

# Policy networks, database pedagogies, and the new spaces of algorithmic governance in education

*Ben Williamson*

*School of Education, University of Stirling, ben.williamson@stir.ac.uk*

## Abstract

Educational governance in the UK is increasingly being performed through cross-sectoral 'policy networks' and emerging forms of 'network governance' that signify a shift in political practices from centralized state government to a wider system of public, private and third sector interdependencies. This involves two shifts in the 'governable spaces' of educational policy: 1) a shift in the space of governance from central government to decentralized delivery based on a model or a 'diagram' of governance through networking and database architectures; and 2) a related shift in the space of educational governing practices from a focus on the national space of the education system to the mind and body of the individual as a 'lifelong learner' and a potential future person-in-the-making. This respatialization of educational governance entails moving from a focus on the 'governable space' of the education system, part of the public sector, to 'governing through pedagogy' in order to sculpt and mould the individual learner. The paper examines the participation of a particular policy network of third sector organizations in educational governance. Its approach to both educational governance and governing through pedagogy has as its objective the formation of 'lifelong learners' for a 'pedagogized future' which is to be interwoven with the algorithmic forms of the network and the database. In outline, the paper examines how third sector organizations aim to make education thinkable and intelligible through discourses and images that are based on the algorithmic forms of the network and database architectures. This is continuous with what has been termed in political science as 'digital governance' or 'algorithmic governance.' Digital governance operates through an 'intelligent centre/decentralized delivery' model which depends on the mobilization of a combination of networked communication technologies and database-driven information processing technologies. Then the paper examines how related new governing practices have been mobilized which seek to act directly through network and database technologies upon the thoughts, feelings, conduct and action of individuals. In particular these include social networking sites and other social media applications, and database-led 'learning analytics' and 'adaptive software,' which depend on complex algorithmic data analysis processes, as new forms of governing through pedagogy. Through these tactics, third sector organizations are seeking to reconfigure educational governance through decentralized networks and database architectures, and to reactivate individuals as 'lifelong learners', 'mobile bodies' and potential future persons-in-the-making through network-based and database-driven pedagogies.

## Keywords

algorithms, analytics, databases, governance, governing, governable space, policy networks

## Spaces and subjects of governance

In contemporary educational governance in the United Kingdom, a group of third sector organizations is increasingly seeking to promote new models of governance through 'policy networks' and emerging 'database pedagogies' as a new governing practice. The main aim of this paper is to examine these developments as part of a shift in the 'governable spaces' of contemporary education policy. It is important to state at the outset that 'governance' and 'governing' are two separate though closely interrelated concepts. The term 'governance,' taken from public policy and political studies, signifies a shift in political practices from centralized state government to a wider system of public, private and third sector actors working interdependently and interactively in networks (Cairney 2012). The concept of governing, as used here however, refers to all the everyday techniques and practices which seek to act upon the thoughts, feelings and actions of individual subjects, whether in the 'governable spaces' of the home, the school, the workplace, the hospital, the leisure centre or the shopping mall (Rose 1999), or, more latterly, in the networked spaces of the world wide web. While governance and governing are separate issues, they are also closely related in that the shift to governance

makes up new governable spaces and brings new policy actors into circulation, with new repertoires of ideas, techniques and practices for governing subjects. As Hultqvist (2001: 146) explains, ‘government in today’s context is enacted in a decentralized way,’ emanating not from the ‘central point’ of the state but through ‘a network in which both political and non-political players are involved—the media, the government, various market players, volunteer organizations, and so on.’ One result of networked forms of cross-sectoral governance in education is the production of ‘a more or less coherent image’ of the learner as an individual subject who has been ‘made manageable within the range of assumed qualities and dimensions of political thought’ (Hultqvist 2001: 146). Cross-sector educational governance, then, is not just a structural effect of changing operations of the state, but actively links up and reimagines the learner according to associated changes in political thought; in this case, a shift from the fixed central space of government to the decentralized networks of governance.

These developments are part of a broader set of epistemological and ontological shifts in social scientific thought that have sought to emphasize space, movement, contingency, liquidity and different ‘mobilities’ rather than social structures, stasis and order (Urry 2007). In this sense, the present paper contributes to more spatialized forms of education policy analysis that emphasize things like ‘travelling policies’, ‘network governance’, ‘joined-up policies’ and ‘policies in motion’ (Rizvi & Lingard 2010; Ball 2012), specifically by mapping out and exploring the shifting relationships, flows of ideas, and dynamic networks through which policy solutions are increasingly sought for educational problems.

The analysis focuses on one particular cross-sector policy network as an example of a new space of governance, and then I focus on its specific mobilization of certain kinds of database-driven pedagogic technologies as new practices of governing which aim to act upon the mind and the body of the individual subject in relation to an associated reimagining of the learner. The policy network consists of the ‘third sector’ organizations NESTA (the National Endowment for Science, Technology and the Arts), the Innovation Unit (a social enterprise working on innovation in public services), the RSA (Royal Society of Arts, Manufacturing and Commerce), the Nominet Trust (a social investor focused on the internet for public good), and the think tank Demos. The database pedagogies they promote include networked social media, new learning analytics and adaptive software applications which carry a new image of the learner into the material infrastructure, discourses and pedagogic practices of education.

The paper is concerned, then, with how third sector organizations are making education thinkable, practicable and governable in terms of network architectures and the algorithmic logic of databases, and with the kinds of individual subjects that are to be ‘made up’ (Hacking 2007) through these new spaces and pedagogies of governing. The concept of ‘governing through pedagogy’ (Pykett 2012) captures the ways in which pedagogy is now seeping into many aspects of everyday life, driven by public, private and third sector actors alike, and its role in continually sculpting, moulding and re-educating individuals for a pedagogic future. Third sector organizations, and the discourses and material techniques they deploy, are seeking to establish the pedagogic identities of ‘lifelong learners’ as potential future persons in the making who are enabled to learn throughout the lifecourse in a highly technologized pedagogic future. Thus while much of the data presented in the paper pertains to policies and practices related to schooling for children, these are part of a wider shift to connect and link up learning throughout the lifecourse, a task for which sophisticated and joined-up network and database technologies are required.

I argue that the policy network is deploying these database pedagogies as part of its approach to creating a new ‘governable space’ in education, a space in which governing is increasingly to be done by collecting and compiling individual learner data in order to calculate and predict their future needs and to generate prescriptions for future pedagogy. This is governing being done not through intervening in the national space of the education system but by resculpting and re-educating the mind and body of the learner for a pedagogized future—a shift in the space of governance and its governing practices from the state to the individual subject, facilitated by sophisticated software products. The paper is dealing, then, with two interrelated shifts in governable space:

- Changing the space of educational governance from central government to decentralized cross-sector policy networks
- Changing the space of governing practice from the national education system to the mind and body of the individual subject, facilitated through new networked and database-driven technologies

The central argument I make is that techniques and discourses of ‘governing by numbers’ (Grek 2009) are being augmented with techniques and discourses of ‘governing by algorithm’. While governing by numbers seeks to collect and analyze learners’ performance data in order to cast a grid of statistical calculation and comparability over national education systems, governing by algorithm involves the deployment of advanced software

technologies to 'know' and on that basis to forecast appropriate pedagogies to instruct the individual learner. This is a form of governing through the pedagogies associated with database algorithms, with the aim of managing, administering, sculpting and enabling the 'lifelong learner' with a 'mobile body,' configured to deal with futures yet to come. Ultimately, emerging forms of governance and governing being promoted by third sector organizations are reconfiguring the capacities, conduct, thoughts and actions of the learner.

## Policy networks

The governance of education is increasingly understood as taking place through cross-sectoral networks of public, private and third sector interdependencies that criss-cross sectoral boundaries and national and transnational borderlines. 'Networked governance,' as this style of governing is termed, is spatially decentralized and characterized by fluidity, looseness, complexity and instability (Ball & Junemann 2012). Educational 'policy networks' are a specific form of this type of governance. Policy networks consist of intermediaries, interlockers, and 'policy entrepreneurs whose 'good ideas' straddle sectoral problems (Ball & Exley 2010). Made up primarily of experts from think tanks, policy institutes, multilateral agencies, media consultancies, and experts in public relations, they 'perform the role of conveying ideas between different areas of the production, distribution, or circulation of ideas' in order to 'influence the decision-making process' (Lawn & Grek 2012: 75).

New networked forms of governance in education are increasingly being pursued by third sector organizations such as NESTA, Nominet Trust, Demos, the Innovation Unit, and the RSA. Indeed, the third sector has been made up as a new space of thought and action in education (Williamson 2012). However, their participation in new spaces of educational governance is also ushering in new governing practices. Their participation in 'reinventing public education' involves 'moving from a bureaucratic/professional knowledge about education, a part of the public sector, to individualized, personalized and integrated knowledge about a society' (Grek & Ozga 2010: 272). The shift to individualization and personalization is bringing about the emergence of new forms of governing expertise, and a new kind of governing expert whose claim to authority rests on the capacity to know, assess and act upon the individual—through the collection, collation and calculation of data—rather than to seek to reform the more cumbersome bureaucratic systems of the public sector.

Seeking to govern through data on the individual represents a significant shift in thinking about the 'governable spaces' of education: away from the nationally governable zone of the education system and toward new practices of governing through pedagogical techniques of sculpting the mind and body of the individual subject. This requires sophisticated computer technologies capable of gathering data about each individual in the population. Consequently, documents produced by third sector organizations all talk of computational forms as models for reinventing educational governance. NESTA chief executive Mulgan (2005), for example, writes of the 'co-evolution' of computational technologies with decentralized 'matrix models' of 'e.governance' that involve civil society organizations participating in all public services facilitated by software. Writing for Demos, Leadbeater (2011), who has worked in a variety of roles across the third sector, endorses the potential for 'government by algorithm,' an approach to governance involving systems to mine and analyze 'big data' and algorithmic methods to create 'more effective and intelligent public systems' (Leadbeater 2011: 18).

Recently writing together in a NESTA publication, Mulgan and Leadbeater (2013) both advocate 'systems innovation,' based on the idea of networks of interconnected innovations, which specifies the form of the network as a model for reforming, adapting and creating better systems. The publication is illustrated with 'systems maps' and 'diagrams' of the various feedback loops and feed-forward mechanisms, causal links and levers which underpin network dynamics. The authors embrace the notion of using 'big data' sources to track and trace individuals as they go about their daily lives online. These data include transactional data, such as that generated through online shopping, using transport, and making entertainment choices; and personal and behavioural data shared on blogs and social networks like Facebook.

As political scientists Margetts & Sutcliffe (2013: 139) point out, this big data not only offers scope for understanding human behaviour, social structure, and citizens' civic engagement; it can 'also be used for algorithmic and probabilistic policymaking' and 'for more coercive modes of governance, whether by introducing conditionality into public policy and services or simply exerting "nudges."' This is what Ruppert (2012: 117-118) calls 'database government,' a 'science-in-the-making' which has shifted the focus of government from the 'qualitative' governance of the social to the 'quantitative' governance of the 'informational.'

The arguments of Mulgan, Leadbeater, and the approaches that the organizations to which they are attached appear to endorse, represent a form of 'digital-era governance,' which Margetts and Dunleavy (2013: 6) describe as 'the adaptation of the public sector to completely embrace and imbed electronic delivery at the heart

of the government business model.’ Digital-era governance, they argue, is a response to technological developments such as analysing big data from transactional processes, peer production, network effects, and to new popular ideas of ‘crowdsourcing,’ ‘cognitive surplus,’ ‘wikinomics,’ and the ‘Internet of Things.’ Significantly, digital-era governance is enabled by the coupling of network-based communications technologies with database-led information processing technologies. On the one hand, networks allow for forms of governance through communication with individuals—governance with a voice maybe. On the other hand, database technologies allow for forms of governance through gathering information about individuals—governance with a brain. Combining these technologies of networks and databases, digital styles of governance, then, are to be managed by an ‘intelligent centre’ but facilitated through ‘decentralized delivery.’

Evidence for how such an ‘intelligent centre/decentralized delivery’ model figures in third sector approaches to educational governance can be found in documents published by both the RSA and the Innovation Unit. In a report prepared for the RSA, Ormerod (2010: 10) argues from a highly normative position that networks should be considered as an ‘intellectual framework’ and a ‘mindset’ for understanding how societies and economies function, and thus to inform how policies are devised and planned. Ormerod’s essay refers to networks in terms of ‘social networks’ and ‘social learning’—learning through observation and interaction with others—and to networks in general as the ‘patterns of connections between individuals,’ as well as to large-scale ‘networked systems’ such as crowds, stock markets, and ‘scale free networks’ such as the World Wide Web (Ormerod 2010: 14-15, 29-30). Just as the network has become prevalent as a metaphor for individual and collective life, economics and politics, it has also been mobilized by the RSA as a diagram for reimagining public education.

Further evidence of the prevalence of the idea of networks among third sector organizations comes from the Innovation Unit. In line with RSA’s networks mindset and NESTA’s emphasis on networked systems innovation, the Innovation Unit endorses the idea of an ‘innovation ecosystem’ for education. In such an educational ecosystem school is imagined as a ‘base camp for enquiry’ that is supported beyond school by the internet, mobile technologies, and a ‘vastly increased number of education providers,’ many accessed virtually. The Learning Futures curriculum vision is based on a model of a network of ‘extended learning relationships’ including teachers, tutors, experts, mentors, coaches, peers, and families as well as industry, local businesses, cultural institutions, community organizations, and the internet (Innovation Unit 2012: 11).

In this innovation ecosystem, education is reimagined through the imagery of the use of social networking sites to encourage peer-to-peer learning and collaborative research; online chat, instant messaging and email to help to strengthen the student-teacher relationship; digital portfolios as a continuous performative record of assessment; the use of Twitter hashtags to collate research sources (Hampson, Patton & Shanks 2012). Learning Futures constructs pedagogic identities that can be characterized as networked learners participating in a connected ecosystem of learning at home, at school and online—for a prospective future in which the internet itself is presupposed as a new learning institution. Finally, Learning Futures suggests the use of database-driven performance technologies which can collect data in order to ‘know’ learners, sort and aggregate them on the basis of personal and behavioural data, and respond with an algorithmically generated ‘playlist’ of appropriately personalized pedagogy (Hampson, Patton & Shanks 2012). Discursively framed by the RSA and the Innovation Unit in this way, the network and the database appear ‘easily and routinely to criss-cross the distinction between the technical and the social’ (Barry 2001: 14).

Networks and databases are thus the dominant spatial forms facilitating the reinvention of governance. However, neither networks nor databases are neutral devices, but are entangled in normative imaginings of the future. In relation to the former, networks are a ‘typically modern fantasy’ and ‘a diagram on the basis of which reality might be refashioned and reimagined: they are models of the political future’ (Barry 2001: 14, 87). Likewise, a ‘database way of thinking’ about governing seeks to intervene, through ‘personalized packages of public services,’ in ‘both who people are and who they are possibly becoming’ (Ruppert 2012: 128, 130). Through these network diagrams and database ways of thinking, education is being made up as a new governable space, one to be administered by decentralized cross-sectoral combinations of public, private and third sector actors, with the aim of governing through the collection, compilation and calculation of informational data on the individual learner. These techniques of algorithmic governance are also sinking down into pedagogy itself and into new tactics of ‘governing through pedagogy.’

## Database pedagogies

In recent years there has been an explosion of interest in database-led technologies of ‘big data,’ ‘data mining,’ and ‘data analytics,’ all of which have been taken up enthusiastically by third sector organizations such as NESTA (e.g. Davies 2013). Database-driven technologies are today significant since ‘the sociotechnical instantiation of many aspects of the contemporary world depend on database architectures and database management techniques’ and the technical processes of ‘ordering, sorting, counting, and calculating’ that they

involve (Mackenzie 2012: 335, 338). However, interweaving individuals more and more densely into new database architectures is creating vast and new forms of social, personal and behavioural data that may not only reflect everyday existence but actively constitute and reshape social practices as they occur (Beer & Burrows 2013).

A specific development related to these database-led technologies in the field of education has been the growth of 'learning analytics.' NESTA has advocated 'adaptive learning technologies' which use student data, algorithmic learning analytics and feedback mechanisms to adapt and personalize learning:

Adaptive learning technologies use student data to adapt the way information is delivered to a student on an individual level. This data can range from online test scores to session time (how long users spend on a single exercise) to records of where a user has clicked or touched while figuring out a problem. Based on this feedback, the programme will understand which content to point the user at next—planning a personalized learning journey. (Nesta 2013a)

An accompanying NESTA document claims these adaptive technologies provide 'the means to shift away from a one-to-many model of teaching, so that every child has a 'digital tutor' that is responsive to their interests, their prior-conceptions and achievement'; and the potential for 'intelligent online platforms that can use data gathered from learners to become smart enough to predict, and then appropriately assist and assess, that learner's progression to mastering the concept being taught' (Nesta 2013b).

Buckingham-Shum (2012) has described learning analytics as a 'digital nervous system' for education, an artificial 'brain or collective intelligence' that can measure and interpret a learner's activity, provide real-time feedback and adapt the learner's future behaviour accordingly. The applications of learning analytics include tailored course offerings, predictive modelling, learner profiling, and the design of 'intelligent curriculum.' The aim of some learning analytics developments is to create automated pedagogic systems, or what might be termed database pedagogies. These database pedagogies can include automated messages which provide brief and simple nudges or fully automated intelligent tutoring systems: the automatic production of personalized pedagogies.

NESTA has specifically supported and promoted Beluga Learning, a learning system based on the application of data-based learning analytics, adaptive software and artificial intelligence technologies. The Beluga system makes use of two types of learner data. It collects 'intelligent data' such as curriculum data, semantic data and linked data that is often collected by educational institutions. It also collects 'off-put data' from students' own social media programmes and conducts 'smart analysis' on both of these sources of data in order to create a profile of each individual user which can be compared and matched with an entire population of user profiles:

The data is allowing the software to make a real-time prediction about the learner and changes the environment, ... the pedagogy and the social experience. ... This process occurs continually and in realtime, so that with every new piece of data collected on the student, their profile changes and the analytical software re-searches the population to compare once more. ... The content and environment then adapt continually to meet the needs of the learner. (Beluga Learning 5-6)

Beluga Learning utilizes advances in artificial intelligence, combined with learning analytics and adaptive learning, to develop a 'smart system' that is able to 'behave with an intelligence' and circumvent the role of the teacher.

Database-led learning analytics and adaptive software systems such as Beluga exemplify what Kitchin and Dodge (2011: 85) have termed 'automated management.' This term captures how new software systems can be coded to collect and process information about people and things in ways that are increasingly automated (technologically enacted), automatic (the technology performs without prompting or direction) and autonomous (making judgements and enacting outcomes algorithmically without human oversight). Automated management is a form of governance that uses surveillance data to target and reshape behaviour:

Unlike traditional forms of surveillance that seek to self-discipline, new forms of surveillance seek to produce objectified individuals where the vast amount of [data] harvested about them is used to classify, sort, and differentially treat them, and actively shapes their behaviour. ... Software ... makes possible a fundamental shift in how information is gathered, by whom, for what purposes, and how it is applied to anticipate individuals' future lives. (Kitchin & Dodge 2011: 86)

As Urry (2007: 15) argues, ‘human beings are being reconfigured as bits of scattered information’ and as ‘mobile bodies’ leaving digital traces of themselves in space. In everyday life automated management raises the issue of the ‘technological challenges to human agency offered by the decision-making powers of established and emergent software algorithms’ and the extent to which ‘algorithmic power’ may be ‘becoming a part of how we live, a part of our being, a part of how we do things, the way we are treated, the things we encounter, our way of life’ (Beer 2009: 987). The codes and algorithms of databases work by collecting, compiling and calculating transactional data about people, and creating profiles and classifications in order to sort and sift them for a variety of (sometimes political) purposes (Ruppert & Savage 2012). This constructs algorithmically a digital shadow-profile, or a kind of data-based doppelganger, that can precede individuals wherever they go (shopping, travelling, working, learning) and may be used to modify how each person is treated. Thus, educationally speaking, transactional data is now being utilized as a governing resource for classifying, sorting and ordering learners, and for anticipating and activating their future behaviour (Williamson 2014).

A key issue emerging from these developments of automated, automatic and autonomous database technologies, and the ‘mobile bodies’ they configure, concerns the assumptions about the learner that are programmed into the system. For Facer (2013: 715), educational databases ‘reconstruct’ the learner as a ‘cybernetic system’ made up of inputs and outputs rather than an ‘embodied person.’ As Ruppert (2012: 125) has argued in relation to government education databases:

database devices are based on the logic that the subject is made up of unique combinations of distributed transactional metrics that reveal who they are and their capacities, problems and needs. An individual is not simply a child or youth, but rather a combination of needs and services.

Consequently, children can be ‘discovered and made up by these technologies’ as a ‘potential future person yet to come’ (Amoore cited in Ruppert 2012: 131). Learning analytics is perhaps the ideal pedagogic technology for ‘knowing capitalism’ (Thrift 2005) which mobilizes powerful data collecting and calculating technologies to know and act upon individuals and populations. In education this is a process which requires knowledge and information about learners to be ‘collated, monitored and interpreted by service providers, and even used as the basis for forecasting future needs’ (Grek & Ozga 2010: 285). The process involves defining ‘personalized packages’ of pedagogies for learners that are ‘formulated from distributed data about them and targeted to meet their needs but not seen by them’ (Ruppert 2012: 128).

What are the implications of learning analytics and similar database pedagogies for individual learners? One way to conceive of learning analytics is through the notion of recursive feedback. In an analysis of recursive data in contemporary popular culture, Beer and Burrows (2013) argue that data accumulation does not just ‘capture’ culture but is recombined through feedback loops to actually shape, reconstitute and co-construct popular culture and everyday practices. They offer examples such as automated recommendations services and ‘behavioural advertising’ in consumption practices. These services accumulate personal and behavioural data from online transactions and run these data through predictive analytics in order to generate personalized recommendations. These systems work recursively by continually harvesting by-product data and feeding it back into their predictive recommendations, so that ultimately the user and the service are constantly reshaping each other generatively. There is undoubtedly algorithmic power at work in such devices, ‘not of someone directly having power over someone else,’ but the programmed power of ‘the software making choices and connections in complex and unpredictable ways in order to shape the everyday experiences of the user’ (Beer 2009: 997).

Shaped recursively through such feedback loops, the individual subject of the learner presupposed by database pedagogy is, as Cheney-Lippold (2011) has argued in relation to databases generally, an ‘algorithmic identity,’ an effect of computational processes which infer categories of identity on the basis of the collection and analysis of personal information and behavioural data. An algorithmic pedagogic identity associated with database pedagogies is algorithmically inferred from its transactions, its generation of data, and its amenability to intervention through data-based analytics technologies. These technologies work recursively and dynamically to identify individuals based on patterns and regularities; on that basis to make predictions and recommendations for learners; and through those algorithmic processes, to shape and structure how they might think and act in the future. This is a generative process of the learner and the database pedagogy constantly co-constituting and reconfiguring each other. The learner is being reconfigured through these feedback loops as a lifelong learner engaged in a ceaseless pedagogic process facilitated by algorithmic power. These pedagogic techniques seek to mould learners for a future in which the algorithmic pedagogic techniques associated with networked and database-driven technologies will be a familiar and everyday feature of governing.

The process follows Hacking's (2007: 285) contention that technologies of identification and classification 'interact' in the process of 'making up' new 'kinds of people.' As Ruppert (2012: 128-29) explains in relation to government databases, the distributed data used to produce personalized packages of services 'may interact with the people through governing interventions that reinforce the "identity" of a person so discovered'; that is to say, the data 'interact with people and change them and since they are changed they are not quite the same kind of people as before.' Learners are thus to be 'made up' as data doppelgangers to be utilized recursively to predict future needs and programme future pedagogic intervention. The algorithms of database-driven technologies in education do not just work by identifying and categorising individuals, but are dynamically co-constitutive of new kinds of learners—mobile bodies and potential persons for futures yet to come. In this sense, governing by algorithm is an emerging mode of educational governance which seeks to re-sculpt and reactivate learners directly through automated and recursive database pedagogies.

## Conclusion

This paper has begun to explore how educational governance is being respatialized through third sector participation in education in England. I have outlined two shifts in the spatial reconfiguration of educational governance: first, a shift towards more complex, mobile and networked forms of governance, diagrammatically characterized by its intelligent centre and decentralized delivery model, involving public, private and third sector actors acting within public education in England; and second, a related shift to new forms of governing through network and database technologies with the algorithmic power to know and act upon the capacities of the individual—or governing through sculpting individual minds and bodies rather than through governance over the national space of the education system.

The style of governance endorsed and promoted discursively by third sector organizations is a form of digital-era governance which employs network-based communications technologies and database-driven information processing technologies both as discursive models and technological methods for activating new forms of pedagogy. This is an example of what Pykett (2012) has described as 'governing through pedagogy,' an emerging tactic by which both state agencies and other non-state actors manage, administer, discipline, shape, care for and enable subjects as lifelong learners for a pedagogized future. Third sector organizations are seeking to govern through the database pedagogies of emerging software and algorithms, and to sculpt the 'mobile bodies' of lifelong learners who are enrolled into the ceaseless feedback loops of everyday database pedagogies. The current growth of learning analytics and the recursivity of data is evidence of how education is being made governable as an algorithmic space constituted by individuals' information, data, and its analysis, rather than a national space of state government, with the aim of producing lifelong learners for a networked and database-led pedagogic future.

## References

- Ball, S.J. (2012) *Global Education Inc.: New policy networks and the neo-liberal imaginary*. London: Routledge.
- Ball, S.J. & Exley, S. (2010) Making policy with 'good ideas': policy networks and the 'intellectuals' of New Labour. *Journal of Education Policy* 25, no. 2: 151-169.
- Ball, S.J. & Junemann, C. (2012) *Networks, New Governance and Education*. Bristol: Policy Press.
- Barocas, S., Hood, S. & Ziewitz, (2013) Governing Algorithms: A provocation piece. *Governing Algorithms: A conference on computation, automation and control*. New York University, 16-17 May. Available online: <http://governingalgorithms.org/resources/provocation-piece/> (accessed 13 September 2013).
- Barry, A. (2001) *Political Machines: Governing a technological society*. London: Athlone Press.
- Beer, D. (2009) Power through the algorithm? Participatory web cultures and the technological unconscious. *New Media and Society* 11, no. 6: 985-1002.
- Beer, D. & Burrows, R. (2013) Popular culture, digital archives and the new social life of data. *Theory, Culture and Society* 30, no. 4: 47-71.
- Beluga Maths (2013) What is Beluga Learning? *Beluga Learning* website. Available online: <http://www.belugalearning.com/index.php/research> (accessed 13 September 2013).
- Bernstein, B. (2000) *Pedagogy, Symbolic Control and Identity*, rev'd ed. Oxford: Rowman & Littleman.
- Buckingham-Shum, S. (2013) *Learning analytics*. Moscow: UNESCO Institute for Information Technologies in Education. Available online: <http://ite.unesco.org/pics/publications/en/files/3214711.pdf> (accessed 13 September 2013).
- Cheney-Lippold, J. (2012) A New Algorithmic Identity: Soft Biopolitics and the Modulation of Control. *Theory, Culture & Society* 28: 164-181.

- Coyle, D. (ed.) (2009) *Reboot Britain: How the promise of our new digital age can tackle the challenges we face as a country*. London: NESTA.
- Davies, J. (2013) Sampling society? The foundations of a new frontier in understanding society. *Nesta website*. Available online: [http://www.nesta.org.uk/blogs/big\\_data/sampling\\_society\\_the\\_foundations\\_of\\_a\\_new\\_frontier\\_in\\_understanding\\_society](http://www.nesta.org.uk/blogs/big_data/sampling_society_the_foundations_of_a_new_frontier_in_understanding_society) (accessed 13 September 2013).
- Facer, K. (2012) Personal, relational and beautiful: education, technologies and John Macmurray's philosophy. *Oxford Review of Education* 38, no. 6: 709-725.
- Graham, S. D. N. (2005) Software-sorted geographies. *Progress in Human Geography* 29, no. 5: 562-580
- Grek, S. (2009) Governing by numbers: The PISA 'effect' in Europe. *Journal of Education Policy* 24, no. 1: 23-37.
- Grek, S. & Ozga, J. (2010) Re-inventing Public Education: The new role of knowledge in education policy making. *Public Policy and Administration* 25, no. 3: 271-288.
- Hampson, M., Patten, A. & Shanks, L. 2012. *10 Ideas for 21<sup>st</sup> Century Education*. London: Innovation Unit.
- Hacking, I. (2007) Kinds of people: Moving targets. *Proceedings of the British Academy* 151: 285-318.
- Hultqvist, K. (2001) Bringing the Gods and the Angels Back? A Modern Pedagogical Saga about Excess in Moderation. In K. Hultqvist & G. Dahlberg (eds). *Governing the Child in the New Millennium*, 143-171. London: RoutledgeFalmer.
- Innovation Unit. (2012) *Learning Futures: A vision for engaging schools*. London: Paul Hamlyn Foundation/Innovation Unit.
- Kitchin, R. & Dodge, M. 2011. *Code/Space: Software & Everyday Life*. London: MIT Press.
- Lawn, M. (2003) The 'Usefulness' of Learning: the struggle over governance, meaning and the European education space. *Discourse: Studies in the cultural politics of education* 24, no. 3: 325-336.
- Lawn, M. & Grek, S. (2012) *Europeanizing Education: Governing a new policy space*. Oxford: Symposium.
- Leadbeater, C. (2011) *The Civic Long Tail: Big data and the wisdom of the crowd*. London: Demos.
- Mackenzie, A. (2012) More parts than elements: how databases multiply. *Environment and Planning D: Society and Space* 30: 335-350.
- Margetts, H. & Dunleavy, P. (2013) The second wave of digital-era governance: a quasi-paradigm for government on the Web. *Philosophical Transactions of The Royal Society A* 371. Online first: <http://dx.doi.org/10.1098/rsta.2012.0382> (accessed 13 September 2013).
- Margetts, H. & Sutcliffe, D. (2013) Addressing the policy challenges and opportunities of 'Big Data.' *Policy and Internet* 5, no. 2: 139-146.
- Mulgan, G. (2005) Reshaping the State and its Relationship with Citizens: the Short, Medium and Long-term Potential of ICTs. In M. Castells & G. Cardoso (eds). *The Network Society: From Knowledge to Policy*, 225-240. Washington, DC: Johns Hopkins Center for Transatlantic Relations.
- Mulgan, G. & Leadbeater, C. (2013) *Systems Innovation: Discussion paper*. London: Nesta
- Nesta. (2013a) 13 predictions for 2013. *Nesta website*. Online: [http://www.NESTA.org.uk/news\\_and\\_features/13for2013](http://www.NESTA.org.uk/news_and_features/13for2013) (accessed 28 May 2013).
- Nesta. (2013b) Decoding Learning. *Nesta website*. Online: [http://www.nesta.org.uk/areas\\_of\\_work/public\\_services\\_lab/digital\\_education/assets/features/more\\_and\\_better\\_learning\\_using\\_technology](http://www.nesta.org.uk/areas_of_work/public_services_lab/digital_education/assets/features/more_and_better_learning_using_technology) (accessed 28 May 2013)
- Ozga, J., Dahler-Larsen, P., Segerholm, C. & Simola, H. (eds) (2011) *Fabricating Quality in Education: Data and governance in Europe*. London: Routledge.
- Pykett, J. (ed.) (2012) *Governing through Pedagogy: Re-educating Citizens*. London: Routledge.
- Rizvi, F. & Lingard, B. (2010) *Globalizing Education Policy*. London: Routledge.
- Rose, N. (1999) *Powers of Freedom: Reframing political thought*. Cambridge: Cambridge University Press.
- Ruppert, E. (2012) The Governmental topologies of database devices. *Theory, Culture and Society* 29, no. 4-5: 116-136.
- Ruppert, E. & Savage, M. (2012) Transactional Politics. *The Sociological Review*. Special Issue: Sociological Review Monograph Series: *Measure and Value*, edited by L. Adkins & C. Lury. 59, supplement s2: 73-92.
- Thrift, N. (2005) *Knowing Capitalism*. London: Sage.
- Williamson, B. (2013) Soft openings: The psychotechnological expertise of third sector curriculum reform. *Pedagogy, Culture and Society* 21, no. 2: 217-237.
- Williamson, B. (2014) Transactional pedagogy: Cross-sectoral policy intermediaries, data analytics, and self-learning software in educational governance. In T. Fenwick, E. Mangez & J. Ozga (eds). *Governing Knowledge*. London: Routledge.