Rethinking the Spaces of Standardisation through the Concept of Site

James Merricks White
Maynooth University (IE)

Abstract: This paper proposes a site-based methodology for the study of standards and standardisation. Rather than consider standards as a global phenomenon, or theorise them as a network of relations, their spatiality is rethought as an outcome of their ongoing enactment. Both the moment of a standard's implementation and its supporting apparatus are opened up to genealogical analysis using the work of feminist philosopher Karen Barad. In particular, her concepts of 'apparatus' and 'iteration' forge a link between the particularity of 'site', and the circulation and materialisation of standards. By following such an approach, a multitude of heterogeneous agencies are revealed, and with them, the potential for change.

Keywords: standards; standardisation; spatial theory; site ontology; methodology.

Submitted: May 12, 2017 – **Accepted:** October 2, 2017

Corresponding author: James Merricks White, Rm 2.07 Iontas Building, Maynooth University, Maynooth, County Kildare, Ireland. Email: james.white.2014@mumail.ie

Introduction

Standards are inherently spatial. They are spatial in their distribution. Not everyone is affected by standards in the same way, nor has access to the same standards for quality and care. What is common for the very wealthy is often completely inaccessible to the very poor (Star and Lampland 2009, 6-7). Standards are also spatial in the arrangement of the materials and behaviours they bring about. They are realised in the built environment, embodied not only in physical forms, but in the social and economic patterns of their interaction and use. Regular positions and juxtapositions seem to sediment into a technological unconscious of preindividual gesture and habit (Thrift 2004).

The process of making something standard can be understood as a spatial operation. Sometimes standardisation occurs accidentally, as when apparently minor decisions and actions become the *de facto* way in which something is done. Many standards however are intentional and are the result of regulatory or voluntary adoption. Once a voluntary standard has been published it must be circulated and implemented. This is usually achieved through global markets, supported by promotional materials and by a normative obligation to adhere to best practice (Mendel 2006). But spreading a standard is not the same thing as ensuring that it is everywhere the same. In some instances, adherence self-regulates. This is the case with the internet protocol, IPv4. A personal computer unable to access the internet would be nearly useless – IPv4 is intrinsic to all multipurpose operating systems. Often however, it is necessary that conformity to a standard be assessed independently. In the case of ISO 9001, the dominant quality management standard, accredited third-party auditors verify compliance. Complex institutional structures and practices have been established to help assure that such voluntary standards are correctly implemented (Loconto and Busch 2010).

Given the diversity of standards and their modes of propagation, it is important that their spatial effects be addressed materially and discursively. This paper uses the concept of 'site' to open up a new approach to the spaces of standardisation. I begin by teasing out various connotations of the word 'standard'. Instead of offering a narrow and succinct definition, I define a standard as any set of rules or values which produces effects in the world. Having specified the field of analysis, I move on to the broader context of standards and standardisation by briefly reviewing relevant historical and sociological literature. In the third section, I reflect on how the spaces of standardisation have been thought about. While the metaphor of 'the network' is important, I argue that it limits the kinds of agencies involved in standardisation. I propose that the spaces of standards be reconceived using 'site ontologies' (Schatzki 2002; Woodward et al. 2010). Next, drawing on the work of feminist philosopher Karen Barad (2003; 2007), I describe one way in which this might be achieved. I argue that Barad's use of 'apparatus' and 'iteration' open up a way of linking site to the empirical study of the circulation and implementation of standards. A brief discussion of IPv4 and ISO 9001 follows, in which I give an indication of the spatial and social perspective that would be emphasised in such an approach. By rethinking the spaces of standardisation, I hope that this paper will make a modest contribution to ongoing efforts to develop social and cultural methods based on Barad's thought (Orlikowski and Scott 2015; St. Pierre et al. 2016).

1. In What Sense Standard?

Mores, manners, norms, habits, conventions, customs, traditions, standards, codes, regulations and laws are often assumed to be discrete and well-defined things. This is both a semantic and an epistemological tendency. As Busch (2011, 4) observes, these divisions are mirrored in the subject topics of academic disciplines. Anthropologists study customs and traditions, sociologists focus on norms and habits, legal scholars study laws, political scientists are interested in regulation, and so on. At a higher level of abstraction, science and engineering confine themselves to natural and technological standards, whereas the social sciences emphasise those of a social nature. The various meanings of the word 'standard' challenge the independence of these terms however. Standards traverse the social and the technological, the human and the nonhuman, and the material and the meaningful, just as they encourage researchers to cross the boundaries between academic disciplines and their topics of enquiry.

The entry for 'standards' in the Oxford English Dictionary (2017) speculates that the term's use as an exemplar of weights and measures is derived from its use as a military ensign. During battle, the king's standard stood for the central point of organisation and command. Similarly, a standard length is the object from which all lengths are obtained. Systems of measurement and calibration can be understood as organised hierarchies of authority, at the apex of which sits the physical embodiment of the measure (Crease 2011).

Standards in the singular plural (as in high standards, or double standards), signifies social norms of virtue or worth (Williams 1983, 298). This is usually what is meant when people refer to a good living standard or a minimum standard of housing. While efforts were made in nineteenth century France to codify a vital minimum level of subsistence for workers (Simmons 2015), typically this kind of standard is implied. More concrete are the standards of ethical practice adopted by professions. Medicine is the most obvious example of this, with the swearing of the Hippocratic oath, however it exists in other occupations as well. The professionalisation of electrical engineering, for example, is historically associated with the formal description and adoption of a standard of practice in nineteenth century Britain (Arapostathis 2008). Explicit occupational certification, as for accounting, is an instrumentation of this idea. Associated with this kind of standard are epistemic issues relating to the establishment of the authority of truth claims, as in the literatures on standards for justification (Boltanski and Thévenot 2006) and evaluation (for example Daston and Galison 2007; Porter 1995; Shapin and Schaffer 1985).

A standard can also refer to something pervasive or well established (such as a jazz standard or a *de facto* industry standard). This sense of the word does not refer to any individual object, nor to a set of social values or norms. It does not imply prefigurative documentation. Rather, it refers

to a class of things which are standard by virtue of their general circulation and repetition. This adjectival use of 'standard' is spatial by definition.

Putting these meanings together, I understand a standard to be any set of rules or values which produces effects in the world – material and discursive, spatial and temporal, human and nonhuman, and social and technological. This definition is broad and encompasses many customs, codes, norms, regulations, laws and so on. Following Busch (2011, 26-27), I find that common distinctions between standards for humans and standards for things (and between private standards and public regulations) do not hold up to scrutiny. Rather than assume or attempt to define these as different, it is necessary to confirm their differences through close empirical examination. Just as actor-network theory proposes an analytical symmetry between human and nonhuman agencies (Callon 1986), so there is no reason to maintain an *a priori* distinction between human and nonhuman standards.

For pragmatic reasons, the two empirical examples I draw on towards the end of this paper are voluntary standards. Voluntary standards are not enforced by a sovereign state but instead are adopted by individuals, organisations and industries under their own aegis. They are also referred to as technical standards or voluntary consensus standards: technical in the sense that they are used to produce technological systems; consensus after the method of their development. Voluntary standards are developed through deliberation and consensus in specialised bodies (known as standards developing organisations or SDOs) such as the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the International Telecommunication Union (ITU) (Murphy and Yates 2009; Schmidt and Werle 1998). They are published as carefully worded documents that describe objects, their encounters and (tolerable limits for) their properties. Some successful examples of this type of standard include: ISO 1161, which describes the design of corner fittings for shipping containers (Murphy and Yates 2009); ISO/IEC 7810, a standard specifying the width of credit cards (Easterling 2014); and ISO 9001, the dominant quality management standard (Furusten 2000; Gibbon and Henriksen 2011). The decision to focus on voluntary standards, rather than standards in general, is in keeping the tentative and exploratory nature of this paper. My aim is not to expand the concept of standards so much as to forward a site-based methodology for their analysis.

2. The Historical Geography of Standards

Standards have both a history and a geography. Their spread is entwined with stories of measurement and precision, voluntary professional

associations, nationally-funded infrastructure projects, and the rise of global audit and management practices.

Research on the spread of metrological systems is largely historical in nature, describing cultures of measurement and comparison, and key moments in the acceptance of universal standards of equivalence (Kula 1989; Alder 2002; Bartky 2007; Crease 2011). In his story of the development of the metre for example, Alder (2002) describes the efforts of two French astronomers to accurately measure the distance between Dunkirk and Barcelona, and so calculate the circumference of the Earth. The universal metre was defined as one ten-millionth the exact distance from the equator to the North Pole and later embodied by a length of platinum stewarded by the International Bureau of Weights and Measures. Taking a broader approach, Crease (2011) draws attention to social conventions of comparison in China and West Africa, before following the story of the International System of Units through to contemporary efforts to tie measurement to universal constants. He describes how the circumference of the Earth fell out of favour as a comparator, superseded in the 1960s by the wavelength emissions of krypton-86 and in the 1980s by the distance travelled by light in a fraction of a second.

Addressing the emergence of technical standards are the histories of precision in engineering (Wise 1995; Alder 1997) and the organisational histories of the SDOs (Schmidt and Werle 1998; Murphy and Yates 2009; Russell 2014). Prior to the 1920s, efforts to co-ordinate social and technological systems were referred to as programmes for uniformity or universalism. The explicit turn to standardisation is linked to Fordism and the Progressive Era in the United States (Russell 2014), and to post-war reconstruction in Europe (Murphy and Yates 2009). Nevertheless, many of the practices involved in the development and implementation of standards can be identified earlier in the labour of machine technicians and engineers. Pressure for precisely and consistently made instruments rose gradually from the late eighteenth century, for use in both war projects (Alder 1997) and civil infrastructure (Wise 1995). Formal standardisation might be thought of as the concretisation of these tendencies into more ardent political and economic agendas. Russell (2014, 64) emphasises the leadership of the private sector in early such efforts in the United States. Standardisation, it was declared in 1926, was "a step toward industrial self-government" (Agnew 1926; cited in Russell 2014, 58) – a self-conscious industrial society was believed capable of co-ordinating and limiting its activities without state intervention. Elsewhere, standardisation is more directly connected to a push for market integration and globalisation. In the 1970s, ISO expanded rapidly under the directorship of Swedish civil engineer Olle Sturén. While he, like the Americans, believed in a values-driven economics, Sturén's ambition was more internationalist. Co-operation with UN agencies, the European Economic Community and the General Agreement on Tariffs and Trade became a cen-

tral responsibility of ISO (Murphy and Yates 2009, 20).

Empirical studies on standards are broad. For example, research has been published on standards for construction (Ben-Joseph 2005; Talen 2012), the environment (Tollefson et al. 2008; Bresnihan 2016), financial services (Porter 2005; Vestergaard and Højland 2011), food and agriculture (Dunn 2003; Bingen and Busch 2006), governance (Barry 2001; Higgins and Larner 2010), healthcare (Bowker and Star 1999; Timmermans and Berg 2003), information systems (Schmidt and Werle 1998; Galloway 2004) and management (Brunsson and Jacobsson 2000; Ponte et al. 2011). Beyond these explicit examples, it is often the case, as Timmermans and Epstein (2010) have argued, that standards skulk in the shadows of many areas of sociological study.

In keeping with the examples of IPv4 and ISO 9001, I want to describe in a little more detail some of the literature on standards for information and communications technology, and their use in the normalisation of bodies, behaviour and social organisation. For Schmidt and Werle (1998), Group 3 facsimile standards, developed at ITU in the 1980s, present an opportunity to explore where formal standards originate, how they are negotiated and the kinds of political, economic and technical pressures they must bear. Technical standards are co-ordination technologies, the authors argue, ordering and interfacing not only the machinery of exchange but also the stakeholders invested in their development. For Galloway (2004), the internet protocols TCP/IP (Transmission Control Protocol/Internet Protocol) and DNS (Domain Name System) are indicative of the distributed but nevertheless selective forms of cultural production inherent to the present political economic regime. This is reflected in the nominally open manner in which the protocols are developed and in the logics of control which they exercise. While on one level TCP/IP distributes the provision of web content, on another DNS bundles-up and recentralises the grammar by which that content is accessed. In addition to these two examples, there is an extensive literature describing the histories of telecommunications and internet standardisation (see for example Abbate 1999; DeNardis 2009; Russell 2014).

In an important work, Bowker and Star (1999) establish an agenda for the study of standards for nomenclature and categorisation. Memorably, they describe the apparatus of race classification in apartheid South Africa and the trajectories and torques it imposed on people's personal and professional lives. The programme pioneered by Bowker and Star is augmented and extended in Timmermans and Berg's (2003) *The gold standard* and in the edited collection *Standards and their stories* (Lampland and Star 2009). Additional works assembled by Brunsson and Jacobsson (2000), Higgins and Larner (2010), and Ponte, Gibbon and Vestergaard (2011) have advanced an organisational and governance perspective on process standards. Since the success of ISO 9001 in the early 1990s, SDOs have increasingly sought to use standards to formalise and promote

management systems. While this might be thought of as a renewed push for industrial self-government, present-day organisational standards are conditioned by 30 years of globalisation and neoliberal policy experimentation (Busch 2011; Easterling 2014). This is less about actively undermining state power than it is about resetting its appropriate boundaries and behaviours.

The impressive breadth of historical and empirical research on standards is emblematic of their reach into social, political and economic life. Any theory of standards and standardisation needs to be sensitive to their social, spatial and temporal context.

3. Thinking about the Spaces of Standardisation

Empirical work on standards and standardisation often operates within an implied scaffolding of absolute space. Space is regarded as a framework of co-ordinates against which global, decontextualised standards touch down in local settings. This is referred to indirectly through uncritical use of concepts such as location and distance (and through the use of metric or imperial units). While this approach is usually adopted pragmatically, its underlying assumptions have been challenged by the critical social sciences. Since the 1970s human geographers in particular have explored the many ways in which space is *produced*, first through the dialects of capitalist production (for example Harvey 2006; Smith 2010) then by way of postmodern and poststructural experimentation with relational ontologies (for example Soja 1989; Crang and Thrift 2000). What these accounts share is an appreciation of space as an ongoing process, and a sensitivity to its role in social and political difference.

Rather than approach standards as an end product or established fact, this shift encourages a reconsideration of standards as unfolding phenomena. The word 'standardisation' is used to specify the process or practices by which something is made standard. In this section, I discuss two broad phases of poststructural thought on the spaces of standardisation. The first uses the metaphor of 'the network' to rethink the relationship between society and technology. The second has sought to advance spatial topologies in different terms. My preference for the second approach opens up a discussion of site ontologies.

Originating in science and technology studies in the mid-1980s, actor-network theory brackets off the ontological problem of the global and the local by focusing on the spatiality of relations. Standards are not described according to location and distance, but connective geometry. An arrangement of interacting actors is perceived as a relational network, which at a different scale of analysis might in turn be perceived as an actor. By following and describing actor-networks, practitioners hope to obtain appreciation for the complexities of the material world. Four con-

ceptual considerations of standards as networks are introduced: Latour's (1990) immutable mobiles; O'Connell's (1993) approach to metrology; Callon's (1991; 1998) irreversibility and stabilisation; and Loconto and Busch's (2010) discussion of a tripartite standards regime. By presenting them in this order, I follow a shift in emphasis from the standardised object to the standardising apparatus.

The immutable mobile is Latour's materialist answer to an epistemological question: how is it that observations cohere and harden into fact? The example with which he introduces the concept is instructive (Latour 1990, 24). Traced in the sand, a map of a coastline is able to convey the information necessary for safe sailing. It selectively draws together the relevant relationships in a manner legible to individuals of different cultural backgrounds. But with the rising tide the map is washed away. For a map to convey its information through space and time, it needs to be written on paper, thus becoming both immutable and mobile. Rather than explain the establishment of facts using method, evidence, argument or social standing, Latour is interested in the materials and representations deployed to assemble allies to an idea. His ultimate purpose is to disclose the mechanics of scientific practice – its mundane activities which are so often taken for granted. Law and Mol (2001), in their exploration of the concept's topology, insist that immutable mobiles are situated between two spatialities: regional space, which prioritises location and relational co-ordinates, and network space, which is concerned with connection rather than position. For them, it is immutability in network space that confers the potential for mobility in regional space. The applicability of the immutable mobile to standardisation has been seized upon by Collier and Ong (2005).

In an eclectic paper, O'Connell (1993) extends the concept to help explain how systems of measurement and comparison are established. Unlike Latour, he is not interested in the persuasiveness of immutable mobiles so much as the communities of conference and exchange that are put into operation around them. O'Connell argues that metrological practices are stabilised "by establishing the authority of a particular representative, circulating it, and assuring that comparisons are made to it" (O'Connell 1993, 165). His point is that a standard is both particular and (in aspiration) universal, embodied within an indivisible object but constructed as a singular authority through the ubiquity of its relations. The appearance of universality is achieved through circulation and implementation.

Even more interested in the stabilisation of practice is Callon (1991), whose theorisation of techno-economic networks encompasses standards and standardisation. Considered as a set of heterogeneous actors bound by the intentionality of their productive methods, Callon's conceptualisation is used to explain how science and technology result from interactions between a large number of diverse components. While the paper in-

troduces many interrelated terms, I am particularly interested in 'irreversibility' and 'stabilisation'. As networks become larger and enrol ever more numerous and diverse components, they resist mutation and change. If this proceeds far enough, a 'codified metrology' can emerge.

> Normalisation makes a series of links predictable, limits fluctuations, aligns actors and intermediaries, and cuts down the number of translations and the amount of information put into circulation. It operates by standardising interfaces – that is, by standardising and constraining actors and intermediaries (Callon 1991, 151).

In such a network, the variety of action performed by any one actor is limited. It becomes docile and predictable, constrained by the norms of the network. The irreversibility of individual practice implies stabilisation of the whole. This has implications for how standards are conceived. Emphasis is placed less on the circulation of a particular fixed actor (the standard), than on the relational fixity of a set of interactions.

Intrigued but not fully convinced by actor-network theory, Loconto and Busch (2010) set out to elaborate the politics of the institutional apparatus of standardisation. Through a discussion of the activities of the SDOs and national accreditation bodies, the authors disclose a tripartite standards regime consisting of standards-making, certification and accreditation. The deliberate act of standardisation is thus brought into relief: "Standards are the values against which people, practices and things are measured, while standardization is the process of making things standard" (Loconto and Busch 2010, 526). Callon's language of techno-economic networks is drawn on to signify the relations at play. Standardising devices are held to co-ordinate and constrain the range of activities available to actors in what is ostensibly a form of irreversibility. But the resulting stabilisation is more explicitly political than what Callon intended. The network is reconfigured as "a market economy, rather than a political or moral economy" (Loconto and Busch 2010, 527) – the space it affords is calculative and coterminous with neoliberal 'governance at distance'.

While these four approaches to standards and standardisation are subtly different, they share philosophical ground. All are materialist, empiricist and adopt a relational ontology in which the boundaries between objects blur. Accordingly, the language of absolute space gives way to a description of the geometries of association. 'Global' and 'local' are replaced by 'network', and connection is explored in terms of character and intensity, rather than location and distance. In this way, standardisation comes to be understood as a stabilisation of object-relations. This is evident in the immutability of Latour's immutable mobiles and in the irreversibility of Callon's techno-economic networks. Although this work is an important corrective to more fixed spatial imaginaries, two issues point to its limit. First, in prioritising connection, something of the presence of

things in the world is lost. The vitality of matter is always at risk of being overwhelmed by the stabilisation of its relationality; the agentive potential of the chance encounter is lost. Second, and following on from this, is a tendency to bifurcate space into relational and material planes. This occurs when actor-networks are made to touch the world, as when Law and Mol (2001) theorise the topology of immutable mobiles as both regional and networked. The problem of the global and the local returns in a new guise.

Other approaches to standards have attempted to work through this problem without networks. Three are worth discussing: technological zones (Barry 2006), global assemblages (Collier and Ong 2005), and site ontologies (Woodward et al. 2010).

The technological zone challenges the opposition between national territories and the deterritorialised flows of capital. Barry (2001; 2006) defines it as a space within which technical practices have been brought into alignment. In other words, the technological zone is a space produced by the adoption of common standards. This is a distinctly political space, conceived in relation to nation states and transnational corporations. But the term evades most apprehensions of territories, markets and networks.

> Zones are not structures, territories or regions, but discontinuous spaces of circulation and regulation. They are not bounded by continuous borders but interrupted by shifting restrictions and blockages and points of conflict. (Barry 2001, 41)

Technological zones can be thought of as a kind of topology. They can overlap or enfold one another. Depending on their intersections with state and corporate spaces, they entail both technical uniformity, and social and political differentiation. While Barry (2001) maintains that zones are not fixed but always in process, demanding constant maintenance and reconfiguration, they are nevertheless path-dependent (Barry 2006, 242).

More open to disruption and dysfunction is the concept of the global assemblage, as set out by Collier and Ong (2005) in the introduction to an edited collection on the problem of global phenomena to anthropology. Here, the word 'global' refers to the capacity for something to be deracinated, transported across social and cultural fields, and take root in a new contextual milieu. This is not understood as a social operation, but rather a technical one, dependent upon material infrastructure, and administrative values and practices. A global assemblage then, is the space of interaction between a global form and the context in which it is articulated. To call such context a locality however is a mistake. Rather, an assemblage is understood as contingent and multiple; a coming together of agencies. It is therefore irreducible to a single logic. As the authors put it, "the term 'global assemblage' suggests inherent tensions: global implies

broadly encompassing, seamless, and mobile; assemblage implies heterogeneous, contingent, unstable, partial, and situated" (Collier and Ong 2005, 12). A global assemblage can thus be understood as the site through which contradictions between the global and the local play out.

In an effort to rethink the spatiality of social movements, McFarlane (2009) pushes back against the 'global' in global assemblage. While he understands that Collier and Ong want to avoid confining assemblages to a particular scale, he nevertheless feels that the concept evokes the scalar hierarchy of the global and the local. As an alternative, McFarlane uses the awkward prefix 'translocal', by which he means to signify multi-sited formations through which things occur.

This position dovetails nicely with Woodward, Jones and Marston's (2010) call for ontologies of the site. Briefly stated, a site ontology is an approach to the description and interpretation of bodies in action and connection (Schatzki 2002). It is neither interested in elaborating encounters between discrete, ready-formed objects, nor in attempting to uncover deeply hidden explanatory forces. Rather, site ontologies focus on material practices and orders of meaning imminent to unfolding events. Social and spatial interpretation is conducted with a light touch, leaving open the possibility for unexpected political impulses and effects. While actor-network theory, particularly in early permutations presented here, emphasises stabilisation, site ontology takes seriously the challenge of propinquity, slippage and happenstance. Important to the argument I have been pursuing, space is not considered external to the site but an expression of its internal logics. Site ontologies therefore undermine the mediating qualities of space (whether construed as a static scaffold, a network configuration or a zone of operation), preferring to reconfigure such effects as an outcome of enactment. Put differently, in this approach the spaces of standardisation do not exert a power which extends beyond the act of their performance.

The spaces of standardisation have been thought of in a number of ways. The most intuitive is as process in which something global or transcendental affects local circumstances. In opposition to this, I have presented a handful of poststructural attempts to denature the integrity of these spatial concepts and think beyond them. Actor-network theory has long granted the spaces of standardisation critical attention. While I find its interventions important, I have argued that limits to the metaphor of 'the network' curb the potential for political agency. In an effort to open up a new analytical perspective, I have introduced the notion of site ontologies, in which space is conceived as emergent with phenomenal enactment. While this philosophical disposition has great potential for research on standards and standardisation, little has been done to develop what this might involve.

4. Towards a Baradian Approach to Standards Research

In *Meeting the Universe Halfway*, Karen Barad (2007) elaborates a metaphysics dedicated to the realism and naturalism of entangled agencies. The primary ontological unit in her philosophy are phenomena, understood as "relations without preexisting relata" (Barad 2007, 139). Within a phenomenal enactment, the intra-action (i.e., interaction within a manifold) of enmeshed posthuman agencies resolve into objects, agents, materials and meanings. For Barad, performative action precedes individuation, subjectification and their attendant physical, social, spatial and temporal apprehensions. Agency is understood as preindividual (Dolphijn and van der Tuin 2012). Surfaces, properties and identities are not inherent to objects but the result of an agential cut applied to an entanglement of relations. Thus, Barad positions the constitution of phenomena prior to the familiar structuring binaries of western thought: nature-culture, subject-object and ontology-epistemology.

Because of the primacy it affords the performative event, Barad's realist philosophy can be referred to as a site ontology (see also Barad 2012). Barad does not use the term site however, preferring to approach spatiality through the concept of the 'spacetimematter manifold'. The term 'manifold' originates in the mathematical field of topology and here signifies a non-Euclidean, multidimensional space of relations. For Barad, matter and meaning are assembled within the manifold, their complex connections and disjunctions expressed in an imbroglio of twists, knots and breaks. She describes the spatial arrangement using the metaphor of bread dough:

> Imagine putting drops of colored dyes into a piece of bread dough. As you knead the dough, the dyes spread out in different patterns of entangled lines and surfaces. But this process is too tame… the changes are all continuous and the dough maintains its topology. So break off some pieces and reattach them to different areas and continue kneading. Take a different kind of dough and make a different manifold with different lines, surfaces, and volumes of colour. Intermingle the dough pieces: new entanglements form, new possibilities emerge. (Barad 2007, 439, note 85)

As an event takes place, the manifold is cut, producing the subjects, objects, spacings and timings so familiar to everyday experience. Materiality, spatiality and temporality are all a result of the expression of the manifold.

Within a Baradian framework, the context of a standard is approached as a 'material-discursive apparatus of bodily production'. This wordy concept needs unpacking. First, the hyphenation of the 'material' and the 'discursive' acts to recognise their ontogenetic entailment and mutual irreducibility: "Neither discursive practices nor material phenom-

ena are ontologically or epistemologically prior. Neither can be explained in terms of the other. Neither is reducible to the other" (Barad 2007, 152). For Barad, it is important to appreciate the agency of matter in producing effects in the world. Second, where Foucault (1980, 194) used 'apparatus' as a way to map out the discursive and nondiscursive practices which give statements meaning, Barad uses the term to encompass the Foucaultian apparatus *and* the apparatus of the scientific experiment. Barad asserts that all scientific experimentation enlists intangible and often unanticipated cultural relations (such as the knowledge and experience of the technician, the most recent outcome of funding applications and the general mood in the laboratory), and that broader social norms and practices are historically interwoven with the vitality and dynamism of matter (that it would be a mistake, for example, to discuss gender without acknowledging the constitutive potential of human bodies, reproductive technologies and health care institutions). Again, the purpose is to acknowledge the mess of agencies swept into the manifold. Third, 'bodily' is used generally. It refers in the first instance to human bodies and other individuated physical bodies (including those of nonhuman lifeforms, technical instruments, land masses, *etc.*), but also might be extended to cover cultural and social bodies (e.g., bodies of text or the body politic). It is intended, following Foucault (1977), to foreground the sites on which power works, but following Haraway (1988), to emphasise the ontological and objectivist ambition of the concept. In summary, the 'material-discursive apparatus of bodily production' is the imminent structure which iteratively configures the agential cut made to the manifold. It includes discursive practices but is broader than them, also encompassing the productivity of nonhuman agency and the manifold on which these things go to work.

To bring Barad's apparatus in closer alignment with a study of standards it is necessary to drill down on another concept she deploys: 'iteration'. For Barad, bodies are continually materialised and identified through the *repetition* of their formative practices. This is encapsulated by 'iterative citationality' which is borrowed from Butler (1993), who in turn adopts it from Derrida (1974; 1988). Iteration is not simply the repetition of the same. Rather, it signifies the difference or modification entailed in repetition. While an iteration necessarily carries something of the same, such that it can be recognised, it nevertheless opens up the possibility for something new (Cuddon 2013, 373). Derrida understood this principally as an operation of words and concepts. Thus, in speaking we cite previous utterances and conceptualisations. But through Butler and Barad, the term takes on new meaning. Specifically, it refers to the working and reworking of power on bodies, and to the configuration and reconfiguration of cuts on manifolds. As such, the *historicity* of matter in its enactment is brought to the fore.

Having laid the groundwork, it is possible to move on to a discussion

of methodology. Barad advocates a kind of social analysis referred to as a 'genealogy of the material-discursive apparatuses of bodily production' (Barad 2007, 451, note 25). For the most part, her use of 'genealogy' adheres to the method developed by Foucault (see Dreyfus and Rabinow 1983). It is necessary to mark two key differences however. The first pertains to her posthuman performativity. The second to her conceptualisation of power.

The weakness of genealogical accounts, according to Barad, is that they tend to overemphasise epistemology. By focusing on the ways in which things in the world are known, rather than the things themselves, human and nonhuman agencies are collapsed into a concern with representation. Materiality is thereby rendered flat and unresponsive. This plays out differently in the work of Foucault and Butler. When Foucault discloses a productive apparatus it is too steeped in the realm of meaning (Barad 2007, 65). The body does not push back against the iterations of power inscribed upon it. While Butler is better on this front, opening up a discussion of the agency of bodies, according to Barad (2007, 145) her genealogy is too anthropocentric. The attention given to the production of human bodies crowds out the nonhuman from the performative event.

An approach more balanced than Foucault's or Butler's would refuse to give preference to human agency over nonhuman agency and meaning over materiality. Barad (2003) theorises this as 'posthumanist performativity'. Two strands of feminist thought are being drawn on here. While the origins of the concept of 'performativity' can be traced to J. L. Austen's theory of speech acts, wherein an utterance consummates an action (Sedgwick 1993) – "I now pronounce you husband and wife" – Barad is more explicitly citing Butler (1990; 1993), whose focus is the association between the performativity of gender and the production of sexed bodies (Barad 2007, 413, note 39). Over the last two decades, the term has been used widely to signify the *effects* of a set of ideas, logics or discursive practices (Butler 2010). As such, performativity allows genealogy to move beyond representation into a description of things in their becoming. The posthumanism evoked by Barad is inflected by the antihumanism of Foucault and the cyborg imaginary of Haraway (1991). It refers not only to a deconstruction of liberal notions of the human subject but to a positive statement on the kinds of things that are able to act. For the posthumanist, agency must be extended to matter in all its forms and not be limited to human (or to ecological) life (see also Bennett 2010; Braidotti 2013). To adopt a posthuman perspective on performativity then, is to perceive material phenomena and meaningful effects as the outcome of action amongst a complex and heterogeneous mess of agencies.

Before she can fully advocate for a Foucaultian genealogy, Barad needs to account for the operation of power. This is achieved, in part, through her discussion of the monograph *Producing Workers: The Politics of Gender, Class, and Culture in the Calcutta Jute Mills* (Fernandes

1997). This ethnographic study explores in detail how structures of class, caste and gender are cited and enacted. Sociological forces are not held to be transcendental to the affects and practices of the workplace but immanent to them: expressed in positions and activities; marking bodies in overlapping and interpenetrating ways; reworked by the meanings and representations with which they are understood (Barad 2007, 229). Foucault's interpretation of power is thus used to reset the terms of the structure-agency debate. Rather than act in an all-encompassing and repressive manner, structure is brought into the manifold as force relations or social alignments (see also Wartenberg 1990). Power does not stand above (or before) things and events. Instead it refers to the sedimentation of (re)iterated agential cuts and to the breadth of effects that are thereby produced: "the forces at work in the materialization of bodies are not only social, and the materialized bodies are not all human" (Barad 2007, 235). Barad approaches power as a Foucaultian but is interested in opening it up to nonhuman agency and to an analysis of (ontologically flat) social structures. Thus, in conducting a genealogy of workers in a jute mill, the material-discursive apparatuses of bodily production which condition powerful effects in the workplace are subjected to the interpretive analytics of Foucault's method.

As human agency is always already caught up within the manifold, there is no possibility of standing outside. The researcher is entwined with their object of study; indeed, they are produced through their intra-actions with it. To see, listen and reveal are all deeply ethical activities. Similarly, Barad is careful to assert that the manifold is open-ended in the sense that there remains the possibility for political change. Human agency is only part of any one mattering but it is a part. In every phenomenon there is an opportunity to effect when, where and how the agential cut is made. But that potential is not boundless. Rather, Barad (2007, 147) envisages a field of possibilities and impossibilities, a multiplicity slowly configured and reconfigured through reiterative enactment. In becoming political subjects, we affect the objects and relations with which we are co-constituted, an act which in turn affects subsequent iterations.

To summarise, the suitability of Barad's metaphysics to the study of standards rests on three theoretical moves. The first is the foregrounding of the site of enactment. Rather than depend upon spatial metaphors external to the event of a standard's implementation, space is conceived as an ongoing process. This rejects the static co-ordinates assumed by the majority of standards research but exposes a rich mix of productive agencies. There is a risk that by fixing analysis upon the moment at which a standard is implemented, how the standard came to be is ignored. Stabilisation could become of greater significance than circulation. But this risk is diminished by the second move: acknowledging the importance of iteration to the process of standardisation. By recognising that standardised practices cite previous articulations and instantiations, this trap is avoided

and the historicity of a standard is fully exposed. But iteration involves 'the same' as well as 'the different', just as standardisation does entail some form of repetition. Hence, with the third move, the stabilisation of a standard is understood through Foucault's conceptualisation of power. Standards are not inherently powerful but can become as much through their circulation and implementation. A widely-adopted standard can thus be thought of as an alignment of discursive and nondiscursive practices or a sedimentation of the cuts made by an apparatus of bodily production.

Standards are not only the rules and values which bring order to a messy world, but also must include the more-than-human context through which those standards were developed and are continually brought about. As such, the event of a standard's implementation should be approached as an ontologically transgressive entanglement of presences and absences, materials and meanings, and natures and cultures. It is only through iterative enactment that this apparatus acquires the power to enforce the neat categorization of things. Thus, Baradian analysis entails a description of the materialities and meanings of a standard's site of implementation, combined with a genealogical interpretation of its conditioning apparatus.

5. Rethinking IPv4 and ISO 9001 through the Concept of Site

Robust genealogy demands patient and detailed description. Given the space remaining, it is impossible to fully achieve this here. Nevertheless, I want to give an indication of the spatial and social perspective of material-discursive genealogy. IPv4 and ISO 9001 serve as my examples.

5.1. The Site of the Internet

When a data packet is sent between two computers using the internet, it is structured according to a document published by the Internet Engineering Taskforce in 1981: Request for Comments (RFC) 791. In this document, expectations for the metadata contained within a data packet are described. What to include, what to leave out and how many bits to allocate each data field were all debated in the months preceding the publication of the RFC. This was further conditioned by the expertise of engineers working on the internet protocols, their institutional and organisational affiliations and the generous funding programme afforded them by the National Science Foundation (DeNardis 2009). The result is a text that is seldom read, but exceedingly powerful. According to a Baradian approach, whenever IPv4 is enacted, RFC 791 and its history (including

the politics of its development and dissemination) are cited and enfolded into the site.

While the internet is commonly perceived as a network, Barad's metaphysics open up an alternative perspective. Whenever data are sent using IPv4, the protocol and its context, conceived as an apparatus, coalesce with the particular agencies of the data packet – the bits which code for it, the computer hardware which supports it, the cables between its origin and destination, the desires initiating its transmission and the partial meanings it carries. All of this is bound together into a relational knot (what I refer to as a site and Barad a spacetimematter manifold), only to resolve into the signal, its spatial arrangement, its timing and its cultural associations. Construed as such, the internet is less a network than an outcome of the citation and realisation of IPv4 and the other internet protocols. In this inversion of the usual spatial logic, the network is interpreted as a performative spatial effect of continuous and ongoing materialisations.

But what is the purpose of this inversion? First, it reveals the variety and heterogeneity of constitutive agencies. The internet does not arrive, stable and fully formed, at a site of encounter. Rather, it is produced from a multitude of material and discursive agencies. Second, the Baradian inversion allows – on a theoretical level, at least – a wide ranging discussion of constitutive relations, and social and political outcomes. In the example of IPv4, the infrastructural trajectories are so well established that what occurs seldom deviates from what is expected. The field of possibilities is so narrow that the protocol and its context appear to fall away. To inventory them as I have begun to do seems speculative, if not pedantic. Nevertheless, a strength of Barad's metaphysics is in the way this background is brought into view.

5.2. The Power of (Re)iterative Quality Practices

ISO 9001 is used to establish quality management systems. Firms seeking compliance are required to formerly document their quality practices and show proof of their adherence to them. The standard does not define how a firm should go about producing products and services, but offers an adaptable set of management principles to help expose and regularise existing business processes. Effectively, it creates a paper trail, extending the reach of auditors to include the *activities* of industry, along with its outcomes.

Given its flexibility and its focus on process rather than performance, the event of ISO 9001's implementation is difficult to isolate. The standard is most obviously cited in the initial formulation of a firm's quality documents. Nevertheless, it would be a mistake to limit ISO 9001 to a realm of representation. It makes more sense that the standard should be described as operating in a fragmented, multiple and incomplete manner.

I therefore understand any business practice for which a formal document exists to also be an enactment of ISO 9001. Certainly, the agency of the standard within such a site will always be partial; its ability to structure and order outcomes will depend on the circumstance. But the power of ISO 9001 is to be found not in the paper trail it produces, so much as in the ubiquity, frequency and subtlety of its effects. As such, a Baradian analysis of the standard draws attention to the molecular and accumulative manner in which power operates.

Through its many sitings the historicity of ISO 9001 is continually brought to bear on the present. This includes both the development of the standard and the steady intensification of its use. ISO 9001's text originated as a mid-1960s quality standard to promote multilateral contract sharing and outsourcing between NATO nations (Gibbon and Henriksen 2011). From here, it was adopted by the UK Ministry of Defence and found its way into British Standard (BS) 5750:1979, before being discussed at ISO in the mid-1980s. The ascendency of the *logic* of quality management is more general than this and has been linked both to the presence of US management consultant W. Edwards Deming in post-war Japan (Murphy and Yates 2009, 72; Busch 2011, 129) and to the backlash against Japanese industry's later incursion into Western consumer markets (Higgins and Hallstrom 2007). Whether by one route or another, the discursive and nondiscursive practices of quality management were long in circulation before the publication of ISO 9001 in 1987. Nevertheless, the sense of objectivity and authority granted by the ISO has legitimised the culture of quality assurance (Mendel 2006).

Perhaps a word of caution is in order. There is a risk of overplaying the distinct agency of ISO 9001 when describing the rise of quality management. Many structuring dynamics are implicated in the material-discursive becoming of quality practices, not the least of which is the neoliberal urge to maximise market information through a regime of quantification, calculation and accountability. While material-discursive genealogy reveals these broader cultural trends, emphasis ought to remain on their operation within the site (i.e., their intersections with ISO 9001 and other local agencies to bring bodies and subjectivities into being). The particular attraction of standards is that they help disclose the shape and intensity of such functions of power. Rather than understand quality management as a transcendental ideology, a Baradian approach breaks it down into a series of practices which, through repetition, rework what can be meaningfully said and done.

Conclusions

This paper has argued for a reconsideration of the spaces of standardisation using a site-based methodology based on the work of Karen Bar-

ad. Rather than conceive of standardised objects as moving and interacting *in* space, it has advanced a position in which space is produced alongside material enactment. Standards are thus understood as an ongoing achievement of powerful apparatuses. By rethinking standards through the concept of site, they are opened up to a diverse range of material and discursive agencies.

My sample of what a Baradian material-discursive genealogy of a standard would involve is limited in two respects. The first is the brevity of these accounts. Genealogy involves the slow and patient description of material, social and historical associations. What I have presented does not try to achieve that. The second is the pragmatically bounded approach to standards. I consider voluntary standards to be a subset of what the concept of 'standard' entails. As such, the need remains to both offer a thorough genealogy of a voluntary standard and to attempt to flesh out how the methodology might be extended to standards in general. The purpose of this paper has been to lay the groundwork for how this might be achieved. Nevertheless, from the two examples presented, I hope to have shown that the methodology offers an interesting perspective on the spatial forms of dispersed infrastructure, and on the shape and intensity of power in cultures of corporate auditing and management.

Acknowledgments

My thanks to Claudio Coletta, Aphra Kerr, Rob Kitchin, Udo Krautwurst, Francesca Musiani and Annalisa Pelizza for their feedback and support. The research for this paper was provided by a European Research Council Advanced Investigator Award, 'The Programmable City' (ERC-2012-AdG-323636).

References

Abbate, J. (1999) *Inventing the Internet*, Cambridge, MIT Press.

Agnew, P.G. (1926) *A Step Toward Industrial Self-Government*, in "The New Republic", March 17, p. 95.

Alder, K. (1997) *Engineering the Revolution: Arms and Enlightenment in France, 1763-1815*, Princeton, NJ, Princeton University Press.

Alder, K. (2002) *The Measure of All Things: The seven-year-odyssey that transformed the world*, London, Abacus.

Arapostathis, S. (2008) *Morality, Locality and 'Standardization' in the Work of British Consulting Electrical Engineers, 1880-1914*, in I. Inkster (ed.), *History of Technology, Volume Twenty-eight*, London and New York, Continuum, pp. 53-74.

Arthur, W.B. (1989) *Competing Technologies, Increasing Returns and Lock-in by Historical Events*, in "The Economic Journal", 99 (394), pp. 116-131.

Barad, K. (2003) *Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter*, in "Signs: Journal of Women in Culture and Society", 28 (3), pp. 801-831.

Barad, K. (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham, NC, Duke University Press.

Barad, K. (2012) *On touching. The inhuman that therefore I am*, in "Differences: A Journal of Feminist Cultural Studies", 23 (3), pp. 206-223.

Barry, A. (2001) *Political Machines: Governing a Technological Society*, London, The Athlone Press.

Barry, A. (2006) *Technological Zones*, in "European Journal of Social Theory", 9 (2), pp. 239-253.

Bartky, I.R. (2007) *One Time Fits All: The Campaigns for Global Uniformity*, Stanford, CA, Stanford University Press.

Ben-Joseph, E. (2005) *The Code of the City: Standards and the Hidden Language of Place Making*, Cambridge, MIT Press.

Bennett, J. (2010) *Vibrant Matter: A Political Ecology of Things*, Durham and London, Duke University Press.

Bingen, J. and Busch, L. (eds.) (2006) *Agricultural Standards: The Shape of the Global Food and Fiber System*, Dordrecht, Springer.

Boltanski, L. and Thévenot, L. (2006) *On Justification: Economies of Worth*, Princeton and Oxford, Princeton University Press.

Bowker, G.C. and Star, S.L. (1999) *Sorting Things Out: Classification and Its Consequences*, Cambridge, MIT Press.

Braidotti, R. (2013) *The posthuman*, Cambridge and Malden, Polity Press.

Bresnihan, P. (2016) *Transforming the Fisheries: Neoliberalism, Nature, and the Commons*, Lincoln and London, University of Nebraska Press.

Brunsson, N. and Jacobsson, B. (eds.) (2000) *A World of Standards*, Oxford, Oxford University Press.

Busch, L. (2011) *Standards: Recipes for Reality*, Cambridge, MIT Press.

Butler, J. (1990) *Gender Trouble: Feminism and the Subversion of Identity*, London, Routledge.

Butler, J. (1993) *Bodies That Matter: On the discursive limits of 'sex'*, London, Routledge.

Butler, J. (2010) *Performative Agency*, in "Journal of Cultural Economy", 3 (2), pp. 147-161.

Callon, M. (1986) *Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay*, in J. Law (ed.), *Power, action and belief: A new sociology of knowledge?*, London, Routledge, pp. 196-223.

Callon, M. (1991) *Techno-economic networks and irreversibility*, in J. Law (ed.), *A Sociology of Monsters: Essays on Power, Technology and Domination*, London, Routledge, pp. 132–161.

Callon, M. (1998) *Introduction: the embeddedness of economic markets in economics*, in "The Sociological Review", 46 (S1), pp. 1-57.

Collier, S.J. and Ong, A. (2005) *Global Assemblages, Anthropological Problems*, in A. Ong and S.J. Collier (eds.), *Global Assemblages: Technology, Politics and Ethics as Anthropological Problems*, Malden, MA, Blackwell, pp. 3-21.

Crang, M. and Thrift, N. (eds.) (2000) *Thinking Space*, London, Routledge.

Crease, R.P. (2011) *World in the Balance: The Historic Quest for an Absolute System of Measurement*, New York, W.W. Norton & Company.

Cuddon, J.A. (2013) *A Dictionary of Literary Terms and Literary Terms* (fifth ed.), Chichester, Wiley-Blackwell.

Daston, L. and Galison, P. (2007) *Objectivity*, New York, Zone Books.

DeNardis, L. (2009) *Protocol Politics: The Globalization of Internet Governance*, Cambridge, MA, MIT Press.

Derrida, J. (1974) *White Mythology: Metaphor in the Text of Philosophy*, in "New Literary History", 6 (1), pp. 5-74.

Derrida, J. (1988) *Signature Event Context*, in *Limited Inc*, Evanston, IL, Northwestern University Press, pp. 1-23.

Dolphijn, R. and van der Tuin, I. (2012) *"Matter feels, converses, suffers, desires, yearns and remembers": Interview with Karen Barad*, in *New Materialism: Interviews & Cartographies*, Ann Arbor, MI, Open Humanities Press, pp. 48-70.

Dreyfus, H.L. and Rabinow, P. (1983) *Michel Foucault: Beyond Structuralism and Hermeneutics* (second ed.), Chicago, University of Chicago Press.

Dunn, E.C. (2003) *Trojan pig: paradoxes of food safety regulation*, in "Environment and Planning A", 35 (8), pp. 1493-1511.

Easterling, K. (2014) *Extrastatecraft: The Power of Infrastructure Space*, London, Verso.

Fernandes, L. (1997) *Producing Workers: The Politics of Gender, Class, and Culture in the Calcutta Jute Mills*, Philadelphia, University of Pennsylvania Press.

Foucault, M. (1977) *Discipline and Punish: The Birth of the Prison*, London, Penguin Books.

Foucault, M. (1980) *The Confession of the Flesh*, in C. Gordon (ed.), *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977*, New York, Pantheon Books, pp. 194-228.

Furusten, S. (2000) *The Knowledge Base of Standards*, in N. Brunsson and B. Jacobsson (eds.), *A World of Standards*, Oxford, Oxford University Press, pp. 71-84.

Galloway, A.R. (2004) *Protocol: How control exists after decentralization*, Cambridge, MIT Press.

Gibbon, P. and Henriksen, L.F. (2011) *On the Pre-history of ISO 9000: The Making of a Neo-liberal Standard*, in S. Ponte, P. Gibbon, and J. Vestergaard (eds.), *Governing through Standards: Origins, Drivers and Limitations*, New York, Palgrave Macmillan, pp. 130-158.

Haraway, D.J. (1988) *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective*, in "Feminist Studies", 14 (3), pp. 575-599.

Haraway, D.J. (1991) *Simians, Cyborgs, and Women: The Reinvention of Nature*, London, Routledge.

Harvey, D. (2006) *The Limits to Capital (Second Edition)*, London, Verso.

Higgins, V. and Larner, W. (eds.) (2010) *Calculating the social: Standards and the reconfiguration of governing*, Basingstoke, Palgrave Macmillan.

Higgins, W. and Hallstrom, K.T. (2007) *Standardization, Globalization and Rationalities of Government*, in "Organization", 14 (5), pp. 685-704.

Kula, W. (1989) *Measures and men*, Princeton, NJ, Princeton University Press.

Lampland, M. and Star, S.L. (eds.) (2009) *Standards and their stories: How quantifying, classifying, and formalizing practices shape everyday life*, Ithaca, Cornell University Press.

Latour, B. (1990) *Drawing things together*, in M. Lynch and S. Woolgar (eds.), *Representation in Scientific Practice*, Cambridge, MA, MIT Press, pp. 19-68.

Law, J. and Mol, A. (2001) *Situating technoscience: An inquiry into spatialities*, in "Environment and Planning D: Society and Space", 19 (5), pp. 609-621.

Loconto, A. and Busch, L. (2010) *Standards, techno-economic networks, and playing fields: Performing the global market economy*, in "Review of International Political Economy", 17 (3), pp. 507-536.

McFarlane, C. (2009) *Translocal assemblages: Space, power and social movements*, in "Geoforum", 40 (4), pp. 561–567.

Mendel, P. (2006) *The Making and Expansion of International Management Standards: The Global Diffusion of ISO 9000 Quality Management Certificates*, in G.S. Drori, J.W. Meyer and H. Hwang (eds.), *Globalization and Organization: World Society and Organizational Change*, Oxford and New York, Oxford University Press, pp. 137-166.

Murphy, C.N. and Yates, J. (2009) *The International Organization for Standardization (ISO): Global governance through voluntary consensus*, London, Routledge.

O'Connell, J. (1993) *Metrology: The Creation of Universality by the Circulation of Particulars*, in "Social Studies of Science", 23 (1), pp. 129-173.

Orlikowski, W.J. and Scott, S.V. (2015) *Exploring Material-Discursive Practices*, in "Journal of Management Studies", 52 (5), pp. 697–705.

Oxford English Dictionary (2017) *standard, n. and adj.*, in http://www.oed.com/view/Entry/188962 (retrieved November 6, 2017).

Ponte, S., Gibbon, P. and Vestergaard, J. (eds.) (2011) *Governing through Standards: Origins, Drivers and Limitations*, Basingstoke, Palgrave Macmillan.

Porter, T. (2005) *Private Authority, Technical Authority, and the Globalization of Accounting Standards*, in "Business and Politics", 7 (3), pp. 427–440.

Porter, T.M. (1995) *Trust in Numbers: The pursuit of objectivity in science and public life*, Princeton, NJ, Princeton University Press.

Russell, A.L. (2014) *Open Standards and the Digital Age: History, Ideology, and Networks*, Cambridge, Cambridge University Press.

Schatzki, T.R. (2002) *The Site of the Social: A philosophical account of the constitution of social life and change*, University Park, PA, The Pennsylvania State University Press.

Schmidt, S.K. and Werle, R. (1998) *Coordinating Technology: Studies in the International Standardization of Telecommunications*, Cambridge, MIT Press.

Sedgwick, E.K. (1993) *Queer Performativity: Henry James's The Art of the Novel*, in "GLQ: A Journal of Lesbian and Gay Studies", 1 (1), pp. 1-16.

Shapin, S. and Schaffer, S. (1985) *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life*, Princeton, NJ, Princeton University Press.

Simmons, D. (2015) *Vital Minimum: Need, science, and politics in modern France*, Chicago, University of Chicago Press.

Smith, N. (2010) *Uneven Development: Nature, Capital, and the Production of Space* (third ed.), Athens, The University of Georgia Press.

Soja, E.W. (1989) *Postmodern Geographies: The Reassertion of Space in Critical Social Theory*, London, Verso.

St. Pierre, E.A., Jackson, A.Y. and Mazzei, L.A. (2016) *New Empiricisms and New Materialisms: Conditions for New Inquiry*, in "Cultural Studies ↔ Critical Methodologies", 16 (2), pp. 99-110.

Star, S.L. and Lampland, M. (2009) *Reckoning with Standards*, in M. Lampland and S.L. Star (eds.), *Standards and their stories: How quantifying, classifying, and formalizing practices shape everyday life*, Ithaca, Cornell University Press, pp. 3-24.

Talen, E. (2012) *City Rules: How Regulations Affect Urban Form*, Washington, DC, Island Press.

Thrift, N. (2004) *Remembering the technological unconscious by foregrounding knowledges of position*, in "Environment and Planning D: Society and Space", 22 (1), pp. 175-190.

Timmermans, S. and Berg, M. (2003) *The gold standard: The Challenge of Evidence-Based Medicine and Standardization in Health Care*, Philadelphia, Temple University Press.

Timmermans, S. and Epstein, S. (2010) *A World of Standards but not a Standard World: Toward a Sociology of Standards and Standardization*, in "Annual Review of Sociology", 36 (1), pp. 69-89.

Tollefson, C., Gale, F. and Haley, D. (2008) *Setting the standard: Certification, Governance, and the Forest Stewardship Council*, Vancouver, The University of British Columbia.

Vestergaard, J. and Højland, M. (2011) *The New Standard in Banking Regulation: From Basel II to Basel III*, in S. Ponte, P. Gibbon, and J. Vestergaard (eds.), *Governing through standards: Origins, drivers and limitations*, Basingstoke, Palgrave Macmillan, pp. 49-74.

Wartenberg, T. (1990) *The Forms of Power: From Domination to Transformation*, Philadelphia, PA, Temple University Press.

Williams, R. (1983) *Keywords: A vocabulary of culture and society* (revised ed.), Oxford, Oxford University Press.

Wise, M.N. (ed.) (1995) *The Values of Precision*, Princeton, NJ, Princeton University Press.

Woodward, K., Jones, J.P.I. and Marston, S.A. (2010) *Of Eagles and Flies: Orientations toward the Site*, in "Area", 42 (3), pp. 271-280.