *protected mode* is "derived … from the efficacy of silence" (Kittler 2013, 213). Unable to intervene in the *operating system* (OS) of the machine, the user is locked out from issuing commands that alter the architecture and addressable memory special to the *real mode* of Intel's x86 *central processing unit* (CPU) introduced in 1978. Intel's 80286 16-bit microprocessor, released in 1982, distinguished between real mode and protected mode, a CPU designed for multitasking applications operating in real-time secured by increased operating system control.[1] Modern operating systems, Windows, MacOS and Linux, continue to use this mode to protect us from our machines, in some sense, even today.

The widespread adoption of protected mode systems impacts upon the economy of expression, practice, subjectivity and knowledge. In one of his rare moments of invoking a concept of power, Kittler suggests that the Foucauldian analysis be reoriented around an investigation of how protected modes

1 Kittler's object of critique is the 80386 32-bit microprocessor released in 1985, which improved upon the protected mode of the 80286 by allowing mode-switching. The 80386 also had greater market penetration and was widely adopted across a range of institutional settings.

specific to technological systems and their "privileges" provide the key to reconstructing the transformation of bureaucracies. While not renowned for political statements, Kittler considers the issue of access rights as, in effect, the new front of a geopolitical war against the hegemony of the United States and the imperial extension of its IT industry across global economy and society.

One might reasonably assert that *Open Source* software (OSS) offers such an alternative to protected mode. But for the most part, OSS mimics if not aspires to the aesthetic regime of the hugely dominant operating systems. Do-it-yourself (DIY) hardware assembly might offer a more deviant alternative, though even moreso than OSS it is unable to scale up to pose any real challenge to the IT behemoths. The DIY hardware movement is increasingly tied to maker culture, which as the long-tail of "artisan-alternatives" is not prepared to admit how the valorization of localism frequently depends on global supply chains (Wark 2013). Virtuous acts of rarefied consumption coupled with the satisfaction of self-assembly fulfill a hipster imaginary of distinction, an inner-city latte variation on IKEA. Just as the imaginary itself is part of a global media production, reverberating from one trendy alleyway to another, its desires are serviced through the concealed operations of the world logistical economy.

The OSS and maker cultures encompass a spectrum from "complicit" corporate-backed organizations (for example, the Apache Software Foundation) through to iconoclasts and hacktivists who offer some scope for critical kick-back. While the OSS movement in general shares an obvious alignment with the call by Kittler (and many others) for forms of open access, or real mode, this does not disqualify the scepticism we register here. Even the most idealistic of projects can become entangled in corporatism. MySQL is a widely used database system, a "poster child" of the OSS movement and the default for many other OSS projects, including the popular blogging engine WordPress. In 2008 the Swedish firm that hosted and supported MySQL was sold to Sun

Microsystems, which in turn was soon after acquired by Oracle, the largest vendor of enterprise database systems in the world. It continues to be supported by Oracle as a means of "upselling" users to its more expensive suite of products. In protest, one of the founders of MySQL then launched a Save MySQL campaign (Wikipedia contributors 2015).

The durability of knowledge practices was and continues to be coextensive with the persistence of parameters. Political existence contracts into the embodiment of Quine's dictum: to be is to be the value of a variable. Manuel DeLanda has, in another context, reflected explicitly upon the conceptual individuation of the assemblage through a process of parametrizing, or "providing it with 'knobs' with modifiable settings the values of which determine the condition of the identity of an emergent whole at any given time" (DeLanda 2011, 187). Just as contemporary philosophy is tempted, then, to think entire ontologies, including social systems, through the affordances of database logics, the operations of modern institutional life and labor are equally determined by processes of parametric adjustment, tuning and tweaking. Changing these values—the settings of parameters—alters the configuration of thought and practice.

By the early 1980s the increasing reliance of all institutions on the parametric affordances of the database reinforces and reinflects late twentieth century theories of institutionalism. For Max Weber, operating under earlier assumptions about the institution, it appeared as a necessarily constrained artefact of capitalist modernity, a comparatively inflexible and non-configurable organizational form without parameters (Weber 1930). In announcing "new institutionalism," Paul DiMaggio and Walter Powell revisited this "iron cage of bureaucracy," reconceiving the modern institutional form as instead an "isomorphic" entity with shared common procedures, structures and operational norms which at the same time could be capable of adaptation to geographic, commercial and industry-specific conditions (DiMaggio and Powell 1983). We argue this isomorphism or "elective affinity"

between organizational forms and techno-materialist conditions at particular conjunctures is recognizable by new institutionalist theorists in part due to its historical coincidence with the ubiquity and relatively enduring quality of the enterprise database. In the same way, the onset of flexible modes of capital accumulation was not a transformation independent of emergent developments in computational architectures. The logistical world of what Anna Tsing (2009) terms "supply chain capitalism" has become increasingly governed largely by the dual and interconnected processes of real-time computationality and just-in-time modes of production and distribution. The agility of the modern institution is, then, contingent upon the combinatory possibilities of relational databases that operate at ever increasing scales.

Since the 2000s the capacity for institutions to adapt to regimes of flexibilization is augmented, rather than replaced, by novel non-relational systems. So-called NoSQL, or *non-relational databases*, appear to relax the constraints imposed by the relational model. Seemingly new paradigms of data management add further layers of what Codd had termed "protective" indirection between users and the physical allocation of zeroes and ones on magnetic or solid state hard drives. Two particular IT terms resonate here: SaaS, or *Software as a Service*, and SOA, or *Service-oriented Architecture*. The first term, SaaS, refers to the delivery of software as a series of features, or *services*, over a network rather than as an executable file that installs and runs from a computer's hard disk. The second, SOA, describes instead a way of developing software to expose critical functions, again as services, over a network for use by other software. Databases do not disappear in these frameworks. Rather, they are transformed into services provided to other systems, other services and part of a larger combinatory puzzle through which clients, both machinic and human, have their informatic demands met. In theory, organizations providing such computational services are interchangeable. In practice, IT language such as standards compliance, consumer choice and the ability to plug-and-play

different services and vendors become tokens in a game of entrenchment that pays lip service to flexibility. Choice is seen through the prism of constrained parameters. This logic refracts the insular world of IT fashions and policies to the larger fields of institutional labor and politics, increasingly dependent upon these apparent abstractions of informational architectures.

Part of the flexibility of what Stefano Harney and Fred Moten term the "algorithmic institution" tasked with the management of "logistical populations" is immanent to the technical operation of enterprise databases such as Oracle and IBM, which are prone to bugs, hardware malfunctions, software glitches and the like (Harney and Moten 2013, 90–91; Harney 2014). Yet the logistical fantasy of a smooth world of seamless interoperability is not disturbed by technical malfunctions alone. As Harney and Moten write:

> Every attempt by logistics to dispel strategy, to banish human time, to connect without going through the subject, to subject without handling things, resists something that is already resisting it, namely the resistance that founds modern logistics. (Harney and Moten 2013, 91–92)

Logistics is always troubled by that which it cannot obtain, by the indeterminate temporal and spatial horizons and hidden reserves of human subjectivity that forever entice the technocratic tendency with the promise enhanced measures of efficiency, yet which by definition remain beyond the calibrating optic of logistics. This is why so much cognitive attention and so many financial resources are expended upon designing more complex computational infrastructures.

"The Service Orientation"

In the first decades of the relational database, it was possible to imagine this tool of bureaucratic enlargement through the metaphor of the physical container. Sitting in air-conditioned

windowless rooms, database servers retained a tenuous but palpable link between the logical and the physical. Databases ran on big iron mainframes or industrial-strength PCs capable of fast input/output operations, low disk and network latency, and high transactional throughput and parallelism. Data had a home; it could be secured, locked down, contained within the appropriately named data center. Deeply nested behind non-descript suburban office exteriors and warehouses, technicians and administrators, with talents that were obscure even to the broader IT industry, kept the machines and data systems humming. Yet the prospect of fully automated labor was never far from the machine dreams surrounding the database. Robots took over the swapping of back-up tapes; self-replicating and load-balancing databases reduced the need for human monitoring.

This is not so much a story of manufacturing and low-wage jobs offshored to developing economies; such features can also be found in the majority of advanced economies. Rather, the integration of multiple layers of value-generating activities is made coincident as a result of technologies of governance such as the relational database. Labor becomes increasingly subject to the logistical regime of real-time coordination, command and control. In an inversion of the processes of software and database design techniques used to simulate "real world" objects such as the "customer" or the "employee," *pace* Chamberlin and Boyce (1974), these labor entities begin to resemble more and more the data structures of enterprise resource planning and human resource (HR) systems they are supposedly modeled upon (Rossiter 2015).

Beginning in the nineties, but maturing with the arrival in the mid-2000s of fully-fledged virtualized or *cloud* services such as Amazon Web Services and EC2 (Elastic Compute Cloud), Microsoft's Azure platform and Google's App Engine, SOAs pose a radically alternative computing paradigm. At the same time this paradigm looks to extends Codd's desire to "protect" users still further. Housed on highly virtualized farms of servers in data

centers, databases could now reside everywhere—and nowhere. What matters under this paradigm is no longer the specific configuration of technical data structures to physical hard drives and machines, but rather the relations, tuples, lists, sets, sequences, keys and tables peculiar to the processing of data. Indeed, the modern database administrator, including the humble maintainer of WordPress websites, is less and less likely to understand how these relations are configured at all. Rather, the database exists, increasingly, as a kind of implied contract to supply its clients with a range of data services, delivered over networks using various standardized protocols that include SOAP (*Simple Object Access Protocol*) or REST (*Representational State Transfer*).

The database is no longer a container, a tangible housing or repository. Instead, it is service oriented: the passive object of a sentence, that which is responsive to requests. From the point of view of the demanding client, it is no longer relevant whether these service requests are resolved by a tightly coordinated cluster of processes running on the same processor, or instead, and increasingly, by a loosely federated web of interconnected services. In effect, this means the architecture is never questioned. Any plea for change or deeper level access is met with resounding indifference by the proprietors of control. The function of the client is to submit to service. Such a technique of capture provides the basis for scalar expansion. One may choose to migrate to other providers, but the time and cost associated with adapting organizational processes and activities to slightly reconfigured architectures is significant. So no matter how much a client may wish to flee service-oriented systems, the operational indebtedness to a particular architecture more often exceeds the will to escape. In spite of the rhetoric of standards compliance and migration pathways, in practice user "protection" risks becoming pacification.

The devolution of computing to the shapelessness of the cloud is one of the IT industry's recurring motifs. Even if it is not inevitable, there is nonetheless a danger in exaggerating the

convergence between networks, storage and computational processes. Already by 1984 it was plausible to market the idea that "the network is the computer" (Olsen 2008; Aytes 2012). Similarly, in 2015, it is also possible to argue that the compelling story of reified services, both in the purely computational sense of SOA and in the economic derivation of SaaS and its near-cognates, *Infrastructure as a Service* (IaaS) and *Platform as a Service* (PaaS), has long since subsided into the background noise of general IT hardware and software commoditization. These technologies have reached their point of design stasis, what in Gartner's jargon would be termed the "plateau of productivity."

Yet the terminology of computing services suggests a more meaningful turn, a re-orientation is underway. Through the prism of the new computing service industries—which include not only the outsourcing of hardware, software and network capacity, but also quasi-human services such as system monitoring and back-up, fault detection and data analytics—it is possible to imagine a highly compressed history of capitalism replayed at a rapidly accelerated velocity. It is as though computing, having earlier exorcised its primary and secondary industry moments, is today running headlong into its post-industrial epoch—an event heralded for capitalism at large only in the 1970s. Aping the age of corporatism, of endless outsourcing, offshoring, vertical and horizontal integration, mergers, acquisitions and divestments of non-core assets, the rise of the global SOA effaces as meaningless the authority of the singular, coherent software system or repository of data. The tangible data product—a hard drive, a floppy disk, a memory stick—is now fully transformed into an etherealized thing, an intangible commodity, an abstract service, often performed either algorithmically or supported via data entry by nimble fingers or server maintenance from bodies in spaces remote to the sites of consumption.

The newly formed fabric of SaaS represents, then, the realization of a particular logic of procedural alienation—a realization in which both the computational time of processing cycles and

human programmatic labor of developing services lose their distinctiveness. In this model, "Software as a Product" disappears. So too does the appealing cottage industry of eighties shareware culture, swap meets, and the then-fledgling Open Source movement, where at least the programmer's authorship and reputation could be tied—however superficially, and now, with some sense of nostalgia—to an identifiable artefact or commodity. In its place comes a grey world of interconnected service endpoints, undifferentiated, integrated and distinguished only by IP addresses and a coded declaration of their capabilities.

This architectural model has its political analogue in the rise of microwork, exemplified by another Amazon site: the Mechanical Turk (MT). [2] Here, for the remaining low-value services algorithms cannot quite yet accommodate, and which need therefore to be especially qualified as Human Intelligence Tasks (or HITs), it is possible to buy and sell human labor at piece-meal rates. The original eighteenth century Turk represented a machine that dissembled the rules specific to its operation, all the while being driven by human labor. The Amazon "refresh" suggests a new possibility: human labor now fills in the gaps for those cases where algorithms are insufficient. Tasks include identifying duplicate Facebook and Google+ accounts, labelling materials of objects in photographs and deciphering handwriting (Limer 2014). This form of service orientation is, today, a fortunately esoteric form of soliciting labor. Yet the close approximation in language and function between Amazon's EC2 and Mechanical Turk—both promote the flexibility of "elastic" resources—offers a glimpse of a degree of "invasive technification" that exceeds the gloomy predictions of Böhme. The algorithmic possibilities of the service-oriented institution are similarly elastic: they continue to stretch and expand across a range of human occupations, a process of

2 A number of participants also addressed MT at the Conference Digital Labor: Sweatshops, Picket Lines, Barricades, The New School, 2014.

labor automation decried since the seventeenth century (see Hobsbawm 1952).

Moving into the twenty-first century, it is not so much the threat of obsolescence as the disappearance of boundaries and responsibilities that, paradoxically, is presaged by the rise of the SOA-led institutions. It becomes increasingly difficult to see in the current orientation towards services how from the point of view of the service consumer certain forms of monotonous and metric-laden human labor can be differentiated any longer from those performed by computers. The work of Business Process Outsourcing (BPO) has become a staple economy across much of the IT sector in India. Servicing the needs of data entry in the medical, insurance, logistical and finance sectors for both large multi-national companies and Small and Medium Enterprises (SMEs), BPO work is secure as long as wages remain suppressed. Like the circuit board that never tires, BPO work and its affective correlate found in call centers is 24/7 both offer a form of "sensory impoverishment" that dulls perception and dissipates any reserves of energy that might be harnessed into forms of labor organizing (Crary 2013, 33, 105).

The Ethereal Database, or, Black Box Politics

If the relational database represents the institutional transition to a computational form of modernism, where paper records were replaced by tuples identified by a primary key and assembled into new kinds of "great tables," then now we are arguably entering into an era of the hypermodern. When information loses its anchorage in physical analogues of filing and record keeping systems and succumbs to a new set of dissolvent metaphorical clusters—of *cloud computing*, agile methods, mobile devices, *virtual machines* and an elasticity of resource provisioning (computational or human)—it loses its last vestiges of tangibility. Adopting Lewis Mumford's metaphor of technology, it can be said to have become "etherealized" (Mumford 1938). For Mumford,

the city was a space where, in a strange shifting of metaphors, information "'etherealized' through the city into *durable* elements in the human heritage" (Mumford 1938, 3, emphasis added). In a quite different sense, the information space once occupied by the relational database can similarly be thought of as something in a hybrid state: simultaneously dissolving, becoming elusive, transparent, ethereal and also gathering in insulated and protective layers, unknowable, a machinic servant receiving inputs and responding with outputs. The black box is at once opaque and utterly transparent.

While "vaporware" indicates software that is so soft that it in fact does nothing, or does not exist, we can imagine an alternative coinage in which the metaphors of ether and vapor infuse with that of a new term like cloud computing. But it is not only the ethereal quality of data management that concerns us here. Such attributes are, as we have suggested, part of the hype machine special to the IT industry and its services. Database records still need to be inscribed as zeroes and ones on magnetic or solid state discs, which are usually located in largely inaccessible data centers. What becomes difficult to think here is the simultaneous properties of ethereal transparency and material opacity that attend the new data services. The commercial enclosure of communications infrastructure coupled with the opacity of algorithmic architectures special to SaaS gives rise to a politics of the black box.

For the data-dependent enterprise this signals, in the first instance, a calculable trade-off between direct control and efficiencies and economies of scale. By shearing off its dependency on "big iron" mainframe computing to service providers while continuing to transact in "big data," the modern institution simultaneously divests yet another no-longer-core activity—managing its own data—while insinuating itself yet further into the unstable set of relations that cut across old institutional lines. Here, the term "architecture," always metaphorically overladen when applied to software, is instead

completely misleading, vanishing into its opposite: a destructured network of loosely coordinated endpoints, refracting service requests and responses from point to point. The possibility for error is accordingly amplified; the responsibility for that error lost, along with any single locus of control over computational results. If, as Jaron Lanier recently suggested, "the distinction between a corporation and an algorithm is fading," under the distributed scenarios of a fully realized SOA/SaaS digital economy even the "algorithm" is no longer singular nor self-contained (Brockman 2014). With the rise of smart cities one finds an increasing feedback operation in which "all that is solid" modulates forms of algorithmic governance and vice-versa. Adaptation and transformation is a mutually constitutive process contained, retrieved and acted upon within the parameters of the database that is now oriented towards an architecture of service delivery. The *SOA database* would be a crude approximation to this concept of data that is no longer "based" anywhere.

In the broad advent of the SOA/SaaS digital economy any organization can avail itself of "elastic" data facilities at seemingly any scale. Any organization can make use of predictive analytics, business intelligence and a host of ancillary services for data authentication, search, logging, billing, monitoring, visualization, conversion, publication and backup. And while these services may be offered in limited variety, by a limited range of vendors, any organization can also differentiate itself through the large combinatory possibilities that an even seemingly small number of parameters provides. The relational database ushered in new forms of predictive and just-in-time data analytics through the ability to develop *ad hoc* queries and reports, thereby allowing modern institutions simultaneously to become homogenized as a general form while differentiated in parametric specificity. The SOA database accelerates both sets of tendencies towards institutional similitude and differentiation. Like the limitless possibilities a finite set of rules provides in the game of chess, the SOA database offers an infinitude of institutional forms to

emerge within the horizon of its parameters. Similarly, it further accelerates the condition and precarity of service-oriented labor, setting new "standards" for how capital is flexibly accumulated and deployed. But where such institutional variation does occur, it is not reducible to the determining form of the database. Culture leaks beyond the structural constraints of data parameters. At the same time the processes of structural decoupling and disaggregation we describe above also introduce new prospects for self-cannibalization, creative destruction and systemic intervention. How to operate outside such limits and invent new systems of organization and cultures of expression will comprise a parametric politics of the present.

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