

Thinking infrastructures

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INFRASTRUCTURES OF TRACEABILITY

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ABSTRACT

The notion, technologies and organizational elaboration of traceability have become more prominent and more systematic in recent years in many different fields, notably food. This essay argues that traceability has many faces: it is a programmatic value embedded in norms and regulations; it is a frontier of technology development such as blockchain; and it is a continuous processual and political dynamic of organizational connectedness, leading also to resistance. These different aspects make up “traceability infrastructures” which embody a number of tensions and dynamics. Three such dynamics are explored in this essay: the tension between organizational entities and meta-entities; problems of agency and the distribution of responsibility; and dialectics of connectivity and disconnectivity. These three dynamics generate three testable propositions which define a prolegomena for a new subject of “traceability studies”. Overall, traceability is argued to be an on-going process of connecting discrete agencies – a process of “chainmaking” – and is formative of more or less stable forms of distributed agency and responsibility.

KEYWORDS: Accountability, Audit Trail, Blockchain, Distributed Agency, Infrastructure, Traceability, Transparency.

INTRODUCTION

Traceability is increasingly and explicitly valued in a wide variety of fields. Indeed, it has become big business as new markets for trust have emerged, fuelled by the promise of digital technologies like blockchain. Consumers care not just about the quality of goods and services, but also about where they come from and this is influencing the governance of supply chains. This interest in traceability is of course not new. In many ways it is as old as writing itself. For example, one important strand of the history of traceability has to do with technologies for assuring the quality of agricultural produce by stamping it with trusted traces of its origins. Thus, the long established classification and labelling of French wine describes its origins precisely in space and time, and functions as a signal of its quality, albeit subject to expert interpretation (Fourcade, 2012). Such practices of traceability are a feature of manufacturing in general. Batch identifiers, product tagging and barcodes (Kjellberg, Hagberg & Cochoy, this volume) exist both for transactional efficiency and to provide assurance to the consumer. In many fields, such as the pharmaceutical industry, this kind of traceability is now regulated by the state.

Another strand of the history of traceability is more forensic in emphasis. The traceability of money and assets is a prerequisite for their recoverability in legal disputes. The traceability of persons via paper technologies of passports (Torpey, 2018) and related forms of identification – including bodily traceability in the form of fingerprints (Coles, 2001) – is integral to state control of borders and the internal movement of people. Such traceability is now relevant to the 21st century crisis of displaced populations and problems of defining legitimate cases for asylum.

In general, traceability, as realised in a multiplicity of technologies, has acquired increased salience in recent years. Emerging from heterogeneous origins in different fields, traceability is becoming a widely diffused social and policy value organized into infrastructures for its production. Driven by a mixture of health and sustainability concerns, consumers and their representatives are increasingly focused on knowing **both** the precise origins of the food they eat. Retail organizations are forced to respond to these demands and are more explicit about their supply chains and sourcing. Drug traceability is no longer a matter of regulatory control within the pharmaceutical production process (See Pflueger, Palermo & Martinez, this volume), but is also a feature of bodily testing regimes for assuring fairness in another big business – international sport. Developments in anti-moneylaundering regulation and practice are also symptomatic of a heightened and organized concern with traceability. Consumer interactions and transactions with financial organizations are critical points of exchange where the risk of financial crime must be managed. At this point of individual-organization interface, the relevant question to be answered is not only “where has your money come from?” but also, to the banking client, “who are you, and where have you come from?” It is this second question which points to the intensifying forensic modality of traceability, supported by an entire industry of organizations, such as Experian and Kroll, dedicated to tracing the origins and biographies of people.

These examples are suggestive but also intimidating for the analyst looking for commonalities. They pose the problem of how to extract an analytics of traceability, its infrastructural dynamics and economic and political trajectories, from these many different manifestations in discrete fields such as accounting, quality control, food and drug regulation, policing and many others. How, given this great variation in settings, might we

explain the expanding cross-sectional concern with traceability? Of course, unsurprisingly, crises and scandals, such as the 2013 horsemeat scandal across Europe (Elliot, 2014), have played a critical role in fuelling demands for more and better forms of regulation and governance. Infrastructures of traceability in one form or another are a response to these demands. Their mundane production and distribution of all manner of traces underwrites the promise of restoring and reforming governance and accountability.

The concept of the “trace” is without doubt ambiguous and semiotically complex. On the one hand it is a referent or sign which stands for something which is absent in space or time, like an inscription in an accounting ledger. On the other hand, a trace like an accounting entry can acquire an ontology independent of the thing it represents, having its own organization and dynamics. In some cases, like the digital tagging of food and wine, the digital trace is designed to move with the physical object to which it is attached. Yet even in this case, the trace is further entangled in an infrastructure of traceability in which the foodstuff does not participate. Money is yet a further example of this ambiguity of sign and thing (Maurer, 2006). All of which suggests that great conceptual care is needed in developing an analytics of traceability and traces which is sensitive to this fluid ontology between sign and thing. In what follows, the use of the concept of trace is therefore a placeholder for further empirical and conceptual elaboration

This essay is a prolegomena for the development of an analytics of traceability and a programme of “traceability studies”. It is argued that traceability has many faces or ontologies: it is a programmatic value embedded in norms and regulations; it is a frontier of technology development; and it is a continuous processual dynamic of organizational connectedness. Each of these ontologies of traceability addresses different but related

aspects of traceability infrastructure. In particular, the essay will briefly discuss how traceability infrastructures and new markets for governance have become intertwined (Hinings et al., 2017). It is argued that such infrastructures are inherently “agency distributing” in nature (Enfield, 2017; Bernstein, 2017) and generate a politics around the expanding/contracting “unitization” of social agency and therefore accountability (Kockelman, 2017). Furthermore, although specific forms traceability may be desired and become embodied in laws, regulations, and inter-organizational practices, there are also varied counter pressures at work, such as social demands for privacy, criminal resistance, and technological failure. Thus, while traceability infrastructures have become increasingly prominent, this essay considers three dynamics of their variation relating to “entity units”, “agency and accountability”; and “connectedness”. This analysis is distilled into three propositions in order to orient further empirical and theoretical work.

TRACEABILITY INFRASTRUCTURE AS IDEA

The first ontology of traceability is “ideational”. It is the promise and dream of an infrastructure or organized capability in which the origins of things and people can be traced and made visible. It is a way of thinking programmatically about the possibility of such an infrastructure in order to motivate its construction. It is the “thinking of infrastructure”. This imagination of traceability is bound up with the myth of transparency (Christensen & Cornelissen, 2015). It draws its organizing and programmatic power from the centrality of this myth to modernity, and yet, as a mode of operationalising that myth, it also has its own distinctive character. The idea of transparency speaks metaphorically and fundamentally to a notion of “revealing”, of being able to see into, and make visible, the interior, the

underlying structure, of things. As Foucault (1970) suggests in the *Order of Things*, new modes of truth and knowledge are made possible by looking beyond surface classifications into the “depth” of language (grammar), nature (natural history) and economy (utility). The idea of traceability broadly reflects this orientation to reveal inner structure - but it differs by emphasising the *origins* of people and things. Traceability is a form of “depth-knowledge” in Foucault’s sense but its epistemology is distinct. The paradigmatic question for traceability is not “What lies beneath the surface of this?” but more specifically, “What are the spatial and temporal origins of this?” and “Where has this (foodstuff, person, object) come from?” The answers to these questions demand a body of systematically organized evidence of such origins - traces. This evidence is specific rather than statistical in nature. Traceability is not concerned with populations as a whole and their macro-regularities. Its object is a specific foodstuff, a specific person, a specific item of clothing and the core question is: “Where has he/she/it come from?”. In short, traceability as an imagined and valued form of knowledge is also a programmatic aspiration for rational traceability infrastructure organized to produce the required specific traces for specific purposes. Traceability is an ideal of knowing the origins of particulars in a granular and precise way; it is the form of accountability of the particular.

This ideal of knowing the origins of things and people is not new, as noted in the introduction to this essay. However, it is an ideal which is increasingly evident in many diverse areas of social life. Indeed, we might argue that the idea of traceability has become a rational organizing myth as a result of demands, in the face of societal complexity and globalization, for increased security, assurance and control over the origins of products and people. The “audit explosion” (Power, 1994) was arguably one symptom of this phenomenon; the “logic of the audit trail” promises the production of security and

assurance from the capacity to trace back to the originating components of performance representations (Power, 2019). More generally, the traceability ideal is also an ideal of governing objects and people – to trace is to govern in a particular way. More on this later.

This ideal of traceability as the ground of societal security is not hegemonic. Importantly, there are also counter-traceability discourses in play which are somehow “parasitic” on the thinking of infrastructure (Brown, 2002; Kockelman, 2010). For example, the right to privacy has been a prominent feature of debates about identity cards in the United Kingdom (Whitley & Hossain, 2008). More recently, it motivates European Union General Data Protection Regulations (GDPR) which became law in many countries in 2018. This legislation grounds a right to be forgotten, i.e., to be not traceable by organizations. Thus, the idea of traceability is not simply associated with the production of trust, but also with a distrust of the infrastructural democratising dream, and the uses to which traces as information about persons may be put by states and big business (on blockchain see Roubini, 2018). In addition, the very property of money as a “fungible” asset is explicitly designed to frustrate the kind of traceability which is now required to counter moneylaundering and the funding of terrorism. Accordingly, the ideal of traceability may be expanding its reach and capability into new fields, but it is also beset by contradictory pressures, not least the presence of organized crime which places a value on lack of traceability, even though criminal organizations are known to keep their own accounts.

To summarise the argument of this section, the first ontology of traceability infrastructure is ideational, grounded in the modern myth of transparency but also having its own cultural status arising from societal demands to know the origins of people and

things. Yet, how is this dream of traceability, matched by capability? To answer this question we must consider the second ontology of traceability infrastructures.

THE MATERIALITY OF TRACEABILITY INFRASTRUCTURES

The second ontology of traceability infrastructures is material and technological. This too has a long history reaching back to the very origins of writing and the central role played by texts in the organization of societies (Goody, 1986). Whether we consider accounting (Busco & Quattrone, 2018), archival science (Yakel, 1996) or anthropology (Hull, 2012a; 2012b; Riles, 2006), it has become paradigmatic that documents do not simply represent and refer to the world, but constitute and perform social relations and organizational realities (Smith, 1984; 2001; Cooren, 2004). Documents are ‘loaded with the ‘habits, intentions, and rationales held by the agencies by which they have been created’ (D’Adderio (2011: 207). Van Maanen and Pentland (1994), drawing in part on Garfinkel’s (1967) classic analysis of organizational records, state that what is recorded is never simply what happened. ‘records are not neutral, technical documents...they are designed to produce an effect in some kind of audience...’.

Modern organizations can be said to be constituted by a myriad of texts: files, diaries, memos, timesheets, questionnaires, checklists, log books as well as formal accounting records (Wheeler, 1969; Riles, 2006). The organized creation and preservation of traces in texts is therefore one of the most fundamental of social practices, a form of memorizing which is both the basis of scientific knowledge (Douglas, 1986) and social control (Foucault, 1977). Yet, as these documentary technologies, from notebooks to digital hash-tagging, have evolved, so too has traceability shifted from being an almost natural by-

product of human transactions to a commodity which is valued and consumed in itself.

Traces of the origins of things and people have become social and economic objects within infrastructures such as archives and audit trails. Science itself has also been an important engine in the transformation of traceability from means to end. For example, technologies of fingerprinting (Coles, 2001) and DNA testing (Aronson, 2007) underpin the construction of the practice of “forensic science”. Traceability infrastructures have also been central to the emergence of GM foodstuffs as commodities (Lezaun, 2006). In general, advances in digitization have provided further on-going technical potential for traceability in many different fields, opening up new markets for production of traces. GPS and related technologies now enable, or claim to enable, fish in a supermarket or restaurant to be traceable to a point of harvest in a specific location by a specific trawler (Lewis & Boyle, 2017). The trace is not the fish but it is the permanent digital shadow of the fish and moves with it.

Yet for all these apparent technical advances in traceability and their historical grounding in documentary processes, their ideational features cannot be disentangled from the material (Orlikowski & Scott, 2010). As possibilities for traceability are actively sold to consumers, they drive further investment in technologies which promise ever greater granularity, precision and trust. This technological ambition is encapsulated by the idea of blockchain which has undoubtedly accelerated the contemporary promise and commodification of traceability. Blockchain is marketed as a virtual, unowned and decentralised ledger which overcomes both the frictions and democratic deficit of immoral intermediaries. Any object of interest can be uniquely recorded, identified and its digital trace is free from possible manipulation. Blockchain is therefore the dream of, the

metaphor for, a perfect, uniquely referential, precise traceability infrastructure. It is the audit trail in its purest form.

Yet, technologies of trace creation like blockchain are always imperfect and incomplete realisations of the ideals that motivate them. Whether we take accounting for performance (Power, 2019), checklists (Gawande, 2010) or medical questionnaires (Pflueger, 2016), the technical promise of traces, understood as accounting “inscriptions” which faithfully represent objects and transactions, is imperfect and incomplete. As Busco & Quattrone (2018) argue in the context of accounting, such inscriptions are always reductive and partial representations of what they refer to. In a blockchain application, such reduction occurs via coding at the on-block/off-block interface. This partiality of the trace is a source of both a politics of resistance to reductionism and also a continuous inventiveness involving the search for new and better forms of traceability. This means that trace creation is dialectical. On the one hand it is animated by an expanding ideal of traceability which is sold. On the other hand, empirical and political disappointment with the impossibility of its ideal realisation, drives the search for new and better forms of traceability.

Materially grounded practices of traceability also fail by intention. Corrupt athletes find new ways to avoid drugs tests. Moneylaundering and financial crime remain at industrial levels. Cybercrime by states and individuals, who themselves evade and contest traceability, provide a continuous reminder of the dialectical character of digital technology. It is both mitigant and source of risk. The digital promise of traceability is therefore powerful and continuously oversold, and this generates heightened insecurity in the face of new failures. The total loss of a large commercial aircraft and its passengers and crew -

Malaysian Airlines MH370 - with few clear-cut “traces” in air traffic digital tracking systems (or physical debris), has demonstrated this painfully.

In the so-called digital age, traceability as digital technology like blockchain has acquired the status of a ‘machine dream’ (Mirowski, 1995) of the completeness of “digital footprint”, not just of humans, their internet surfing habits and consumer tastes (Alaimo & Kallinikos, this volume), but also of the precise historical and geographic pathways of other objects and foodstuffs. Traceability infrastructures mean that the individual fish on my plate in the restaurant now has a personal travel history which is constituted by traces. Advances in digital traceability, and their multiplication, therefore generate detailed “biographical ontologies” which did not exist before - for people, animals and things.

In summary, traceability infrastructures may be associated with new technologies but are also as old as record keeping and writing itself. Traces of many different kinds are created and stored in files (“blocks”) which are rationally ordered (“hashed”) to enable easy retrieval and interrogation. They stand imperfectly for the events, things and people which they represent, but also have their own social facticity, although this may be manipulated, destroyed or contested by counter- traces. In recent times the digitization of traces has expanded the possibility for traceability beyond the archive, accounting system or library by increasing the capability, or at least the promise of a capability, to connect different traces into historical “chains” for blocks of people and objects. It is to this process of connecting that we now turn.

TRACEABILITY INFRASTRUCTURE AS PROCESS

The third ontology of traceability is *processual*. Traceability requires the organization of technologies – documentary and digital – in processes which create and maintain

connectivity among persons and things. Developments in fisheries are paradigmatic of this processual character. Lewis & Boyle (2017) attribute the rise of traceability in the fisheries industry to mixed pressures and concerns about fraud, sustainability and labour exploitation leading to a range of regulatory measures, especially in the European Union and USA. These initiatives have been paralleled by the development of tracing processes utilising digital “point of harvest” technologies, such as vessel monitoring and electronic log-books. Ongoing technical developments can be understood in part as “phatic labour” (Elyachar, 2010) to construct connectivity and interactivity, grounded in software solutions which are “interoperable” across the fishery supply chain. The regularized use of these tools is a manifestation of, and response to, consumer accountability and sustainability pressures, mediated by retailers and by a variety of non-profit organization, such as the World Wildlife Foundation (WWF). As these traceability processes co-evolve, they support and make possible the regulation and standardization of traceability practices (e.g. WWF., 2015). In effect, it is the project of organizations like WWF to transform the discrete agencies in the supply chain into a “distributed agency” in which multiple organizations connect, act as one, and embody a shared intentionality (Enfield, 2017:12) and responsibility.

The field of fisheries and the emergence of traceability issues conforms to the mixed, multi-organizational form that has been noted in many other areas – such as financial crime regulation - involving a wide range of global actors seeking coordination and trust production across private and public domains (Djelic & Sahlin-Andersson, 2006). While traceability infrastructures are material and technical accomplishments as we saw above, the processes of connecting multiple agents - states, private actors and non-governmental organizations each with an interest in the promise of traceability - displays an ambition to build distributed and interconnected responsibility. The setting of fishery supply chains

shows how processes of agent-connectivity in traceability infrastructures generate governance and responsibility structures, not least as the explicit responsibility for discrete organizational agencies to make themselves transparent and traceable. This distribution of agency is malleable and fluid (Enfield, 2017) and only stabilises by the continuous process of connecting.

Traceability processes have become culturally salient as people, organizations, markets and states have become more conscious of the need to govern and make visible interconnectedness. The greater the perceived interconnectivity and complexity attributed to modernity, in the sense of mutual dependence and distributed agency, the more that explicit traceability infrastructure is required to see, know, govern and sustain it. Furthermore, failures and problematizations of connectivity, which are inevitable, will fuel a new “traceability politics” involving demands for new and better technologies of tracing and connecting.

Developments in fisheries and other food supply chains are interesting in their own right, but the supply “chain” is also a metaphor for what is generally stake. The “chain”, including specifically blockchain, is a promise of connectedness in time (history, biography, origin) and space (organizations, persons, things). Traceability infrastructures fulfil that promise. However heterogeneous their components, they are not quite “assemblages” (Mennicken & Miller, 2012). They embody systematic, organization boundary-spanning processes which represent, act upon and govern the supply chain as an entity. Whereas we are likely to see a real chain as a whole and pay less attention to the individual links, in supply chains it can be the other way around. Traceability infrastructures consist of, and govern, multi-organizational chains. These governance processes may include but are not

identical with audit processes. The traceability that inheres in a fishing supply chain must be created and continuously sustained in order for any particular tracing practices to be possible. A “platform” must be created and exist as a condition of possibility for tracing practices, and for evaluations of the quality of traceability by an auditor. Put simply, an audit trail infrastructure which permits traceability and connection is logically prior to any audit or evaluation (Power, 2019). Traceability infrastructures can be checked or audited to ensure that they are working as desired, not least that the primary traces they embody – the tags, docket, bar codes and so on - actually refer to something real.

Empirically the platform element of traceability infrastructures is likely to co-evolve with the tracing processes that they enable, even though they are analytically distinct. For example, “evaluative infrastructures” for the travel industry and credit analysis (Kornberger et al., 2017; Kurumaki et al., 2013; Orlikowski & Scott, 2014) are operationally dependent on underlying infrastructures of connectivity and traceability. As accountability and market demands for assurance develop, there is investment in creating and sustaining traceability infrastructures as a basis for responding to those demands. Markets for audit and evaluation grow on the back of, in parallel with, and sometimes ahead of traceability capabilities. Twenty years ago I would not have wanted or expected know the exact origin of the fish I eat in a restaurant. Today that possibility exists and is generating expectations. Not only am I now interested in a primary value in the form of the restaurant’s claims about the origin of the food on my plate, but I may also be interested in a secondary, derived value, namely knowing whether this claim has been checked by an independent party.

In sum, traceability is an on-going process of connecting discrete agencies – a process of “chainmaking” – and is thereby formative of more or less stable forms of

distributed agency and responsibility. The final section of the paper draws out three related issues at stake in this processual traceability-governance nexus.

THE DYNAMICS OF TRACEABILITY INFRASTRUCTURES

The emergence of transorganizational traceability infrastructures is yet another phase in societal demands for assurance in the face of complexity and multiple information asymmetries (Shapiro, 1987). This in turn has created demands for the assurance and trust production by regulation, audits, and inspections of many different kinds (Power, 1997). This is the essence of what has been called 'regulatory capitalism' (Levi-Faur, 2005). Societal confidence is increasingly grounded in the connectivities that such regulatory infrastructures promise and create - connectivities between people, organizations and states resulting from the systematic joining up of digital and documentary traces in space and over time. Fish move from the sea to the restaurant plate as they always did, but the new visibility enabled by traceability also generate a new politics of fishing. Whereas that traceability was previously the product of critical analysts like Mintz (1986) in the case of sugar supply chain, now it is being proceduralised and digitized. This shift requires a corresponding theoretical shift in relating markets and governance, namely from the problem of the governance "of" markets to ensure that they operate effectively or according to certain values, to the problem of new commodities and markets "for" governance which traceability infrastructures like blockchain seem to provide.

The preliminary analysis of traceability which has been developed in this essay suggests that it has a variable, composite ontology. Traceability infrastructures are simultaneously ideational, material, and processual. As noted earlier, such infrastructures are likely to be systematic and organized with discrete components and clear, visible points

of connectivity between those components. Traceability infrastructures will tend to be capable of being rationally represented as flows of data and connections between different agencies. Indeed, traceability infrastructures will be representable more or less as a kind of audit trail (Power, 2019). For example, blockchain is audit trail made digital. So we expect to see, and do see, the emergence of second order practices of audit which check that traceability infrastructures are working as they represent themselves to work. In short, new markets for accounts of traceability and for their assurance will be co-produced.

Yet, while traceability infrastructures are likely to look organized and articulated, especially in adviser discourses, like any form of organizing they are subject to a number of pressures, tensions and processual dynamics, not least because, as noted early, aspirations for traceability often exceed capability. Accordingly, to conclude this essay and to introduce themes for future research we explore three such dynamics of traceability infrastructure and distil this analysis into three propositions that may be explored empirically

Entities, traceability and governance

In their classic statement of the neo-institutional agenda, Meyer and Rowan (1977:349) suggest that formal organizations should be conceptualised as ‘sub-units’ of society. In other words, the boundaries of traditionally conceived accounting and legal organizational entities are institutionalised constructs and permeable to the rational myths of society, including myths of governance and control. Indeed, as Meyer and colleagues write in later work, the very idea of the organizational entity as a discrete rational actor is also a myth which characterises the late modern period (Meyer & Jepperson, 2000). From this point of view, organizations as entities are cultural products which are somehow “carved out” of the macro-entity of society.

This neo-institutional vision creates a tension between emerging ambitions to constitute and govern trans-organizational entities like supply chains, and existing institutionalised mechanisms of governing, like accounting, which are grounded in the myth of the discrete organizational entity as an actor (Power, 2018). Traceability infrastructures like blockchains which may be transorganizational therefore embody a significant operational and policy challenge. On the one hand, they seek to create connectivity across a multiplicity of discrete entities; yet on the other hand they aim at the creation and governance of a new kind of meta- or multi-entity entity. For example, prior to the 2009 financial crisis, prudential regulation had a strong focus on individual banking organizations, each with its own individual risk profile. However, the systemically significant interconnections and mutual reliances “between” these organizations was less well articulated and only weakly traceable (Haldane & May, 2011). In other words, the network of bank interconnectedness was not a fully “legible” (Scott, 1998), and therefore governable, meta entity.

This suggests an important feature of traceability infrastructures for further theoretical and empirical consideration. Their emergence reflects a crisis of taken-for-granted entities and points to the growing political significance of the new meta-entities like a “supply chain” discussed above. At stake in the dynamics of traceability infrastructures is the potential transformation of the “external connectedness” of multiple entities into the “internal connectedness” of a single meta-entity. This means that any analysis of these dynamics must attend to the manner in which the rational myth of the discrete organizational actor is, or is not, fundamentally challenged and problematized by another emerging entity, such as the supply chain or the blockchain network. In short, an important analytic and empirical focus must be the continuous dynamic tension within infrastructures

between traceability across and between “separate” (private?) entities and traceability within, and performative of, a new kind of (public?) “meta-entity”. This dynamic of fission-fusion is more than a matter of relative transactions costs and implicates the institutionalisation of new units of social agency (Enfield, 2017: 13). It is also a dynamic by which responsible agency or actorhood does or does not become widely distributed. Thus, we can predict that traceability infrastructures will become sites of a distinctive politics of entity-creation and maintenance, in which values of inclusion, logistical efficiency and security are likely to be contested (Cowen, 2010; Elyachar, 2017). Accordingly, a first proposition for empirical investigation can be advanced:

Proposition 1: The more developed and articulated traceability infrastructures, the more that they perform and make visible new and contested meta-entities as responsible actors

Distributed agency and responsibility

Senior managers in the UK financial services industry have acquired managerial and governance responsibilities beyond their own organizations. The rise of outsourcing and of a wide variety of third party relationships has created supply-chain-like structures both within and outside of large corporate groups. Regulation has responded by creating new governance responsibilities for this supply chain, often via the mechanism of being responsible for risk. Thus organizational actors who are responsible for risk, must address questions such as: “Does my outsourced service provider have good risk management and business continuity systems?” But such actors must also ask their third party suppliers how they know if their own third party suppliers are, for example, behaving ethically? In short, organizational actors who are institutionally grounded in the discrete organization are increasingly required to govern risk beyond its presumed boundaries. Their agency, in the

sense of their accountability, is also framed by other evaluative agents like NGOs or regulators. Indeed, the attribution of responsibility is central to the process of agentification: “There is no interesting account of agency that is not simultaneously an account of those agents who are trying to account for agency” (Kockelman, 2017:16).

“Outsourcing” is the externalization of a supply chain. While technologies of system interoperability may exist for many outsourced functions, such as accounting and business processing, for others they may not. There may also be considerable ambiguity about both capability and responsibility when agency is distributed across third party service providers and supply chains. The “thirdness” of so-called third parties is potentially fluid and does not automatically align with the official “scaffolding of accountability” (Bernstein, 2017).

Individual actors like managers and leaders must face this ambiguity and ask themselves how much traceability is enough, what kinds of traces of the activities of seeming “third” parties are required, and how far can this remote trace production be trusted? Much of what we call governance in these settings boils down to issues of traceability across organizational boundaries where responsibility may not always be clear and is subject to continuous negotiation.

Accordingly, a second thematic focus in understanding the dynamics of traceability practices has to do with the malleability of distributed and de-centred agency in the face of expanding governance responsibilities and societal expectations (often embodied in regulation) across all variety of supply chains, whether or not explicitly and rationally outsourced from one entity to another. Such governance is inherently problematic for several reasons. First, “out-sourcing” is ubiquitous yet the “out” of outsourcing presumes the possibility of the separation of discrete entities that is mythical. Second, distributed

agency, in the sense of responsibility for emergent meta-entities, does not align with capability in the form of credible and socially accepted technologies of traceability. In such conditions, we should expect both considerable anxiety at the level of human individual actors faced with responsibility for parts of infrastructure which they do not entirely control, and also continuous investments in “better” forms of traceability. In this world, the ethical axiom that “ought implies can” (attributed to the philosopher Kant) does not hold: “ought” and “can” are in a continuous dialectic. This dynamic suggests a second proposition:

Proposition 2 The more that organizational actors invest in traceability infrastructures, the more that they will face regulatory and civil society pressures to acquire responsibility for the actions of other entities.

Dialectics of connectivity and disconnectivity

It has been proposed that traceability infrastructures are potentially performative of meta-entities and generate distributed responsibility. Yet, as hinted already, they also embody a fundamental tension between tendencies towards expanded connectivity, meta-entities and distributed agency on the one hand (fusion) and reduced connectivity, a return to discrete organizational entities with circumscribed responsibility on the other (fission). The programmatic ideal of traceability, epitomised by the interoperability of blockchain, is an aspiration for perfect connectivity and for the ‘tight coupling’ of sub-entities within a meta-entity. We aspire to be able to “look through” from one object in this meta-entity – the fish on my plate in the restaurant – to another, namely the (trustworthy) trace of the day, time, place and circumstances of its harvest. This promise pervades traceability discourses and is the engine of its continuation. Yet, the empirical settings of traceability infrastructures are normally far from this ideal. They are loosely coupled, multi-

organizational networks of discrete organizational and human actors. Accordingly, following Orton and Weick's (1990) imperative to pay attention to the simultaneous dynamics of both loose and tight coupling within and across organizations, traceability must be conceptualised as a composite of contradictory forces and pressures which both expand and contract, distribute and restrict, agencies and their responsibilities. Governance failures, gaps and disappointed expectations will pervade traceability infrastructures as these divergent pressures play out. This political dynamic can be distilled into a third proposition.

Proposition 3. The more that traceability infrastructures fail the expectations invested in them, the more that agency will become less distributed, defaulting to discrete organizational entities with circumscribed responsibilities.

CONCLUSIONS

This essay is a prolegomena. It is an attempt to create the subject of "traceability studies" which only exists in the discursive margins of a wide variety of practical and policy activities. Borrowing from Foucault (1970: xi), the essay is an attempt to reveal the "rules of formation" of the present day preoccupation with traces and traceability. And, also as Foucault pointed out, such an intellectual endeavour is a risky project. A prolegomena like this is therefore a kind of intellectual risk management process by which an argument or set of claims are subject to a preliminary "stress test" to determine if they are plausible and merit further investigation and development. The intuition behind this essay is the notion that the technologies and organizational elaboration of traceability have become more prominent and more systematic in recent years in many different fields. It has been argued that traceability has many faces: it is a programmatic value embedded in norms and

regulations; it is a frontier of technology development; and it is a continuous processual dynamic of organizational connectedness. It is also resisted in many different settings. These different aspects give rise to traceability infrastructures which embody a number of tensions and dynamics. Three such dynamics of traceability infrastructure have been explored briefly: organizational entities and meta-entities; agency and the distribution of responsibility; and the dialectic of connectivity and disconnectivity. Each of these dynamics has been distilled into three probabilistic propositions which are potentially testable and may orient future enquiry. A programme of “traceability studies” based on this essay could add to our existing understanding of how infrastructures are ideational, regulative, material, entity-problematising, and agentic in character (Star,1999).

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