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2014 Australian Association for Research in Education Presidential Address

Educational research and the tree of knowledge in a post human digital age

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Abstract The 2014, 41st Australian Association for Research in Education (AARE) presidential address is both inspired and guided by the discursive genres of presidential addresses and the role of the president in a member association such as AARE. In the address, typically the president speaks to the members on an issue or issues that are to shape or conclude their term of office, as it is in my case. Like many of the 40 AARE presidents who have gone before me, I will embed some things that are professional, personal and political—not in the interests of advancing my research agenda, but to add "to the weave and pattern of the association's history" (Reid 2010, p. v). Threads of my research since completing my PhD in 2000 will appear to support the broad argument. Also, I will draw on the outcomes of the 2014 Australian Research Council Discovery round (see Australian Research Council: ARC archives 2016) to encapsulate my key argument that *educational research and its (ex)changes are being reshaped: in a post human digital age, the tree of knowledge is mutating.* To make my argument, I will review how the thinking and doing of educational research mid-way through the second decade of the twenty-first century is constructed and ask what research endeavours might be created to make the best possible worlds for our member community and the aspirations of the association.

Keywords Educational research · Research methodology · Professional associations

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Introduction

The history and qualities of educational research in Australia reflect a trajectory that could be said to follow the patterns of social and educational change which are identified elsewhere—for example in the United States, the United Kingdom and our near neighbours such as New Zealand. The richness of thinking which mediates educational research has any number of "traces" (Green 2010, p. 43). Initially, the foundation disciplines of philosophy, sociology, psychology and history of education were what we knew and relied upon in our research. As the 'turn' in the social sciences proliferated in the later part of the twentieth century, so did the new sociologies of education, critical theory, thinking about practice architectures (Kemmis and Grootenboer 2008), things of the post (Lather and St. Pierre 2013), Big Data[1] (Mayer-Schönberger and Cukier 2013) and the posthuman (Braidotti 2013). Our AARE member organisation[2] includes national and international researchers and the governance operates through an Executive and 26 Special Interest Groups—SIGS. At the time of this Presidential Address in 2014 the listed SIGS were as follows:

1. Aboriginal and Torres Strait Islander Research,
2. Arts Education Practice Research,
3. Assessment Measurement,
4. Doctoral Education Research,
5. Early Childhood,
6. Educational Leadership,
7. Educational Theory and Philosophy,
8. Gender, Sexualities and Cultural Studies,
9. Global contexts for K-12 Education,
10. Health and Physical Education,
11. History and Education,
12. Inclusive Education,
13. Language and Literacy,
14. Middle Years of Schooling,
15. Motivation and Learning,
16. Narrative Inquiry Research Group,
17. Politics and Policy in Education,
18. Post-Structural Theory,
19. Professional and Higher Education,
20. Rural Education,
21. Social Justice,
22. Sociocultural Activity Theory,
23. Sociology of Education,

[1] I have elected to capitalise the two words Big Data (BD) to convey that there is much shouting and shouting out about these two words in the academy and the everyday.

[2] I would like to acknowledge the support of the AARE SIG convenors, the executive, past presidents, members and non-member conference attendees for their contribution to my term of office during 2013–2014. Reflections on my term of office highlight generosity, passion and productivity as hallmarks of the AARE community.

24. Teacher Education and Research Innovation,
25. Teachers' Work and Lives, and
26. Technology and Learning

The SIGS reflect what are the strengths of this member organisation—a large and broad church of educational research, substantively and methodologically. At the 2014 Annual Conference, held in Brisbane at the Queensland University of Technology, 833 attendees participated in a joint conference with our collegiate member organisation, the New Zealand Association for Research in Education (NZARE). In December 2014, the member base of AARE was 666 members. Australian educational researchers are productive scholars. In the international context, I would assert that Australian educational researchers are seen as focused and hardworking innovators, known for their capacity to rack up unprecedented numbers of air miles as we loop around the globe communicating our work and forming new partnerships to seek out the next presentation or grant opportunity. We are all however very aware of the challenges in Australia to maintain the visibility and quality of educational research.

In the humanities and social sciences, Education as a field has progressively strengthened its research profile. In the years between 2002 and 2013, funding awarded to education, and in particular, since 2005, shows steady growth. The report *Mapping the Humanities, Arts and Social Sciences* (Turner and Brass 2014) shows the upward movement of funding awarded to Education during this period, and at a glance looks commendable (see Fig. 3.14 of this report). The State of Australian University Research 2015–2016 *ERA National Report* (Australian Government and Australian Research Council 2015), provides a closeup and more recent picture of Australian Research Council (ARC) research funding overall and what is awarded to the 13 two-digit FoR code (Education).

The report indicates that "In 2015 $4.82 billion of Australian Competitive Grants research income was submitted to ERA 2015. The two–digit FoR codes with the highest percentage of HERDC Category 1 income were 11 Medical and Health Sciences (37 %), followed by 06 Biological Sciences (12 %) and 09 Engineering (9 %)" (p. 88). In the two-digit FoR code 13 (Education), the Higher Education Research Data Collection (HERDC) Category 1 research income however shows less than 2.5 % of the total funding pool awarded to education and represents a sharper picture of what is being returned to Education through ARC funding (see also Graham and Buckley 2014). As university-based researchers are well aware, the competition for research funding in the humanities and social sciences remains intense and this small percentage of overall category 1 funding for the 13 two-digit FoR code (Education) is concerning.

Over a 2-year term, the selection of the theme for a presidential address inevitably occupies a large amount of the private thinking time of a president. In my case, I wanted to ensure that I could capture something that would resonate with the membership, but would also provide the association with a thread that crosses the present and future tenses of educational research. To this end, I own up to both the pleasures of living a life in digital worlds and am someone who unashamedly advocates for the affordances of digital education. But, I also have concerns, as increasingly the digital world positions education and educational research within new systems of governance and governing which are reifying what we may consider

to be education and educational research. As Williamson (2016) points out, "'digital data work' has been normalised within education, as evidenced by proliferating database-related technologies of governance (such as those associated with global testing instruments), and that education is increasingly treated as a 'computational' project" (p. 124). As Big Data is rapidly proliferating (Boyd and Crawford 2012; Cope and Kalantzis 2015; Loukissas 2016; Madsen and Stenheim 2016), by implication, education is becoming more technical signalling that the erasure of educational ingenuity is well underway. The consequences of the Big Data deluge and the infrastructure that it rests upon, when interpreted in dystopian terms, may well even be a gesture to erode the kind of research that gets funded by high-status bodies, such as the Australian Research Council.

Visuality meets datafication

To lead and frame the argument in this address, I will draw on what is at the heart of my contribution to educational research, which, when broadly conceived, is the role of visuality and visualisation in educational research. Visuality generally refers to visual culture, but more recently a more productive definition offered for researchers in the social science community is one that highlights the relationships between visual research methods, data and visual culture (see Rose 2014). Visuality in these times, by definition, is increasingly digitised and intersects with datafication. Visuality can also include Big Data. Big Data does not have a single definition,[3] but has come to be thought of as making reference to "things one can do at a large scale that cannot be done at a smaller one, to extract new insights or create new forms of value, in ways that change markets, organisations, the relationships between citizens and governments, and more" (Mayer-Schönberger and Cukier 2013, p. 6).

Datafication is not the same as digitisation. Information technology has enabled the proliferation of digitised data sources. As Mayer-Schönberger and Cukier (2013) point out, "the IT revolution is evident all around us, but the emphasis has mostly been on the *T*, the technology, it is time to recast our gaze to focus on the *I*, the information" (p. 78). Many authors would claim that it is the field of Business that has purchase on datafication. Initially, it is published books from this field that directed my gaze to the 'Big Data' buzz. Datafication "relates to the use of digital technologies to unembed the knowledge associated with objects by decoupling them from the data associated with them. Datafication is manifesting itself in a society in a variety of forms and is often—but not always—associated with the sensors/actuators and the emerging Internet of Things (IoT)" (Ericsson 2014, p. 6).

Every day, we are instructed in and face information that relies on complex visual representations and thinking. Educators also will have observed how emerging concerns about education and schooling are frequently reported as having origins in comparatively large datasets, what Bernstein may have had in mind when he introduced his notion of the "total pedagogisation of society" (see Lingard 2014,

[3] See also Cope and Kalantzis (2015), Loukissas (2016), Madsen and Stenheim (2016) and Williamson (2016).

p. 3). Without a critical eye, these 'objects' and practises normalise our knowing of and being in the world. When visuality and visualisations meet, not only are we being introduced to the blurring of disciplinary boundaries, but arguably in the twenty-first century visuality has contributed thinking that is now equated with the clarity of statistical thinking (see Tufte 1997), affirming that the Big Data quest and datafication "is a continuation of humankind's ancient quest to measure, record, and analyse the world" (Mayer-Schönberger and Cukier 2013, p. 78).

The increase in the use of visuality and visualisation (what in short hand, irrespective of the paradigmatic orientation of the researcher, is seeing something anew) is well illustrated in the array of PowerPoint presentations generated by the Australian Research Council.[4] Figure 1 created by Aiden Byrne, the then Chief Executive Officer (CEO) appointed in 2012 to the Australian Research Council, shows the Field of Research (FoR) Network Mapping for the Humanities and Social Sciences in 2014.

To my sensibilities, these data have aesthetic as well as rich, communicative qualities. It is reasonable to assert that in the second decade of the twenty-first century we live in an information world and in a wealthy country, such as Australia, data, digital powers and datafication are omnipresent.

Educational research of all forms is deeply implicated in these visually saturated practices. Datafication and Big Data are here and the rustlings of the tree of knowledge are not from the sounds of leaves but are represented through the vibrations of digital matter. In educational policy and educational research, the use of digital matter is well illustrated in the proliferation of 'datafication' that is communicated by organisations, such as the Organisation for Economic Co-operation and Development (OECD 2014) and the Programme for International Student Assessment (PISA). Figure 2, again sourced from Byrne (2014) and the Australian Research Council, shows how Big Data gets constructed and reconstructed for the research community. Figure 1 illustrates the relative Field of Research (FoR) concentrations of key disciplines, including the Humanities and Social Sciences disciplines, with education highlighted in the lower far right of the diagram. Figure 2 shows a network map and the HASS disciplines **alone,** with the two-digit code 13 Education branching into the upper most white space of the image.

Big Data at work

The visualisations and Big Data illustrations that have been captured in this presidential address (see Figs. 1, 2, 5, 6, 7) give us a glimpse of the interrelationships that are criss-crossing the production of knowledge through visualisations—Big Data, knowing and the 'us', the educational research community. Datafication, as I argue later in the paper, veils 'Big Data' and raises a number of questions for the educational landscape and educational researchers and includes the necessary acumen to work these data.

[4] In 2014 alone there were presentation listings that run to 17 A4 pages available for review on the ARC website, see http://archive.arc.gov.au/file-search/Media_Centre?level_1=Media%20Centre&level_2=Presentations&level_3=2014&sort=asc&order=Document%20Name)

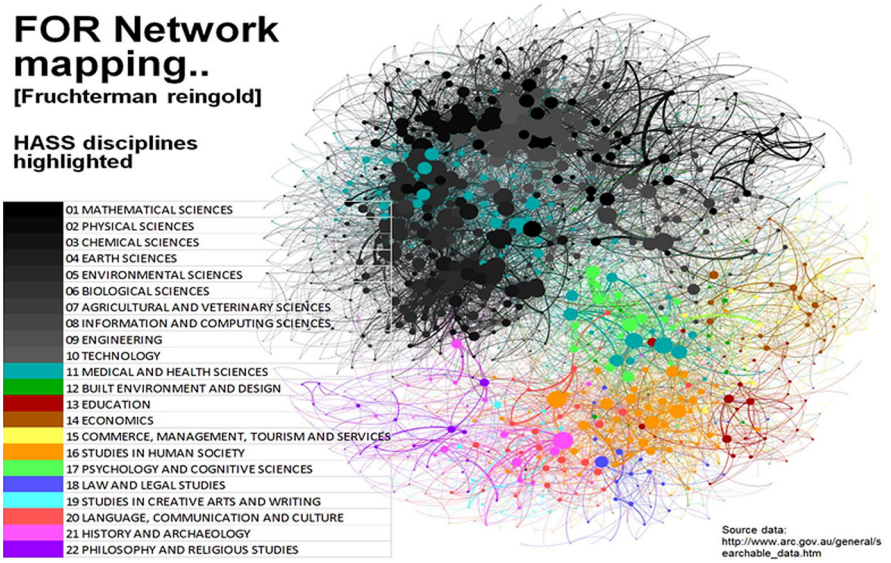

Fig. 1 Byrne (2014) Field of Research Network Mapping Australian Research Council, slide 32, reproduced with permission. Accessed http://archive.arc.gov.au/file-search/Media_Centre?level_1=Media%20Centre&level_2=Presentations&level_3=2014&sort=asc&order=Document%20Name; Link ptx 20141028&30_DVCsR-byrne. Fruchterman–Reingold algorithm—a force-directed layout algorithm

The resources that l draw upon are both theoretical and empirical. I have been engaged as an education researcher since completing my PhD in 2000. I have now spent as many years of my career in higher education as I did in the school system. Unsurprisingly, my research interests began with and remain in the field of education and particularly pedagogy and curriculum. Researchers more and more, regardless of the paradigmatic orientation, will include in their outputs, illustrations, extensive forms of digital computation and data representations. Many of these representations were invented in the nineteenth century—but now look dramatically different—and pay homage to graphic imagery that has been used for centuries, drawing from diverse cultural traditions and representations. The 'sociograph' or 'sociogram', for example, diagrams that were popularly used in sociological and psychological research in the 1980s still remain in use but, due to the power of technology and computation, representations can now take account of more data and the forms of representation have multiplied exponentially. Datafication is also highly visible in a range of fields such as cognitive and engineering science, medical and social sciences, the arts and architecture. These data can look and be considered both 'big' and 'pretty' and have given researchers new insights and possibilities for generating and communicating data and project outcomes.

As Mayer-Schönberger and Cukier (2013) remind us, although the ideas of the 'information revolution' and the 'digital age' have been around since the 1960s, as recently as 2000, "only a quarter of the stored information in the world was digital. The other three quarters were on paper, film, vinyl, LP records, magnetic cassette tapes and the like" (p. 9). Further "(t)he digital deluge now sweeping the globe is the equivalent

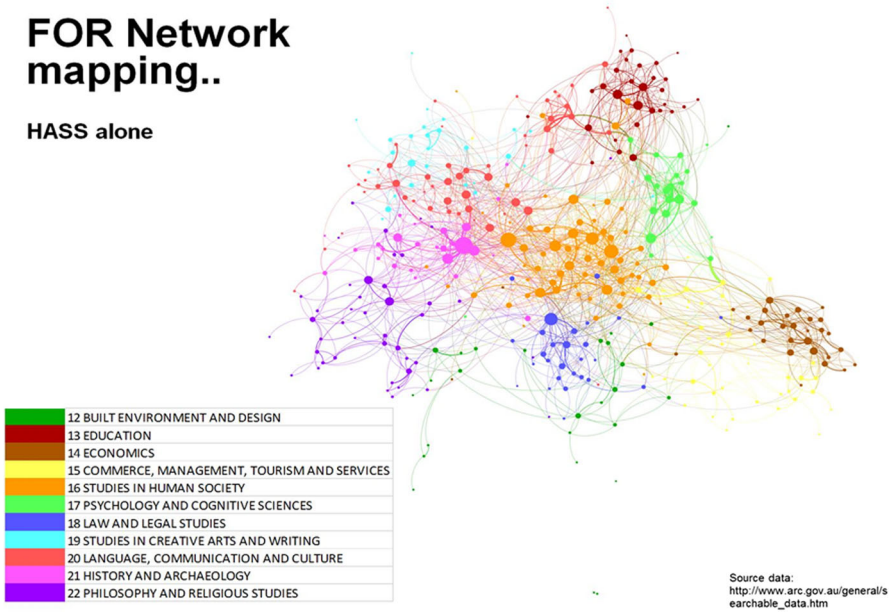

Fig. 2 Byrne (2014) Field of Research Network Mapping—Humanities and Social Sciences Alone slide 34, reproduced with permission. Accessed http://archive.arc.gov.au/file-search/Media_Centre?level_1=Media%20Centre&level_2=Presentations&level_3=2014&sort=asc&order=Document%20Name; Link ptx 20141028&30_DVCsR-byrne

of giving every person living on Earth today 320 times as much information as is estimated to have been stored in the Library of Alexandria" (Mayer-Schönberger and Cukier 2013, p. 9). Mayer-Schönberger and Cukier include in their deluge of information and in the processes of datafication and datafying many things we might not consider to be information, such as geospatial locations, vibrations, tweets and the like. Today, during rapid socio-technological changes, we are more likely to tweet, place an image on Instagram, use video gaming, employ scanning technologies or load knowledge to our blogs. The Creative Commons network (see http://creativecommons.org.au/) has been established to account for and respond to issues of copyright and the assurance for genuine attribution of creative works, including music and images. History is no longer captured by print alone (Fig. 3).

Enter information visualisation

The first macro example of datafication through information visualisation that I draw upon and illustrative of the discursive formations of 'Big Data' is displayed in the work of Manuel Lima. In his Book of Trees (2014)[5] drawing up the humanist symbol of knowledge and its expansive strength and branches, he notes:

[5] Type the author name Manuel Lima and The Book of Trees (2014) into your search engine and highlight images to view a snapshot of the book and the numerous reviews of the work which are detailed on blog sites.

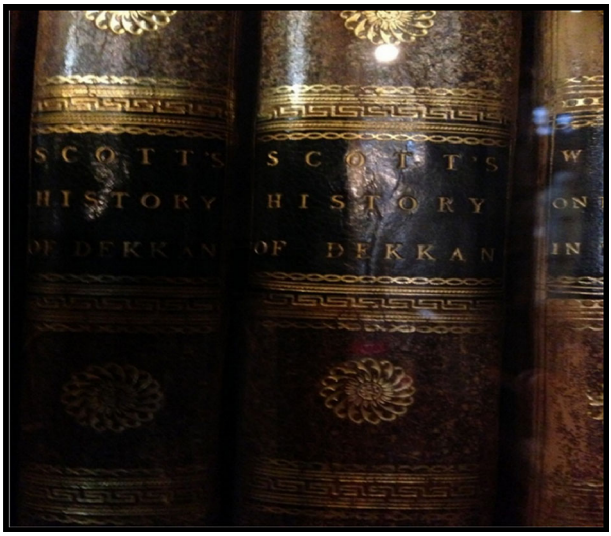

Fig. 3 Antiquities in print: Scott's History of Dekkan, 1794 John Rylands Library, Manchester, UK. Still digital image, ©Julianne Moss

> information visualisation is a remarkable, ever changing field of study with deep roots in cartography, the illumination of manuscripts and medieval visual exegesis… Given the recent upsurge of interest in the field, it's tempting to contemplate information visualisation as an entirely new discipline rising to meet the demands of the twentieth first century. But, as with any domain of knowledge, visualisation is built on a prolonged succession of efforts and events, the evidence of which has in many cases been lost or scattered in dark, dusty cabinets (Lima 2014, p. 9).

The subsequent chapters in Lima's book (Fig. 4) are divided into types of tree visualizations: figurative, vertical, horizontal, multidirectional, radial, hyperbolic, rectangular, Voronoi, circular, sunbursts and icicles. In sum, these visualizations reveal the multiple and virtual geometric underpinnings of the humanist symbol of knowledge, the tree. Three illustrations which are found in Lima's book and attributed to public domain sites provide exemplars of tree visualisations. As the dates of the illustrations indicate, these images span a timeline of some nine centuries.

Lima's book, viewed and read in depth, well illustrates how software-generated design, based on mathematical functions, allows for the production of distinctive representations that are not achievable through traditional approaches (Figs. 5, 6, 7).

3D printers and post digital representations

My next example that further highlights the reconstruction of knowledge, disciplinary hybridising, datafication and the changing relationships with matter draws upon the development and proliferation of 3D printers. The 3D printer (or

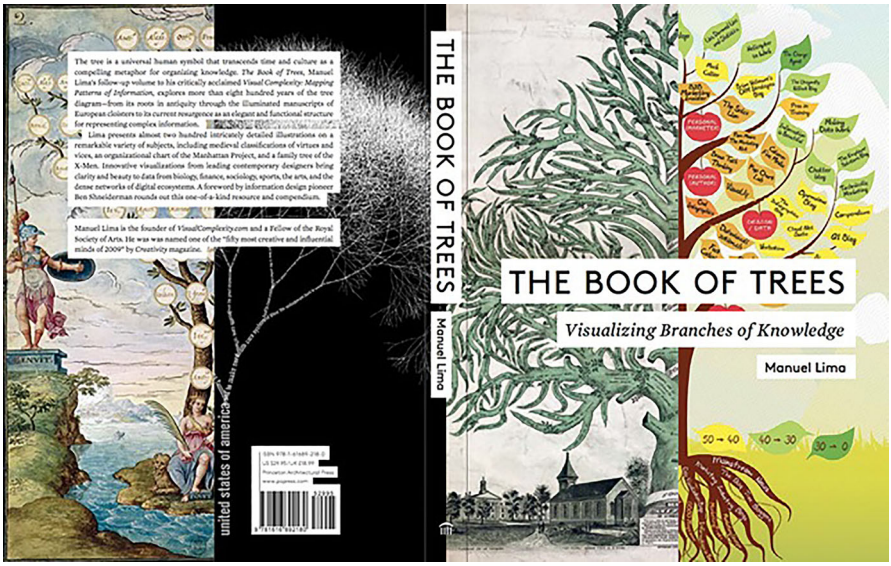

Fig. 4 Book Cover, The Book of Trees Manuel Lima (2014). Reproduced with permission of the author. Attribution Press kit, http://www.mslima.com/myhome.cfm

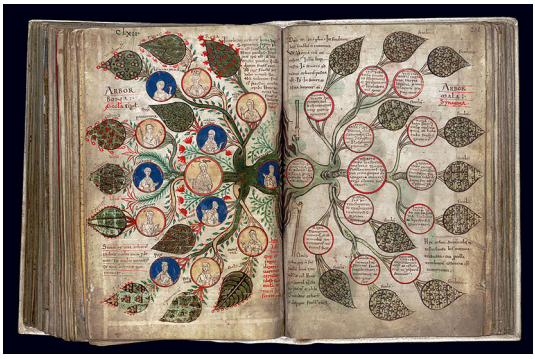

Fig. 5 Tree of virtues and tree of vices, from Lambert of Saint-Omer, Liber floridus, 1121. Attribution: Princeton Architectural Press, included with permission from Princeton Architectural Press Blog http://blog.papress.com/post/75164526612/tree-diagrams-through-the-ages-from-the-book-of. Accessed 15 October 2015

additive manufacturing as it is commonly known) is a 'thing' of the information-based and technologised age that has been around since the 1980s. In 2010, a 3D printer cost $20,000. Now, one can be purchased for just a few hundred dollars. In the everyday world, typically little attention is paid to the construction or the presence of how objects and digital computational processes align. Overnight, a single 3D printer can turn a two-dimensional plan into a three-dimensional object. The process of using the 3D printer begins with diagramming, conceiving the form to produce representations that are manufactured through the printer to produce innovations in design and technologies that become everyday domestic objects, prosthesis, engineering parts, toys, furniture and the like.

Applications of 3D printers are growing exponentially in all disciplines and fields and this includes education and teaching. In the Foreword to the catalogue of the

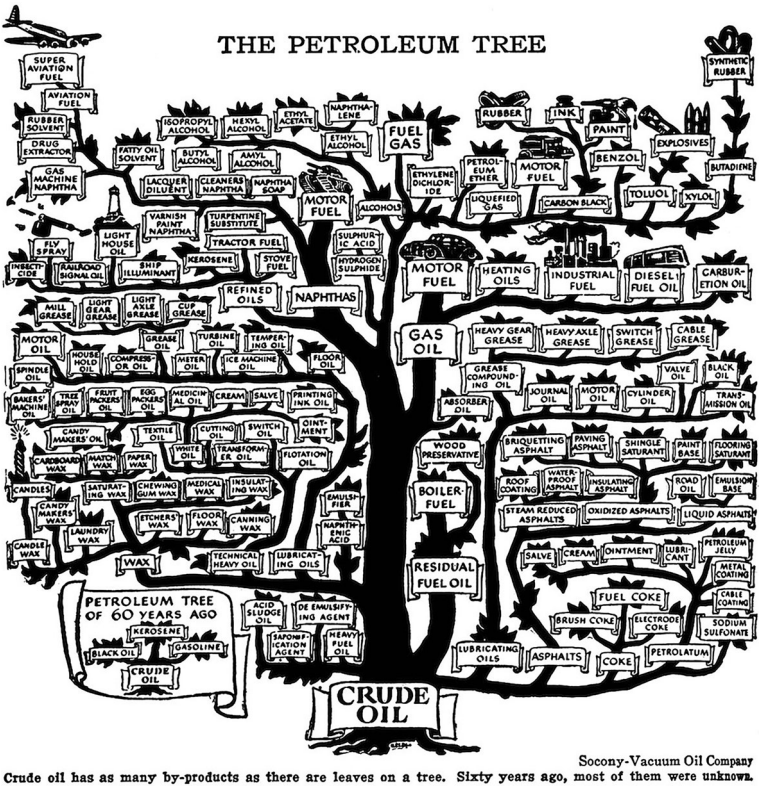

Fig. 6 Petroleum Tree (1957), an illustration of petroleum uses, Sacony-Vacuum Oil Company. Attribution http://visualoop.com/blog/30063/vintage-infodesign-65-2. Included with permission from Princeton Architectural Press. Accessed 15 October 2015

exhibition entitled *Out of Hand: materialising the post digital*, held in 2013 at the New York Museum of Arts and Design (MAD), David McFadden, Chief Curator, states that "The digital 'revolution' of our time has inalterably changed the shape of the material world: forms that were once difficult or impossible to make are now readily achievable; new materials challenge our preconceived nature of value" (McFadden 2013 in Labaco 2013, p.7). 3D printers are increasingly instrumental to our material and bodily connections and are recognised by progressive educators as having a place in the school curriculum.

George Aranda, a Research fellow at Deakin University, has seen the potential of the 3D printer in the primary science and technology curriculum and has put the technology in the hands of primary-age students. Science as Aranda explains to us "is full of representations, whether they are photographs of the moon, a sine wave or animated models of cells" (Aranda 2014). The project has been sourced by the crowdfunding initiative Pozible, Research my World (see http://www.pozible.com/project/187468), and has enabled both teachers and primary-age students to learn about representations in the teaching of the primary science curriculum (Fig. 8).

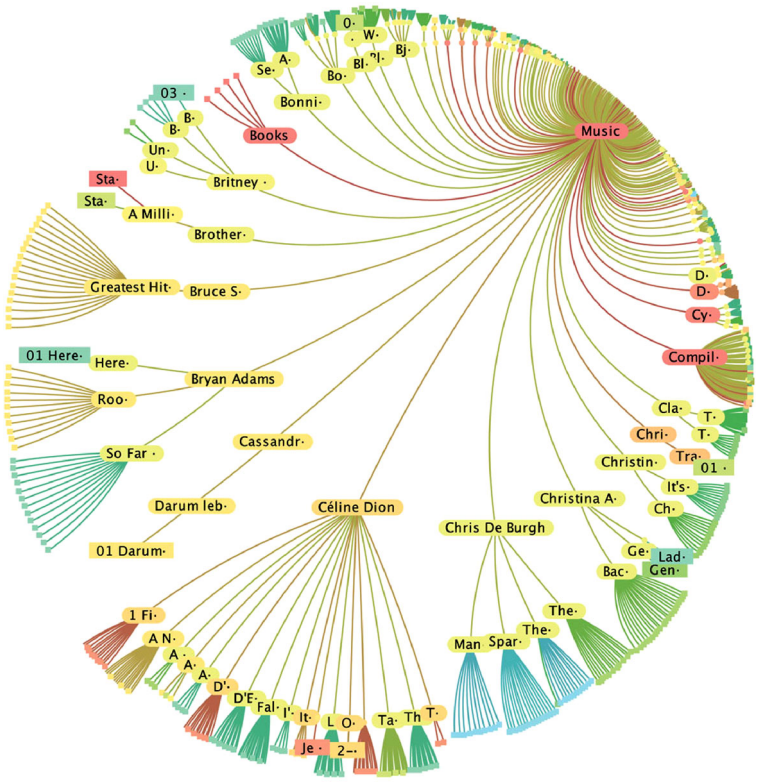

Fig. 7 "Treeviz" (mac implementation of a Treemap concept), Werner Randelshofer, 2007 Attribution: Princeton Architectural Press, included with permission from Princeton Architectural Press Blog http://blog.papress.com/post/75164526612/tree-diagrams-through-the-ages-from-the-book-of. Accessed 15 October 2015

Visual methods and posthuman emergence

Digital technologies have reconfigured many aspects of everyday life and as a consequence the boundaries between various disciplines have morphed. This has, in part, contributed to the rise of, and pressure for, cross disciplinary studies. As someone who is interested in researching the practices of schooling and policy through visual methods, I have written about the need to be wary of the seductions of visual research (see Moss 2011); yet on the other hand, I have also urged researchers and classroom practitioners to recognise that the proliferation and ready access of the visual can undo some of the normative conceptions of schooling. Visuality and its affordances, used critically, can enable close representational scrutiny of schools, enabling their histories and everyday practices to be re-examined and revised. In the past decade, researchers in this field have made significant methodological contributions to educational research (see Moss and Pini 2016).

Fig. 8 George Aranda with 3D printer. Digital still image, ©George Aranda reproduced with permission

I will now turn to another example which is drawn from my recent research. Two of these Australian Research Council (ARC) projects have produced what I also define as Big Data sets (see Yates et al. 2010; Halse et al. 2015). In the Halse et al.'s project,[6] we put the visuality and 'Big Data' (many hundreds of still digital images, surveys and geographic information systems (GIS) data) to work as a part of a multidisciplinary research design to understand some more about intercultural understanding (ICU) in primary and secondary schools. To this end, the research design assured that all of the visual data sources were continuously scrutinised as part of the recursive research design of the project. Researchers engaged in this element of the project attempted to problematise and account for the scale of these datasets and the potential seduction of these data sources was considered in the analysis.

In one part of the study, colleagues Trevor McCandless, Joanne O'Mara and I took an architectural reading of the school buildings. The element of the ICU research that we focused on addresses the second aim of the project to improve ICU outcomes through "an in-depth, longitudinal study of the impact of students and teachers' ICU of teacher professional learning, ICU interventions with students, and research-led redesign of the cultural architecture of schools; i.e. policies, processes, practices" (Halse et al. 2011, p. 6).

The qualitative data generated in this aspect of the study were images taken by the researchers as they accompanied each of twelve Victorian school principals on tours of their schools. This element of the fieldwork was followed by a face-to-face interview, conducted 1 month after the tour, with each school principal. Central to the interview was the sequenced display of the researcher-taken images unique to each school that were organised by the researcher into a single PowerPoint presentation. The PowerPoint presentation from each individual school was read by the researchers as both material and empirical data, elucidating responses from the

[6] The study was funded by an Australian Research Council Grant in partnership with the Victorian Department of Education and Training (DET), the non-for-profit foundation Together for Humanity (TFH), the Victorian Curriculum and Assessment Authority (VCAA) and Pukunui Technology (ARCLP 120200319).

Fig. 9 myFlag—mySchool Victoria, Australia, 2013, still digital image, ©Joanne O'Mara, reproduced with permission

school principals on their intentions in developing these sites and the messages concerning the school they sought to convey.

We took school entrances to include offices and foyers, and asserted that these spaces can be read as 'borderlands' and 'boundary places'. Foyers mark off schools as functional units, as social entities (Luhmann 2012), and thereby help differentiate them from the rest of society. As borderlands, foyers are scrutinised and policed. However, as gateways they function as a communicational interface between the school and the outside world. To the extent that first impressions are important, these sites are constructed to provide that first impression and this construction is done with both care and thoughtfulness regarding the message the school wants to transmit. The still digital photographic images documented the artefacts and architecture of the entrance spaces. The semi-structured interviews provided the principals the opportunity to further elaborate on the ubiquity of everyday school life and their framing of intercultural understanding (Figs. 9, 10, 11, 12).

In our analysis, we concluded that with respect to ICU, schools stand in complex relationships with their communities. Interpreting school foyers through visually mediated practises where objects and spaces are considered to be data, we argue, furthers our knowledge of the leadership practises required for intercultural school redesign (see Moss, O'Mara and McCandless 2016). As Sherry Turkle points out in her book, *Evocative objects—things we think with,* objects and human understanding do mutate. "Objects bring together thought and feeling…we often feel at one with our objects", and secondly, "Evocative objects bring philosophy down to earth" (Turkle 2007, p. 9). Place, space and objects are not neutral. As such, spatialized practices need to be considered as both inhibitors and enablers of intercultural understanding in primary and secondary schools. Places such as foyers

Fig. 10 Welcome: P-9 school foyer Victoria, Australia, 2013 still digital image ©Julianne Moss

Fig. 11 Welcome: primary school foyer Victoria, Australia, 2013, still digital image, ©Joanne O'Mara reproduced with permission

are spaces where bodies enter and perform the opening and closing of school relationships. Objects curated in cabinets and decorated walls customise knowledge of intercultural understanding as authorised school curriculum practises (Figs. 10, 11, 12).

Fig. 12 On Display: primary school foyer Victoria, Australia 2013, still digital images, ©Joanne. O'Mara reproduced with permission

The twelve schools that joined the ICU Project all did so with a vision to improve intercultural understanding in their school. However, in no sense does that mean that all schools sought the same things from the project or from the changes they attempted to implement from the project. Interculturality, we are arguing, is not a series of 'right answers' that any project can provide schools, but rather is deeply embedded in the lived experience of everyone in a school community. Seeking to change that lived experience requires a commitment to how things could be, a working "with, from and over" (Thomson and Blackmore 2006, p. 164) and further thinking of "life as surplus" (Braidotti 2013, p. 96).

The boundaries of big and pretty data

Researchers from all paradigms and fields are reporting that datafication and visualisations have much to offer—the promise of interdisciplinary collaboration and computation production that is made in your hand or on your lap with small-and medium-sized devices are enriching possibilities for our engagement in and alongside research communities—anywhere and anytime. But as well as promise, there is seduction. The promise lies in what these data are doing, how they are materialising in the project and where they may travel regardless of the paradigmatic orientation. Being in the middle of data is not about some essence, but is suggestive of velocity, variety, volume and veracity. But what these data generate is not necessarily 'more' just because you are 'big' and 'pretty' data. For Deleuze (1998), the diagram is considered to be the "distribution of power to affect and the power to be affected" (pp. 72–73). Diagrams for Deleuze illustrate

"historical 'social fields' that, while being unstable, are continually changing" and "become manifest as social forms, for example, in figures, statements, visual arrangements or forms of architecture" (Deleuze 1988 in McCosker and Wilkin 2014, p. 161). As McCosker and Wilkin (2014) affirm, "in data visualisation, the data clearly matters. But it is important to distinguish between matter, or that which enters the diagram and its substantiation as the visualisation, figurative or objective form" (p. 162). However, the visualisation, the figure, "should be better understood less in the sublime beauty of the figure than in the diagram that provides the (virtual) space for experimentation, differentiation and problem-posing" (McCosker and Wilkin 2014, p. 163). Big Data therefore is not a homogenous mass and is also marked by its binary 'small data' (Lindstrom 2016), a position that I shortly take up in this argument.

As someone who embraces critically led practices in the social sciences and has lived a career of attempting to influence a less exclusive form of schooling, the challenge to understand and come to know and explain Big Data's entrée into education and educational research is confronting. Selwyn and Facer (2014) have drawn our attention to how issues of inequities and digital technologies interact with each other. As they state, "(t)hese digital inequalities are especially pronounced in terms of socio-economic status, social class, race, gender, geography, age and educational background…Aside from the inequalities of access, there is growing evidence that digital technology use is not the equitable and democratic activity that it is portrayed to be" (p. 489). The focus for Selwyn and Facer (2014) are the technologies and the everyday end user. A cursory glance across any number of education institutions reveals a parallel to their assertions—that is, digital infrastructure and access to information are privileged in some settings over others. For example, compare the digital infrastructure and access to research afforded to not-for-profit community organisations, or school systems that are rural, remote or named as being disadvantaged compared to that of a present-day university or inner city elite school.

So what can be done by an association that is driven by educational research in the midst of post-human digital age where I argue that there is a mutating tree of knowledge? To this end, in light of my argument, I will review, mid-way through the second decade of the twenty-first century, albeit in a very punctuated manner, how do we make the best possible worlds for our member community and the aspirations of the association? I do this by drawing in the binary to Big Data—that is, small data.

Big and small data

Conceptually, a discussion of 'Big Data' (Cope and Kalantzis 2015; Loukissas 2016; Madsen and Stenheim 2016; Mayer-Schönberger and Cukier 2013; Williamson 2016) could continue by expanding the veracity of its definitional framing and increasing proliferation in educational and social science contexts; however, this is not my purpose in this address. The impact of Big Data on school communities, as Sahlberg and Hasak (2016) note, has not gone unnoticed:

> If you are a leader of any modern education system, you probably care a lot about collecting, analyzing, storing, and communicating massive amounts of information about your schools, teachers, and students based on these data sets… Two decades ago, the type of data education management systems processed were input factors of education system, such as student enrollments, teacher characteristics, or education expenditures handled by education department's statistical officer. Today, however, Big Data covers a range of indicators about teaching and learning processes, and increasingly reports on student achievement trends over time.

However, for a field such as education, it has long been established that both big and small data remain central to our endeavours. "Small data" (Lindstrom 2016) and "small data environments" (Mayer-Schönberger and Cukier 2013) form the binary pair of big and small data and bifurcate notions of data. Often critiqued, as it is dichotomous thinking, binaries however can be useful. I have learnt this practice from Donna Haraway, who, suggests that binaries "are tools essential to the construction of each other" (Haraway 1991, p. 111) and although "the representational technology makes too much clatter" (Haraway 1991, p. 112) a "noisy little analytical engine"[7] (Haraway 1991, p. 111) can be put to work to unfetter singular constructions, "artefacts and facts", the "language mediated objects in the knowledge game" (Haraway 1991, p. 185) to honour both partiality and accountability.

Rethinking our engagement with educational research and its (ex) changes: as the tree of knowledge mutates in a post-human digital age, listening to the noise of the big/small data machine, I would argue that both **big** and **small** data have some things to add to our current struggles to ensure that educational research is listened to and continues to flourish. In educational research, debates over big and small data have been well rehearsed through the quantitative and qualitative debates, the rise of mixed methods research and the post humanist break which was foreshadowed by Donna Haraway (see Haraway 2004) and more recently referred to by Braidotti as the "post-human predicament" (Braidotti 2013, p. 1). There is not space in this paper to rehearse the debate in depth, other than to indicate that in current times it is fair to say that the social science community is engaged in a refreshed debate which pertains to the rise of the use of mixed methods and the continuing development of post qualitative research that is punctuated by the "shared discourses and representations of the non-human, the inhuman, the antihuman, the inhumane and the posthuman" (Braidotti 2013, p. 2). My purpose in this paper is not to enter these debates and argue for "a new form of science, a better technical fix for get-ting a purchase on social policy issues" (Torrance 2012, p. 111), but rather to problematize the emergence of the Big Data phenomenon and its alignment to

[7] Haraway (1991) constructs the noisy little analytical machine as something that"... works almost like the dichotomous systems of European Renaissance rhetoricians, such as Peter Rasmus to persuade, teach and taxonomize simultaneously by means of analytical technology that palpably makes it objects simultaneously with bisecting them…Noting this tradition does not invalidate its use; it *locates* its use and insists on partiality and accountability. The difference is important. Binaries, rather suspect for feminists I know can turn out to be nice little tools from time to time" (Haraway 1991, p. 111).

visuality, which, as Barbara Pini and I point out, does not necessarily coexist comfortably (see Pini and Moss 2016).

Throughout my 2014 presidential address and now this paper, which is part of the record of my term of office, I have illustrated how visuality and datafication are foregrounding where Big Data is rippling and shifting the ontological and epistemological grounds that underpin educational research. In the final section of the paper that has been written after the delivery of the address, I am calling up the noisy machine of big/small data in an attempt to produce a generative unfolding that marks the (his)story of the period. Here the words of Rosie Braidotti are helpful.

> Human embodiment and subjectivity are currently undergoing a profound mutation. Like all people living in an age of transition, we are not always lucid or clear about where we are going, or even capable of explaining what exactly is happening to and around us…Human, all too post human, these extensions of what bodies can do are here to stay. Are we going to be able to catch up with our post human selves, or continue to linger in a theoretical and imaginative state of jet-lag in relation to our lived environment? (Braidotti 2013, p. 196)

Conclusion

I want to conclude the 41st presidential address with a sense of hope for educational futures through education research that characterises an "affirmative politics" (Braidotti 2013, p. 192) and takes the binary of big and small data and the noise of this little machine as something for the research community to work with. Recently, critical analysis of the Big Data phenomena in education has emerged. As Sahlberg and Hasak (2016) point out, "Too strong reliance on externally collected data may be misleading in policy-making. Perhaps the most important next step is to realise the limitations of current Big Data-driven policies and practices". Much of my struggle as both an educational researcher and a contributor to policy and practice has been built on the recognition that although there are many new and perceived as 'novel' data sources, the production of difference continues to expand and it is incumbent upon researchers to actively engage in continuing "conscientization" (Lather 1991, p. 68) and sensibilities beyond the "analogue paradigm" (Mayer-Schönberger and Cukier 2013, p. 15).

The 2014 presidential address has invited the association's membership to consider from our respective fields of educational research, how we might respond to questions about knowledge and new knowledge production that begins with provocations of visualisations sourced from Lima (2014), and foregrounded how and why datafication and datafying are entering the discourses of education through the proliferations of Big Data discourses. The projects that remain in progress from the 2014 Discovery Project the 13 two-digit FoR code (Education) that focus attention on digitised and technologised worlds optimistically embrace a "vitalist materialism" and perhaps a willingness to "catch up with our post human selves"

(Braidotti 2013, p. 55, 192). However, as Dorothy Smith (1990) reminds us the "membrane" (p. 125) between discourse and everyday life is permeable.

In our work as researchers and members of a research community, the rise of Big Data and datafication, the words offered by the 1988 President of AARE Leo Bartlett who calls for "engaging the practises and policies of education educatively" (Bartlett 2010, p. 70) perhaps ought enfold "diffraction" (Haraway 1997, p. 63) as a principle for making a difference in a world that generates data both big and small, human and non-human. In Haraway's words:

> Diffraction patterns record the history of interaction, inference, reinforcement, and difference. Diffraction is about heterogeneous history, not about originals. Unlike reflections, diffractions do not displace the same elsewhere, in more or less distorted form, thereby giving rise to industries of metaphysics. Rather, diffraction can be a metaphor for another kind of critical consciousness at the end of this rather painful Christian millennium, one committed to making a difference and not to repeating the Sacred image of the Same. (Haraway 1997, p. 273).

I opened the address by foregrounding visuality, datafication and Big Data and I am concluding by cautioning the membership that whilst Big Data has emerged as part of the knowledge networks that are unique to our times, both 'Big Data' and 'small data' human and non-human are at work in the twenty-first-century knowledge exchanges. Datafication offers us a revitalised connectivity and interactivity between digital and physical objects and mass information. Datafication is generating news, new forms of quantification and is disrupting scientific method.

As Lingard and Gale (2010) proffer, the genre of the presidential address can be masked. The "magisterial discourse" (p. 30), (after Bourdieu and Wacquant 1992) of Association presidents will reposition the collective 'us' to consider the relationships of "subjective interests…individual research interests and their institutional locations" (Lingard and Gale 2010, p. 30). Taking up the issue of Big Data and coupling and decoupling the complex knowledge systems of visuality and datafication, I am owning up to the magisterial discourse, and conclude with a question: In these rapidly changing social conditions, can educational researchers persist with the familiarity of hacking away at an inert tree of knowledge?

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