

NETWORK ALLIANCES:

PRECARIOUS GOVERNANCE THROUGH DATA, STANDARDS, AND CODE

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INTRODUCTION

We share the general concerns of this book about the ways in which education, alongside most other social services from health care to air travel and banking, is being managed through comparative technologies. These effectively translate complex knowledge processes and human relationships into data. Such translations render processes calculable, and enrol them into massive digital networks that track, sequence, assess, procure and direct most social activity in advanced societies. To better understand how these processes mobilize particular educational practices, we argue for the utility of network analysis following Bruno Latour (2005). While controversial, versions of actor-network theory are increasingly brought to bear in educational studies of governmentality and knowledge. These approaches tend to avoid the limitations inherent in explanations that rely upon dominant ‘paradigms’ and political ideologies. They also deliberately decentre human actors, their meanings and politics. Instead, we argue for analysis that traces myriad negotiations among material devices, embodiments, and technologies with social desires and discourses. Through these sociomaterial vitalities, particular forms of knowledge become performed and stabilized.

In an actor-network analysis, it is the ‘translation’ of complex processes into comparable, calculable items such as numeric items of data that can exercise control in knowledge and education. Calculation works through material practices that depend upon things like written benchmarks, inspection forms, achievement tests, databases, league tables, and so forth. Callon and Law (2005: 718) offer the term ‘qualculation’ to capture the ways that arithmetic and qualitative accounts are melded in acts of calculation. Things have to be valued in particular ways, they must *qualify* for calculation, which involves qualitative processes. And, acts of qualculation involve all sorts of ways to manipulate things within a single spatio-temporal frame, only some of which are arithmetic. Similarly, standards of practice attempt to create comparability by controlling conduct across space and time. In both cases of governance through data manipulation or through standards implementation, regulation is accomplished through traces and representations that can fix an idea and move it around – through specifying texts, required tools, or mandated protocols. These traces become enacted and represented through codes and algorithms that naturalise and quantify, but tend to obscure the politics of their own performances.

In this chapter we outline how actor-network approaches can trace the micro-processes through which associations of heterogeneous materials of things, technologies, bodies, etc are accomplished, and how these become translated into networks and mobilised over time and space to govern educational practices. We use the term actor-network theory or ANT lightly: like any analytical orientation, it has developed a wide range of distinct sensibilities, preoccupations and methods that are highly diffused and internally contested, and that we have discussed in detail elsewhere (Fenwick and Edwards 2010);

Fenwick and Edwards 2013). While we do not wish to flatten these into one enactment, we also do not wish to become caught up here in debates about what ANT or ‘after-ANT’ is, was, or should be. Our approach is to signal what appear to be particularly salient conceptual resources and approaches for studying educational governance, and we tend here to draw from the writings of Bruno Latour (2005). We also feature examples of studies claiming to work with Latour’s concepts to analyse various processes of educational governance through practices of comparison. These include standardised achievement testing, PISA, an implementation of educational policy, the negotiation of standards in professional healthcare practices, and the increasing proliferation of code in processes of learning and knowledge production. All of these point to the materiality and the politics of negotiation in the network dynamics through which governance is realised. As Latour (2005: 261) has argued, the value of such analyses is ‘to highlight the stabilizing mechanisms so that the premature transformation of matters of concern into matters of fact can be counteracted’.

A NETWORK ANALYSIS OF GOVERNANCE

Let us begin with an example. This one is a commonplace and particularly powerful form of governance: standardized tests of student achievement, which are increasingly mandated across states and provinces in North America. An actor-network analysis of this phenomenon has been produced by Jan Nesper (2002), showing how such tests themselves embed a history of network constructions, struggles and mediations which have settled into one fixed representation. The fixed items of such tests work to ‘translate’ complex learning practices into limited categories. The calculation of these translates year-long and vastly different educational processes around the state into numeric scores. Teachers become bypassed as mediators of pedagogy and knowledge, and students become directly enrolled into subject matter that has been translated into the test’s limited forms of knowledge. Because the stakes are high in the calculative process (schools scoring less than a certain percentage lose their accreditation), Nesper shows that the test mobilizes a whole series of events and people to align with its forms: administrators force curricula to conform to the test’s demands, teachers drill classes in test preparation, remedial classes are arranged to improve students’ test achievement, and fear is mobilized among all. The result is a

funneling, hierarchical network in which the state becomes a centre of accumulation collecting standardized representations of all the students in its political borders. The state can then summarize and compare students as a class, and more importantly speak for and act upon them. (Nesper 2002: 375)

In these extended networks of evaluation, as Nesper (2002) points out, particular materials and people are assembled and translated to become aligned with the standardized form while others such as the testers, supervisors and the state are not. But these actors also are effects of network processes. They are combined with other forms, representations and artefacts. They are ‘hooked up’ with other networks already on the move: ‘historically and geographically stretched out in materially heterogeneous networks that overlap and interact with one another’ (Nesper 2002: 376). As Latour (2005) points out, a war room can command and control anything only as long as it maintains connection with distributed sites of action through continuous transport of information. Evaluation and accountability ‘is made only of movements, which are woven by the constant circulation of documents, stories, accounts, goods and passions’ (Latour 2005: 179).

The test effectively circulates across time and space: an intermediary that mobilises particular pedagogies and knowledge, and inscribes them within new texts and data bases. The circulating test and the networks that are created around and through it become linked with massive assemblages in other domains, such as the networked activities that generate mandated curricula, supra-national policies, media reports about educational crises, etc. Latour (2005) argues that when we trace the specific micro-processes and political negotiations through which heterogeneous elements become allied to form these different networks, and the specific ongoing linking labour through which they and their associated networks sustain and expand the network's movements, we can better understand how centres of power come into being and exercise influence in local sites of activity.

In sum, then, this analysis traces the micro-interactions through which diverse elements are performed into being: how they come together - and manage to *hold* together - in assemblings that can act. As we see in the example of standardized achievement tests, these complex, interwoven 'networks' can spread across space and time, and produce policies, knowledge and practices. Pushing the network logic even further, this analysis understands that all elements are enacted as they become assembled into particular collectives of activity. A student memorizing study notes late into the night or a teacher designing test preparation classes do not exist outside the test network, anymore than the test materials or data base calculations. In Michel Callon's (1991) terms, the nature of all agents and what they do depends on the morphology of relations in which they are interwoven.

Network sensibilities are particularly useful for following these relational strategies. The empirical approach notices how things become invited or excluded, how some linkages work and others don't, and how connections become more stable and durable by linking to other assemblages. Analysis can focus on minute negotiations that go on at potential points of connection, and trace the kinds of connection or partial or dis-connection that materialize. The connections are never settled, but constantly being re-negotiated, shifting the alignments and forms of the entities that have come together.

At the heart of actor-network analysis is attention to 'translation', a term used by Latour to signify the ways in which elements shape or change one another in these connections, and how they become reconfigured and redirected as they become enrolled into new networks of activity. Nespore (2002) for example shows how test items translate complex knowledge and learning processes into limited categories and numeric scores that can be easily compared and calculated. Latour's particular contribution is to highlight, in particular, the powerful role played by moving materials in such governance processes – the objects, bodies, texts and technologies that become entangled in enactments of teaching and learning.

Another emphasis for actor-network analysis in questions of governance is upon 'matters-of-concern', which Latour (2005: 19) has continued to argue are often mistaken for 'matters-of-fact'.

What we are trying to register here... is a huge sea change in our conceptions of science, our grasps of facts, our understanding of objectivity. For too long, objects have been wrongly portrayed as matters-of-fact. This is unfair to science, unfair to objectivity, unfair to experience. They are much more interesting, variegated,

uncertain, complicated, far reaching, heterogeneous, risky, historical, local, material and networky than the pathetic version offered for too long by philosophers.

In Latour's reading, our everyday lives are infused with things regarded as matters-of-fact. The laptops and software we use, the cars and road systems we drive, the routines and social rules of our work, the science that informs our perception, etc – these tend to be treated as settled, evident, and mostly stable. But of course, all of these embed many live networks and controversies that once were matters-of-concern. For Latour (2005), the political project is to highlight the controversies and uncertainties of matters-of-concern, and to prevent their premature closure into matters-of-fact. Take accounts of governance. A network analysis can trace how they circulate and how certain accounts become accepted and used as though they are matters-of-fact. The notion of hegemony, for example, can be followed to examine how consent to ideology is actually achieved and how hegemonic projects become anchored through particular networked activities and objects of everyday life.

However what is also important to foreground is that networks do not simply fix and circulate entities in ways that control processes, identities, knowledge and so forth. The process is of continual becoming, as social and material elements become entangled and mutually constitutive. These processes are highly political, bringing certain things into presence, concentrating value, and creating differential distributions of capacity. There also are many forms of network assemblages, some more open and provisional, others more tightly prescriptive, or highly diffuse. There are usually always counter networks and supplemental networks at work – and these assemblages co-exist in a complex multiplicity in any given occasion of practice. Network analysis is not only about tracing how things become entangled into particular assemblages but also where are the weak points and the creative openings. Where are the gaps where elements are not joined up sufficiently to mobilize particular practices? What networks supposedly are cooperative but do not link coherently? Actor-network analysis can help to illustrate what are sometimes very ambiguous lines of control and competing webs of elements in play, as we see in examples below.

GOVERNANCE THROUGH MEDIATING DATA

Turning to another example, Radhika Gorur (2012) draws from Latour in her study investigating how PISA both translates complex educational processes into static data, and becomes powerful in itself as a form of scientific knowledge. What Gorur shows is that practices associated with PISA stabilize and extend knowledge through everyday material practices. These assemble and then align wide-ranging objects, ideas and behaviours, including a vast array of information from diverse locations and contexts:

[PISA] has mapped the world, ordered knowledge and disciplined people into taking up their assigned positions at regular intervals. It has coded, classified and marked people and concepts, and produced new and interesting associations. When PISA becomes a matter of chains of translation, [then acts of] intervening at points along that chain, requesting verification or reference or challenging a translation become practical matters.

PISA is a prominent example of the larger policy shift in education whereby data production and calculation have become critical mediators in new governance processes (Ozga 2009). Output measures to monitor accountability (test scores of pupil achievement and school inspection scores) have become increasingly powerful in the rise of deregulated and decentralized service has increased reliance. This in turn has led to rapid growth in data production by various actors, further demands for data, and changing modes of gathering and translating information in a relentless process of ‘breeding’ and integrating data (Ozga 2009: 154). In her analyses of these processes, Jenny Ozga shows how actors such as local authorities become clearing houses in mediating data. Their local contextual knowledge is flattened or lost in large-scale national data systems, and their roles reduced to servicing the data production systems as calculating devices. Although Ozga (2009:158) doesn’t draw explicitly from an ANT analysis, she very much focuses on the importance of non-human elements in this ‘network of agencies that are held together in webs of data’ to form new governing relations. For Ozga, data itself plays the pivotal role in these disaggregated, distributed forms of governance. These items of data, as Nespore showed through his actor-network analysis of data produced through achievement testing, each embed and freeze a history of complex processes and network relations that have been reduced to a comparable, calculable material form.

Thus it is important to recognize the translation processes that produce this data, and the wider effects of these translations. Jill Koyama (2009) shows how very local activities become translated and integrated vertically into massive alliances of private and public sectors in her study of the implementation of the USA policy ‘No Child Left Behind’ (NCLB) in the New York City District. She examined in detail how for-profit ‘supplemental educational services’ (SES) providers became legitimated and integrated into the school system through the alliances and circulation of material and social bodies. These included hot lunches, enrolment packages, district officials, school administrators, parent coordinators, databases, test scores, timetables, and profit. A particular device that became pivotal in creating the required assemblage as it circulated was the enrolment packet given to students to enable them to receive the remedial instruction provided to the school system by the for-profit SES tutoring agency. Only students who received free hot lunch were eligible. The enrolment form not only selected and excluded students for the SES service, but also accounted for billable service by the for-profit SES tutorial agency, and guaranteed sufficient overall student enrolment numbers to transfer funds from the school district to the SES provider. At one point, however, schools began reporting serious shortages of SES enrolment packets, or packets in languages unsuited to their students. Additional packets were refused by district officials, citing previous wastages caused by insufficient monitoring of student eligibility. School administrators began restricting the number of enrolment forms made available to parent coordinators of the tutoring programs, suspecting improper distribution of the forms. But a problem in the system was that SES enrolment occurred weeks in the year before determinations were made about which children were eligible for free lunch. Superintendents suspected parent coordinators of ‘hijacking’ the forms to help children receive enrolment packets in time to join the SES program. One explained, ‘I can’t just be sending more and more forms out there. I don’t mean to sound paranoid, but each form represents 2000 dollars for a provider and we have been told that [SES] providers are out there buying enrolment forms’. Some parent coordinators, ever resourceful to meet angry parent demands, began to simply photocopy more forms. Schools in turn refused to accept

these ‘counterfeit’ forms even for students that legitimately qualified for the services, prompting further parental outcry.

As we have explained elsewhere (Fenwick and Edwards 2011), the enrolment form links the SES agency directly with free lunch in ways that bypass a child. It can be exchanged directly for cash, or calculated in billing practices that transfer funds from a school to a for-profit company. It also helps mobilize unexpected responses that reconfigure the relations among parents, the dynamics of parental relations with the school, and the school’s relations with the district. The enrolment form ultimately is a powerful device that determines students’ access to remedial instruction, enabling assemblages that acted to prevent qualified students from accessing the very programs to address inequity that the programme was set up to provide.

Thus we see the micro-conduits of material linkages through which a school system becomes accountable to data production rather than to student learning. Koyama shows us how the for-profit SES provisions became translated into specific and stable practices among various entities – tests, reports, databases, school principals, tutoring enrolment packages, district officials, private tutoring companies – which all enacted practices of calculation that ultimately produced inequities. The NCLB’s SES mandates were closely dependent on calculations that compared, categorized, valued then linked data with consequences such as provision of privatized remedial tutoring for disadvantaged students. Teachers, administrators, parents and the for-profit tutoring company all become focused upon the numbers rather than children’s specific learning requirements. Test processes appeared to be measuring student learning, but were actually intended to fulfill the company’s contractual stipulation with the school district to track and record progress. In all of this, however, numbers can be messy and unreliable mediators in the network. In one example, a supervisor from the tutoring company fabricated low test scores so that the numbers following his intervention would reflect enough improvement that the firm’s contract would be renewed. The suspicious test scores, despite questions, finally became accepted by all as a consequence of a defective database. The network’s durability held, despite counter-factual evidence, because the matters of concern enrolling most participants in the SES network involved reporting high numbers subsequent to low numbers.

In Koyama’s study we can see how the global is assembled in policy, aligning complex dynamics into a single frame where they can be flattened, calculated, and compared against other powerful networks. Gorur’s ANT analysis also shows how data-driven alignments such as PISA, as an assemblage of knowledge and governance, are also precarious. They are held together through ongoing work that sustains their connections and enactments. What appears to be entrenched authority and universality of powerful PISA actor-networks actually depend upon fragile, provisional linkages that can be interrupted, weakened or refused. Even when a policy and its associated enactments have become black boxed, therefore, it can be rendered vulnerable when assailed by persistent questions: what do these figures and explanations actually represent? PISA, like the SES network, is a fragile assemblage performing itself as solid and immutable. However, the assemblage is never stable. It constantly moves as values are renegotiated. Such networks are matters of concern through which to challenge the matters of fact that represent comparisons of student achievement across the globe.

STANDARDS AND STANDARDISATION

PISA is one example of how the standardizing of data enables calculation processes that govern a range of educational practices and forms of knowledge. For standardization to actually work, as Geoff Bowker and Leigh Starr (2000: 232-233) suggest, there must emerge a difficult balance of comparability across sites alongside 'margins of control', opening spaces of 'intimacy' for actors in practice. Excessively high levels of control can threaten the local intimacy at each site that brings standardization to life in myriad networks of action. Actor-network accounts of standardization in education make this abundantly clear. But we need to be careful. Some have misinterpreted network analysis to focus upon an 'immutable mobile', such as a powerful text, travelling around different regions and insinuating itself into different messy negotiations among actors in ways that translate all into an extended network. However this representation is inadequate to describe educational practice, or arguably any practice. Different assemblages are possible in the network of standardization, assemblages that emerge among the nodes and folds of extended networks, but not as stable entities. These assemblages themselves emerge and shift and dissolve into new forms as their constituting entities encounter interruptions and discover new approaches. Local network negotiations will always be influenced by humans' creative tinkering, objects' limitations, and other networks functioning in the same space that reinforce different meanings of quality and priorities. These ongoing disturbances jostle alongside a standard's attempt to control and demand compliance. While the resulting assemblages often bear sufficient comparability to sustain certain necessary dimensions of consistency, they also demonstrate Law's (2004) admonition that there are no orders, only orderings, and these are always precarious.

A nuanced example of this is available in Mulcahy's (1999) study of vocational cooking instructors working with students in kitchens. She shows how different forms of competency standards are present and held in tension in a series of embodied relations. National industry standards in hospitality are important, of course. They circulate in various forms: as representations on a piece of paper, but also in teachers' unique interpretations of these standards in their demonstrations and directions to students. Alongside these, however, Mulcahy detects instructors' very personal, embodied standards of practice that are too 'materially complex' for formal representation as competency – such as predicting the effect of a flavour on a particular dish. And there are other local standards at work. Certain networks of practice that had become stabilized and treated as standards in this site arose historically from instructors' accommodation over time to the materiality of their particular context (such as unavailability of certain ingredients and local abundance of others). Further, instructors drew from accumulated experience of watching and assessing students' growing capacity, knowing when students came to embody acceptable performance in some aspects of a skill while not quite mastering others. Instructors' work with students, then, unfolded through embodied negotiation of these different forms of standards. No one formal standard or term of competency is privileged over another, in everyday practice. Mulcahy concludes that, at least in teaching-learning and vocational encounters, standards are accomplished face to face, through interactional work. They

are not so much read off the written specifications and then applied, as recreated on the job, using the written specifications as a resource or guide. Achieving competence is a matter of using embodied skills, face-to-face communication, and collective negotiation by which the outcomes of the work can be taken into account. (Mulcahy 1999: 94)

Another example, this time from health care research, draws from ANT concepts to show how this local enactment of standardized protocols can be viewed as a crystallization of these many networks circulating in the activity. Stefan Timmermans and Marc Berg (1997) examined professional practice of the standard protocol for Cardio-Pulmonary Resuscitation (CPR). In the 80 different cases of CPR they observed, Timmermans and Berg (1997: 288) found that in most, professionals adapted the standard: ‘seen from their perspectives, it is the protocol's trajectory which is secondary and which is aligned to their own goals and trajectories... it is dealt with in terms of their local specificities’. Nurses acted beyond their scope by dropping hints to inexperienced physicians, which may prompt more aggressive treatment by the physician, new drugs not specified by the protocol were introduced, and strict directives of the protocol were altered in situations of ‘the very hopeless patient’. Timmermans and Berg concluded that the universality demanded by standards to ensure consistent practice is always what they call ‘local universality’. Tight control is unreasonable for non-human elements in medical situations where machines break down, X-rays can show unexpected images, and blood cells can behave oddly. The protocol’s explicit demands always need tinkering.

Local universality, then, implies a context of practice, of multiple crystallizing and dispersed trajectories, of reappropriation, repairing, combining, and even circumventing the protocols and standards, of leaving margins of freedom, of reminding, of long processes of negotiation, of diverse interests, and so forth. (Timmermans and Berg 1997: 298)

A standard functions not as one professional’s strict performance of a universal standard but as the outcome of negotiation processes among various actors. Furthermore, the protocol itself is what Timmermans and Berg describe as a technoscientific script that crystallizes multiple trajectories.

The protocol designers, funding agencies, the different groups of involved physicians, patients' hopes and desires, organizational facilities, laboratory capabilities, drug companies, the patients' organs' own resilience, and so forth, all come into play in the negotiation processes leading up to the 'final' protocol. What kind of drugs are used, how they are to be dosed, who should receive them: all these 'decisions' are not so much a product of consciously developed *plans* as a result of these continuous, dispersed and often contingent *interactions*. The actual shape of the tool, in other words, resembles no one 'blueprint' but is accomplished 'in-course'. (Timmermans and Berg 1997: 283, emphasis added)

Protocol as a standard interferes in these different trajectories, changing them in the moment when they are brought together. This moment not only gathers and transforms, but also creates visibility of all the trajectories and roles and purposes of those involved. This is why Timmermans and Berg call it a ‘crystallization’ of multiple trajectories. As a network moment, a moment of translation in Latour’s terms, this transaction is contingent and temporary. Whatever is performed in that moment is not guaranteed to have any prescriptive power for subsequent action.

This conception illuminates what goes on in the translation of standards. In the moment of translation, the protocol is one actor with a historical trajectory, in a commotion of actors each with their own trajectories. These are drawn together to perform that protocol with some

reasonable outcome aligned with their own desires. The network analysis helps interrupt the assumption that standards function as an exercise of domination and submission or resistance to focus instead upon the interplay that is performed anew in each setting while maintaining sufficient consistency of practice.

These various representations of standards incorporating bodies in motion, equipment, blood, ingredients, dishes produced, politics, talk, and texts are not static and separate. They flow constantly in movement and relations in sites of everyday practice. Mulcahy (1999: 97) suggests that practitioners knowingly engage in a 'strategic juggling of representational ambiguity' among these varied standards. This juggling translates the formal competency standard into diverse representational forms of competency that settle the 'problem' of difference at the local level. The question then becomes not only, 'where *are* standards?' but also what political negotiations enable certain performances of standards and constrain others. A network analysis can trace the material specificities of these performances, showing how bodies, dispositions, pedagogical encounters and understanding are produced at the point of situated performance in specific environments.

CODE AND ALGORITHMS

Fundamental in these actor-networks that order and govern education, among other social processes and entities, are data, calculation, and comparison across space and time. It is not surprising that Foucault's (1991) concept of governmentality has become so important to those studying policy processes, or that network analysis is influentially drawn upon to frame the actions at a distance through which power is exercised. However, while the centrality of calculation and comparison is often asserted, what has been less explored are the forms of computer coding and algorithms through which this work is actually performed. Critical to enabling networks to work and extend across space and time are technologies. These technologies have taken various forms across historical time e.g. railways, printed books, the telephone. However, it is arguable that there is a qualitative leap taking place in the potentialities for networked governance through the growth, extension and mobilities of computing.

Computing has also become a key means of performing these networks through common processes of tagging, classification, calculation and circulation. These require codes and algorithms. It is the work of codes that is being opened up by the emerging area of critical software studies (Kitchin and Dodge 2011). Thrift (2005: 240) observes that:

... software has grown from a small thicket of mechanical writing to a forest of code covering much of the globe ... code runs all manner of everyday devices, from electric toothbrushes to microwave ovens, from traffic lights to cars, from mobile phones to the most sophisticated computers.

To do this requires enacting data infrastructures. Integral to this are the development, adoption and application of the standards that enable data to be organized, networked and moved. It is not simply data mobilised through such practices. Thus,

It is not just bits and bytes that get hustled into standard form in order for the technical infrastructure to work. People's discursive and work practices get

hustled into standard form as well. Working infrastructures standardize both people and machines. (Bowker, 2005: 111-112)

And, as Kitchin and Dodge (2001: 4) suggest, ‘although code in general is hidden inside the machine, it produces visible and tangible effects in the world’. They identify coded objects, coded infrastructures, coded processes and coded assemblages as participating in shaping sociospatial organisation.

Yet, if ever there is an area that is black boxed, it is the nature, production and performance of computer software. Effectively, computing is presented as a form of prosthesis, rather than as part of more complex networked assemblages within which the software is one element, and which necessarily involve their users in a wide range of socio-material relationships. Computers order, preserve, and allow access to resources, but they also promote and preclude certain kinds of social and spatial relationships. How the codes they draw upon come to do those things is not usually examined and, for us, this is potentially part of what Thrift (2004) has termed a ‘technological unconscious’ of contemporary life.

This requires standardised ways of describing content and the development of ontologies and typologies. In order to be encoded, to be read as data therefore, content is required to be reduced. However, by insisting that things are described and knowledge represented in particular ways, much is hidden, including the very means of concealment. The picture here is one of multiple hidden translations, some effected by human and some by non-human actants, that are incorporated into technology applications through codes, ontologies and metadata (Miller & Bowker, 2009).

In actor-networks that govern education, it is the coding and the linking of data, the applications of technical standards, and the decision-making and reasoning processes articulated through computer code that mobilise objects and information flows to perform very particular practices through coded infrastructures: student and school records, e-learning systems, libraries and information access services, assessment of students, teachers and indeed all educational dynamics. What hidden codes do is to make it more difficult to determine how and when they are acting, and on what basis. Particularly significant, and yet at the same time largely unrecognized, is the role played by forms of classification and standardisation associated with the development of databases, and the ways in which complex knowledge is represented (Lampland & Star, 2009). While, as Bowker (2005, p. 140) argues, ‘you can’t store data without a classification system’, our argument is that how this occurs and with what effects, is largely left unexamined and unquestioned in analysis of networked governing in education. With the passing of time and the incorporation of such data into new assemblages and application, the pre-history of data capture, calculation processes, emergence of standards, and general application of rules disappears from view and becomes part of the taken for granted ‘evidence’ upon which to develop educational policies and practices.

CONCLUSION

As education becomes networked into global configurations authorizing particular knowledge, standardized audit procedures and league tables, a network analysis helps to

reveal how these alignments are formed and held together through much more than ideologies and discourses. It is to the mundane materials and their infusions with human desires and fears that we need to look. Nesor (2002:376) suggests important questions about 'how and in what forms people, representations and artifacts move, how they are combined, where they get accumulated, and what happens when they are hooked up with other networks already in motion'. For understanding processes of knowledge regulation, this approach breaks through the 'gap' between policy as prescription and as local enactment, and traces how all performances are produced as effects of unfolding material networks.

What is the specific contribution of this approach? As we have argued in this chapter, a network analysis offers methodologies and questions to trace assemblages that enact governing moments. The analytic focus shifts from the social and discursive to the sociomaterial, and from structures to contingent negotiations and translations. Through these negotiations of connection, standards of knowledge become developed and mobilised, performed in different ways and sometimes resisted. But different negotiations and connections increasingly act to translate these performances into data, calculate and compare them numerically, and extend the growing data assemblages across large populations or regions. By following the linkages forging these actor-networks together, as well as the dynamics playing out around them in the penumbra of marginalized and counter-networks, educational analysis can better appreciate the directions and forces that perform some practices and beliefs, dissolve others, and create contradictions.

The reveal of such analysis is not a simple story of powerful networks and infrastructures. As the examples in this chapter indicate, network analysis shows the interplay among myriad, often contested or incoherent, network trajectories in everyday practice that carry force in governing knowledge and activity. This raises new questions for considering governance of knowledge in specific settings. What is the nature of the different network assemblages are at play? Which network trajectories become crystallised in moments of enacted practice? What practices of knowledge and identity become produced in these networks? What negotiations occur as elements take up, resist, or compete with attempts to enroll them into particular patterns of action and knowledge? How do actors juggle competing networks of standardization? What and who becomes included and excluded?

When governing assemblages are exposed as a series of precarious connections exercising variable force, educators might find it easier to see how their own everyday work becomes inscribed into these powerful networks. They might also more easily identify the most productive entry points and strategies to interrupt entrenched practices or to propel new emergences.

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REFERENCES

- Bowker, G. (2005) *Memory Practices in the Sciences*, Cambridge, Mass.: MIT Press.
- Bowker, G., and Star, L. (2000) *Sorting Things Out: Classification and its consequences*, Cambridge, MA: MIT Press.
- Callon, M. (1991) 'Techno-economic network and irreversibility', in *A sociology of monsters: Essays on power, technology and domination*, ed. J. Law. (p.132-65), London: Routledge.
- Callon, M. and Law, J. (2005) 'On qualculation, agency, and otherness', *Environment and Planning D: Society and Space*, 25 (5): 717-733.
- Fenwick, T. and Edwards, R. (2010) *Actor-Network Theory in Education*, London: Routledge.
- Fenwick, T. and Edwards, R. (2011) 'Considering materiality in educational policy: messy objects and multiple reals', *Educational Theory* 61 (6): 709-726.
- Fenwick, T. and Edwards, R. (2013) 'Networks of knowledge, matters of learning, and criticality in higher education', *Higher Education*, online first, DOI: 10.1007/s10734-013-9639-3
- Fenwick, T. (2010) '(un)Doing standards in education with actor-network theory' *Journal of Education Policy*, 25 (2): 117-133.
- Foucault, M. (1991) 'Governmentality', trans. Rosi Braidotti, in G. Burchell, C. Gordon and P. Miller (eds) *The Foucault Effect: Studies in Governmentality*, (pp. 87–104), Chicago, IL: University of Chicago Press.
- Gorur, R. (2012) 'ANT on the PISA trail: following the statistical pursuit of certainty,' *Educational Philosophy and Theory*, 43 (1): 76-93.
- Kitchin, R. and Dodge, M. (2011) *Code/Space: software and everyday life*, Cambridge, MA: MIT Press.
- Koyama, J.P. (2009) 'Localizing No Child Left Behind: Supplemental Educational Services (SES) in New York City,' in *Critical Approaches to Comparative Education: Vertical Case Studies from Africa, Europe, the Middle East, and the Americas*, ed. F. Vavrus and L. Bartlett, New York: Palgrave Macmillan.
- Lampland, M. and Star, S. (2009) (eds) *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life*, Ithaca: Cornell University Press.
- Latour, B. (2005) *Reassembling the Social: An introduction to actor-network theory*, Oxford: Oxford University Press.
- Law, J. (2004) *After Method: Mess in social science research*, London: Routledge.
- Miller and Bowker 2009

Mulcahy, D. (1999) '(actor-net) Working bodies and representations: Tales from a training field', *Science Technology Human Values* 24 (1): 80-104

Nespor, J. (2002) 'Networks and contexts of reform', *Journal of Educational Change*, **3**: 365–382.

Ozga, J. (2009) 'Governing education through data in England: from regulation to self-evaluation', *Journal of Education Policy* 24 (2): 149-162

, N. (2004) 'Remembering the technological unconscious by foregrounding knowledges of position', *Environment and Planning D: Society and Space*, 22: 175-90.

Thrift, N. (2005) 'Beyond mediation: three new material registers and their consequences', in D. Miller (ed.) *Materiality*, Durham, NC: Duke University Press.

Timmermans, S. and Berg, M. (1997) 'Standardization in action: Achieving local universality through medical protocols', *Social Studies of Science* 27 (2): 273-305.