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A World of Standards but not a Standard World: Toward a Sociology of Standards and Standardization*

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*We dedicate this article to the memory of our friend and mentor Leigh Star.

Key Words

science and technology, expertise and professionals, economics, politics, standard-setting organizations

Abstract

Standards and standardization aim to render the world equivalent across cultures, time, and geography. Standards are ubiquitous but underappreciated tools for regulating and organizing social life in modernity, and they lurk in the background of many sociological works. Reviewing the relevance of standards and standardization in diverse theoretical traditions and sociological subfields, we point to the emergence and institutionalization of standards, the difficulties of making standards work, resistance to standardization, and the multiple outcomes of standards. Rather than associating standardization with totalizing narratives of globalization or dehumanization, we call for careful empirical analysis of the specific and unintended consequences of different sorts of standards operating in distinct social domains.

THE UBIQUITY OF STANDARDS

The world's cargo moves steadily from place to place inside millions of rectangular boxes—standard-sized containers, bearing corporate logos such as Maersk, Hapag-Lloyd, and COSCO, that can be stacked neatly on trains, in ports, and in the holds of ships. Students around the world are regularly assessed and ranked using standardized tests, whose outcomes may determine their career paths. Many doctors, hospitals, and health insurers have embraced evidence-based medicine, promoting standard guidelines to make decisions about how patients should be treated. An ever-increasing number of national and international standard-setting bodies devote themselves to determining which standards should rule and how standards might be enforced. It is easy to observe how life increasingly depends on the creation, institutionalization, use, and dissemination of diverse kinds of standards; it is likewise clear how often political activity takes the form of resistance to the imposition of standards or debates about their appropriate makeup or sway. Yet despite significant and diverse sociological work that intersects with the issue of standardization, the study of standardization remains an underappreciated framework for the analysis of many core aspects of modernity.

In this review, we place standards and standardization in the foreground as ubiquitous but underestimated phenomena that help regulate and calibrate social life by rendering the modern world equivalent across cultures, time, and geography. Standardization may seem to be politically neutral on the surface, but in fact it poses sharp questions for democracy: How do we hold the standard makers accountable? Whose benefits are served by standards? When standards conflict, which ones should prevail? Standardization also raises questions about the role of science and expertise in regulation: What evidence is sufficient or necessary to implement standards? Who should set standards? Which risks are acceptable? Finally, the spread of standardization sparks numerous concerns about consequences. How does

standardization work in domains marked by individualism and localism? How much standardization is necessary for a standard to function as a standard? And, importantly, what does it mean to be nonstandard in a world where standards reign (Star 1991)?

While drawing on general literature on standards from many fields (Bowker & Star 1999, Brunsson & Jacobsson 2000, Lampland & Star 2009), we emphasize the sociological significance of taking standards and standardization seriously. After defining and characterizing our topic, we describe how standardization has emerged as a sociological concern among scholars investigating a range of domains of social life, even while standardization has come to mean somewhat different things to scholars focused on different sorts of problems. Drawing on the existing literature, we then proceed to analyze examples of key aspects of standardization, including creation and resistance, implementation, and outcomes. We conclude by emphasizing the distinctly sociological contribution to the study of standards as well as how the study of standards may, in the future, benefit the work of sociologists who normally consider themselves to be studying other sorts of phenomena. Throughout, we are attentive to the normative dimensions of standardization as a powerful, sometimes subtle, and sometimes not-so-subtle means of organizing modern life. Yet we argue against any simple suggestion that standards or standardization are inherently either good or bad. Instead, we call for careful empirical analysis of the specific (and sometimes unintended) consequences of different sorts of standards operating in distinct social domains.

DEFINITIONS

The literary theorist Raymond Williams (1985) traced the English word “standard,” in its modern senses of a source of authority and a level of achievement, to the fifteenth century. By contrast, he noted, “standardization” came into recognizable use only in the late nineteenth century by way of the domains of science (standardizing the conditions of an experiment) and

manufacturing (standardizing parts). Williams also recognized the odd tension between these two etymologically related terms: Standards are typically deemed laudatory; they are something one aspires to live up to. But standardization in its popular uses is derogatory; it connotes a dull sameness, the suppression of individuality in the service of industrial uniformity. The derogatory connotation persists; it is well captured by Ritzer's (2000) *McDonaldization-of-society* thesis, as well as by much writing that views the standardization of people as inherently dehumanizing. Yet it is hard to see how standards can be purely good while standardization is wholly bad, given that standardization presumes the existence of standards, whereas standards cannot endure with any potency unless they are standardized across social domains (Busch 2000). Standards and standardization typically imply one another, which means that we need greater nuance to understand their implications for a world significantly shaped by both.

Drawing on Bowker & Star (1999), we define standardization as a process of constructing uniformities across time and space, through the generation of agreed-upon rules. The standards thereby created tend to span more than one community of practice or activity site; they make things work together over distance or heterogeneous metrics; and they are usually backed up by external bodies of some sort, such as professional organizations, manufacturers' associations, or the state. In a further elaboration, Lampland & Star (2009) note that standards often are found nested within other standards, that they are distributed relatively unevenly across the social landscape, and that they prescribe ethics and values in ways that matter greatly for individuals. Given the range of meanings packed into the term, it is not surprising that standardization likewise has many possible antonyms: Depending on one's motivating question, the opposite of standardization might be flexibility, discretion, interpretation, diversity, individualism, uniqueness, arbitrariness, anomie, or chaos.

Brunsson & Jacobsson (2000) emphasize that the promulgation and enforcement of

standards is a central type of social regulation. Standards may productively substitute for various other forms of authoritative rule. When organizations or states are weak and cannot coerce behavior through direct orders, standards can fill in the gap to coordinate activity (Brunsson & Jacobsson 2000, p. 32). And although standards are often promulgated by experts, they may come to function as an alternative to expert authority—a way of embedding authority in rules and systems rather than in credentialed professionals (Brunsson & Jacobsson 2000, p. 42). At the same time, regulation via standards can serve as an alternative to regulation through social norms and conventions (Brunsson & Jacobsson 2000, p. 12). To be sure, there is a fuzzy line separating the domain of standards from that of norms and conventions (Lampland & Star 2009, p. 24). Although many standards (for example, building codes) are specified in highly formal ways, other standards (such as the high standards of conduct expected for a vocation) rely on implicit, shared understandings. In this review, we are primarily interested in the more or less formal standards, which tend to be those developed and adopted through explicit procedures that historians can trace. However, there are important examples of scholarship concerning informal standards (Boltanski & Thévenot 2006, Smith 1993), and formal and informal standards may often serve to reinforce one another in practice.

Standards and standardization are thus omnipresent conduits of a modernizing and globalizing world. Yet as Lampland & Star (2009, p. 11) observe, standards quite often fall into the category of “boring things” that fail to elicit much attention or scrutiny. Although standards are often formally (or legally) negotiated outcomes, they also have a way of sinking below the level of social visibility, eventually becoming part of the taken-for-granted technical and moral infrastructure of modern life. Ironically, however, it may be just this relative invisibility that gives standards their “inertia,” as Bowker & Star (1999, p. 14) call it, such that changing them or ignoring them can be difficult, time-consuming, and costly (Thévenot 2009).

Standards certainly are not wholly determinative of the social behaviors that they purport to regulate, as we discuss in more detail below. Certainly compliance with standards often has a more voluntary dimension to it than compliance with many other forms of social regulation (Brunsson & Jacobsson 2000, p. 36). Yet standards can rarely be ignored.

We find it useful to classify standards into four important subtypes (Timmermans & Berg 2003). Design standards set structural specifications: They define the properties and features of tools and products. Such standards are explicit and more or less detailed specifications of individual components of social and/or technical systems, ensuring their uniformity and their mutual compatibility. Terminological standards, such as the International Classification of Diseases, ensure stability of meaning over different sites and times and are essential to the aggregation of individual elements into larger wholes. Performance standards set outcome specifications. For example, a performance standard can specify the maximum level of complication rates deemed acceptable for specific surgical operations. The last category is procedural standards, which specify how processes are to be performed. Such standards delineate the steps that are to be taken when specified conditions are met.

THINKING SOCIOLOGICALLY ABOUT STANDARDS

The sociological literature reveals a fascination with a plethora of standards: labor standards, the standard of living, sexual double standards, grading standards, human rights standards, standards of proof in court, food standards, animal welfare standards, standard time, safety standards, gold standards, standards of decency, national standards in education, and many more. Yet while these specific standards are a frequent object of sociological attention, most such writing adopts the terms in their everyday senses and eschews examination of the broader sociological significance of standard-setting and standardizing. In 1996,

Singer (1996) issued a call for what he termed a sociology of standards, but his concern was with the perception of declining standards among major social institutions—a very different project from the one proposed here. We begin instead by excavating the history, within social theory and sociology, of an engagement with standardization as a process and standards as a defining aspect of modern life.

Many dominant concerns in nineteenth- and twentieth-century social theory prefigure an interest in standardization, even if the term itself was rarely used. Marx's analysis of capitalism examined the standardization of conditions for economic activity in a capitalist market, as well as the spread of the commodity as a standard mode of economic exchange (Marx 1867 [1977]; see also Busch 2000). In addition, Marx's depiction of the relentless growth of a world market pointed, as a global consequence, to an increasing homogeneity, both economic and cultural. Not only were production and consumption assuming a cosmopolitan character in place of national distinctiveness, he argued, but "as in material, so also in intellectual production. The intellectual creations of individual nations become common property. National one-sidedness and narrow-mindedness become more and more impossible, and from the numerous national and local literatures, there arises a world literature" (Marx & Engels 1848 [1978], p. 476).

Weber extended the analysis of social homogenization by studying the "leveling" effect of the great bureaucratic machines of modern life (Weber 1946, p. 226), which emphasized "the abstract regularity of the execution of authority" and rejected on principle the notion of doing business "from case to case" (Weber 1946, p. 224). Thus bureaucracy furthered the emergence of the mass in place of distinct individuals. Moreover, bureaucracy both exemplified and promoted the broader processes of rationalization that were manifested everywhere in modernity. Weber's analysis of rationalization pointed to such examples in the modern West as the rise of standard forms of bookkeeping, musical notation, and

experimentation in science (Weber 1930 [2002], pp. xxvii–xlii).

To be sure, not every social theorist has associated modernity with processes that result in the homogenizing of social forms. Indeed, Durkheim viewed sameness (mechanical solidarity) as the distinctive feature and constitutive glue of premodern societies, whereas modern societies instead were held together through the connections among highly differentiated, but interdependent, components (organic solidarity) (Durkheim 1933 [1984]). Yet, as Zerubavel (1982) makes clear in his Durkheimian analysis of the rise of standard time, even modern, social organization may frequently depend on processes of standardization for its functional success. Zerubavel treats the demarcation of time zones within countries as an example of organic solidarity, in which regions became marked as distinct yet interdependent. However, this geographic differentiation was constructed only through the imposition of an overarching framework that subjected the abstract concept of time to a precise, formal, and universal specification.

Much subsequent theoretical and empirical work has intersected with the theme of standardization, notably including the neoinstitutionalist concern with understanding the causes and consequences of “institutional isomorphisms” (DiMaggio & Powell 1983). The focus of neoinstitutional theory on exposure to similar norms and rules has been used to examine the diffusion of standards across organizations within a similar institutional environment (Dahl & Hansen 2006). The diffusion of standards may also serve as a way for organizations to institutionalize, albeit in pro forma or ritualized ways, systems of compliance with legally imposed mandates (Edelman 1992).

By a different route, Foucault’s analysis of the gradual historical diffusion of disciplinary techniques from the margins to the center of modern societies was meant to account for unexpected uniformities across the range of institutions, practices, and knowledge systems that constitute modern subjectivity: “Is it surprising that prisons resemble factories, schools,

barracks, hospitals, which all resemble prisons?” (Foucault 1979, p. 228). To be sure, Foucault’s term for the process that underlay the social control functions of such institutions was normalization, yet many of his concrete examples of disciplinary techniques concern the formal standards of modern organizations, rather than norms alone.

Through these various analytical pathways, a concern with standards and standardization has made its way explicitly into numerous sociological subfields. For example, within economic sociology, Carruthers & Stinchome (1999) have analyzed how market liquidity presupposes an agreement that commodities are standard and homogeneous, and they describe several alternative routes to the standardization of commodities, including standardized manufacturing, the grading of natural products, and legal mechanisms. Sociolinguistics is another domain that has been affected by the study of standards, particularly with respect to the study of how standard languages emerge through suppression of nonstandard variants (Trenz 2007). In education, standards for teaching subjects, and standardized assessments of both students and teachers, have been critically examined for bias and effectiveness (Koretz 2008).

Because of the role that scientific and technological expertise plays in standard creation, a large proportion of the sociological writing on standards and standardization comes from the field of science studies. This is no coincidence: Science itself benefited from standardization, and scientists and engineers continue to provide technical expertise for standard creation. Several historians and social scientists contend that standardization fueled the growth of scientists’ authority (Porter 1995, Shapin & Shaffer 1985). At the same time, much work in science studies has critically examined how standardization is made possible in science, emphasizing the complex negotiations required to create standardized materials and tools (Berg 1997, Casper & Clarke 1998, Fujimura 1992, Hogle 1995, Jordan & Lynch 1998, Latour & Woolgar 1979, Timmermans & Berg 2003). Standards promise to provide the optimal technical

solution for particular problems, and scientists and engineers are often called upon to provide expertise for standard-setting. This does not mean, however, that standards are intrinsically neutral. Standards' objectivity, universality, and optimality are hard won victories that can be heavily contested by third parties lobbying accusations of bias and politicization.

Analyses of standardization that come from science studies are notable for emphasizing the local and the contingent and for treating "universals" as a complex construct (Timmermans & Berg 1997). By contrast, a dominant thrust of much of the work from social theory and sociology that we have described as being relevant to the study of standards is a tendency within it to emphasize the link between standardization and the homogenization or flattening of social life in modernity. An immediate and important rejoinder concerns the rise of post-Fordist economic activity, as well as associated cultural forms, that are organized according to a different logic: In place of mass marketing and mass consumption, the model becomes one of niche marketing and "flexible specialization" (Amin 1994). We consider this point essential for a full understanding of the place of standards and standardization in the world today. On the one hand, it is important to observe that grand narratives of homogenization not only are often overstated in failing to account for local interpretations, but also may fail to engage with significant shifts away from, or challenges to, economic, social, or cultural homogeneity. But on the other hand, there is every reason to believe that post-Fordist production and consumption, even while reacting against homogeneity, are also thoroughly dependent on standards of various sorts. Clearly, these include design standards and procedural standards, without which post-Fordist (or any other) economic activity could not be carried out. But in addition, niche marketing presumes a more or less standardized specification of which niche groups are interpellated by marketers or of the limited menu of options that are made available to consumers. The activist Naomi Klein captures the latter point well in

her description of the modern-day shopping mall food court, which offers consumers, in place of a single standardized product à la McDonald's, a fairly standard array of ethnic food options (Klein 2002, p. 117). In short, the creation and enforcement of standards is an important research topic regardless of the extent to which standardizing processes seek to produce, or succeed in generating, broad-scale homogeneity.

It should be clear from the preceding consideration of the place of standards and standardization within social theory and sociological subfields that standards emerge as a sociological topic from multiple (if overlapping) vantage points. (One might say there is little standardization in the study of standardization.) As a consequence of the many resonances of standards within sociology, the study of standards may intersect with the study of numerous other topics, including objectification (Timmermans & Almeling 2009), formalization (Lampland & Star 2009, Stinchcombe 2001), quantification (Espeland & Stevens 2008, Porter 1995), routinization, classification (Bowker & Star 1999), commensuration (Espeland & Stevens 1998), commodification, evaluation (Thévenot 2009), regulation (Cambrosio et al. 2009), and rationalization (Carruthers & Espeland 1991, Berg 1997) and the elaboration of standard forms of problem-solving such as policy paradigms (Hall 1993), templates, assemblages (Li 2005, Ong & Collier 2005), and repertoires of contention (Tarrow 1998, pp. 20–21).

Yet while many bodies of sociological work engage with standards and standardization, relatively few scholars analyze standards directly. In the next sections, we offer conceptual tools and vantage points to study standards as standards. For heuristic reasons, we subdivide the life course of standards into the phases of creation, implementation and resistance, and outcomes. Of course, in practice these processes tend to blur into each other: Much creation work occurs during what is supposed to be the implementation stage of standards, and one outcome of standardization is often the creation of yet more standards.

THE CREATION AND RESISTANCE OF STANDARDS

It is impossible to determine the first widely used standard or to write a singular history of standardization. Standards can be plausibly found wherever archeological records indicate some form of communication. Thus, in Pompeii, visitors can still admire the *mensa ponderaria* in the temple of Apollo—the table of standard volumes used by merchants and their customers to measure goods. As the historical record improves, we find more examples of standards. Yet the history of standards is neither linear nor cumulative, although many authors subscribe to the notion that increased globalization requires more standardization (Brunsson & Jacobsson 2000, Krislov 1997, Tamm Hallström 2004).

Each standard has its own history, and it is the specificity of that history that makes the standard a compelling topic of social analysis. The origins of the procedural standards formulated by scientific management gurus in the first decades of the twentieth century involve a different set of aims, logics, and stakeholders (Noble 1982) than, for example, the standardization of rapeseed in China (Tanaka & Busch 2003). These standards originate as plausible solutions to unique historical contingencies. It is only embedded within this historical context that a standard's creation can be appreciated as being (as the case may be) remarkably innovative or surprisingly conservative.

Still, we can distill some common themes that recur in the emergence of standards. One such theme is that standard creation is fundamentally a social act. Although theoretically one person could create a standard, most standards are built collectively and, in order to work in a standardized way, require some form of buy-in by multiple others. A key issue in studying standard creation is then to map the interactions among the multiple parties involved in the creation process, even paying attention to those that could reasonably be expected to be included but are currently not part of the creation process (Clarke 1991). We should note why

some parties opt for standardization in light of alternative courses of action and what the cost is of standard creation. We should also pay attention to the actual standards that certain groups tend to create. Standards differ in scope, specificity, flexibility, exactitude, cost, and payoff. The creation of standards can thus be thought of as the meeting of numerous parties with the aim of obtaining legitimate coordination, comparability, and compatibility across contexts. In this section, we emphasize the roles played by scientists, engineers, representatives of industry, courts, states, standard-setting bodies, and activists.

Because of required technical expertise and the legitimacy awarded to science, we often find clusters of scientists and engineers among standard creators. They may work for research and development purposes closely related to their jobs (Webster & Eriksson 2008), but may also ply their expertise for industry and trade organizations, the military, state regulators, and advocacy organizations (Jordan & Lynch 1998). The professionalization of the field of engineering coincided with a widespread standardization of objects and tools. Engineering societies at the beginning of the twentieth century created their own standardization committees and aimed for intercompany standardization (Noble 1982). And in the domain of science, “scientists strive for standardization in rendering their somewhat ad hoc activities in the laboratory into replicable and reputable public accounts” (Brown 1993, p. 156). Of course, not all standards reflect technical and scientific expertise. Some standards, such as corporate governance codes, are based on the practical experience of industry insiders (Seidl 2007).

An extensive literature documents that the initiative for many standards over the past 150 years came from the fields of industry, business, and trade (Brunsson & Jacobsson 2000, Chandler 1977, Krislov 1997, Morgan 1989, Tamm Hallström 2004). Economic historians argue that the need for standards emerged when production processes and goods crossed geographical boundaries (Chandler 1977, Morgan 1989, Pollard 1983, Shenhav 1999).

Diverse manufacturing techniques and industrial products generated much duplication and confusion. Each company created its machined parts, with little regard to compatibility with others. Competition thus threatened to slow down the rise of corporations (Noble 1982). A national railroad system, for example, was impossible without agreed-upon track sizes. Two U.S. trade organizations, the American Railway Association and the Master Car Builders Association, adapted the standard gauge track in 1886 and standardized automatic couplers and air brakes in 1893 (Beniger 1986).

Standards creation in the areas of trade and business in this period of rapid industrialization occurred through either top-down initiatives or organic bottom-up processes. Rather than being a necessary and inevitable requirement for capitalism, standardization occurred at varying rates in different fields (Noble 1984). In the electrical industry, where relatively few companies competed, standardization occurred rapidly. The more fragmented and diverse chemical industry had to await corporate consolidation before standardization was possible. Stakeholders in some fields counted on the emergence of a market leader with a proprietary industry standard (Genschel 1997). Historians of science have documented this process of gradual consolidation around an industry standard—for example, the fight between Sony's Betamax and JVC's VHS video standards in the late 1970s (Yasunori & Imai 1993).

Even in the business world, standard-setting was not just an industry-driven process. Governments and courts stimulated standardization. An early government-sponsored study of steam boiler accidents, for example, showed that many explosions were due to a lack of standardized boiler parts (Shenhav 1999). World War I legitimized governmental standardization efforts when the U.S. Congress, with the support of then-Secretary of State Herbert Hoover, issued mandatory specifications for war-related purchases. Hoover also organized the Division of Simplified Practice, which developed procedures for cutting down on

various sizes, varieties, and grades of commodities (Shenhav 1999, p. 63). During the war, a widespread standardization effort of materials, machinery, and parts was coupled with a drive for product simplification, aimed at reducing industrial inefficiency, but also leading to a consolidation of industries, with smaller manufacturers disappearing in the wake of stronger corporations (Morgan 1989).

In the same period, courts were another instrumental actor in promoting standards with, for example, their support for standardization of human behavior. Scientific management received a boost because large businesses, afraid that antitrust legislation would cripple them, considered novel means to become more cost-effective. When the railroad companies requested an increase in ticket rates, scientific management proponents testified that their methods could have saved the railroads \$1 million per day. The court ruled in their favor and helped spread this form of standardization.

Standard creation has been streamlined by national and international nongovernmental standard-setting organizations. Over time, especially in the United States, the power of governmental standardizing agencies has declined and the power of industry standard-setting agencies has grown. In the interwar period, the governmental National Bureau of Standards gradually lost out to the engineering umbrella organization the American Engineering Standards Committee (AESC), made up of trade associations, professional groups, private companies, and government bureaus. The AESC, reconstituted as the American Standards Association, wrested jurisdiction from the National Bureau of Standards and gave industry greater control over standard-setting (Olshan 1993). In 1944, the Allies set up a United Nations Standards Coordinating Committee, the predecessor of the International Organization for Standardization (ISO), to coordinate between national standards and to promote postwar trade. Initially, the ISO issued recommendations, but in 1970 the ISO expanded its jurisdiction by publishing international standards to be adopted as national standards. The

impetus for this development was an intensified international trade in goods and the resultant compatibility problems due to outsourcing of components in different countries. Other international organizations such as the World Bank, the International Monetary Fund, the World Trade Organization, and the OECD have insisted on the development or adoption of standards by participants (Seidl 2007).

The American National Standards Institute, ISO, and similar standard-making groups follow similar principles for the creation of standards. They promise optimal solutions to recurring technical problems in the name of the general public, based on consensus among stakeholders with, in principle, voluntary compliance (Higgins & Tamm Hallström 2007). A sponsoring organization can thus call for the creation of a standard, invite partners to collaborate on the standard, and then depend on the standardizing organization to distribute the standard. The presence of such a standard-setting infrastructure leads to the proliferation of standards (Tamm Hallström 2004). Standards are presumed to be in the public interest, but the public to whom standards apply is usually not directly represented in standard creation (Berg et al. 2000, Biondi & Suzuki 2007). Standardization by committee leads to compromises, bitterly contested power plays, and negotiations. A participant with an extensive national tradition of standard creation, such as the British at ISO (Furusten 2000), can steer the content of standards. Similarly, a strong personality can influence the creation of standards, as seen in the role of a leading psychiatrist in the creation of the DSM-III (Kirk & Kutchins 1992). The composition of standard committees inevitably creates an institutional bias, which may be less of an issue for, say, technical standards in telecommunications (Genschel 1997) but is more problematic for the creation of medical treatment standards where drug companies sponsor the evidence and the research of committee members (Healy 2004).

Activist groups are one more constituency to be considered in relation to standard creation, as they have resisted or pressured

standardization efforts to obtain their objectives. In the regulation of genetically modified organisms, public advocates in coalitions with critical scientists and nongovernmental organizations (NGOs) played a constitutive role in more rigorous regulatory standards using existing standard-setting bodies (Jasanoff 2006). In the United States and Europe, critical scientists and environmental activists were able to link a controversial technology with a contested trade liberalization process to generate publicity and political pressure (Murphy et al. 2006). Consumer activists in the 1980s obtained similar results fighting for more rigorous meat contamination standards in the midst of a public health crisis over “hamburger disease,” an outbreak of foodborne diseases traced back to *E. coli* contamination in beef meat (Juska et al. 2000, p. 262).

Rather than lobbying in Brussels, Geneva, or Washington, DC, some activists have created their own certification organizations. These entities, operating outside the state and with only limited input from industry, offer a seal of approval after certification but confront questions of legitimacy. When the environmental advocacy group the World Wildlife Fund helped set up the Forest Stewardship Council with a tripartite chamber consisting of environmental, social, and industry stakeholders, the forest industry balked at the transparency of rulemaking and the inclusiveness of the organization. Taking the position that those who implement standards and bear the cost of compliance should set standards, they created competing standard-setting organizations (Gulbrandsen 2008). Under neoliberal policies in a globalizing economy, market and nonmarket actors thus rely increasingly on standards to manage reputations, make claims credible, and rationalize competition, especially when traditional forms of regulation (e.g., governmental) have been politically delegitimized (Bartley 2007).

Activists have also played an important role in targeting one general form of standardization: the diverse and controversial set of projects that are directed at a “standard human” (Czerniawski 2007; Epstein 2007, 2009;

Igo 2007; Lengwiler 2009). Attempts to construct a standard human are unavoidable, in part because other standards have spillover effects. To standardize transportation is inevitably to standardize the perceptions and tastes of travelers (Schivelbusch 1977); to standardize policies is to standardize those administered by them (Busch 2000). Thus, the creation of the DSM-III not only changed the classification of psychiatric disorders but also standardized international drug development, third-party reimbursement, clinical research, and patient identity across the globe (Lakoff 2005). Yet the assumption that human diversity can be controlled for often has consequences that are harmful to individuals—whether those are the smaller people who are crushed by automobile air bags or the larger people who must crush themselves into standard-sized airplane seats.

Biomedicine is one domain in which conflicts over standardizing the human have been particularly acute in recent decades. Unlike scientists who work with nonhuman laboratory animals, who in some cases have literally standardized animals for research purposes [see Kohler (1994) on the creation of the standard fruit fly], clinical researchers who study and test drugs on human beings cannot actually reduce the variability inherent in the species. What they can do, however, is make assumptions about when and whether such variability is medically relevant, as well as about which individuals can best stand in for humanity for purposes of medical testing. By the 1980s, in the United States, a broad array of health advocates had become concerned that in practice the standard biomedical human was imagined as a white, middle-aged male and that other groups were underrepresented as subjects in biomedical experiments. The result, it was argued, was inadequate medical knowledge about biological processes and about the safety and efficacy of medications in women, racial and ethnic minorities, children, and the elderly. As Epstein (2007) describes, the “antistandardization resistance movements” that opposed such practices have proven successful in obtaining new policies

that mandate the inclusion of various groups as subjects in biomedical research and that call for the measurement of outcome differences across categories such as sex, race, ethnicity, and age.

The story is instructive in suggesting how the creation of standards may become the object of controversy that spans professional and lay worlds. Yet it also makes clear the ultimate indispensability of standards to modern work domains. New policies that promote medical inclusion not only established new standard operating procedures for biomedical research but also authorized an alternative way of standardizing the human. When advocates of the inclusion-and-difference paradigm repudiated the notion that humanity could be standardized at the level of the species, they did not veer fully to the opposite extreme of embracing total particularity and the medical uniqueness of each individual. Rather, advocates proposed that the working units of biomedical knowledge-making could be groups—women, children, the elderly, Asian Americans, and so on—that were then defined in highly standardized ways. The new policies enshrine niche standardization (Epstein 2007, pp. 135–54): a way of transforming human populations into standardized objects available for scientific scrutiny, political administration, marketing, or other purposes that eschews both universalism and individualism and instead standardizes at the level of the social group—one standard for men, another for women; one standard for blacks, another for whites, another for Asians; and so on. In place of a standard human, niche standardization substitutes an intersecting set of standard human subtypes.

In sum, standard-setting is accomplished by multiple parties, and standards can be imposed top-down or emerge by consensus among stakeholders. The stakeholders can involve everyone affected by standards, but a large proportion of standards have come from the area of industry and trade. Standards can be field-specific, national, or international. Standard-setting is motivated by issues of safety, efficiency, or redistribution of resources but may also reflect a strategy to become

a market leader or to institute a regime of self-regulation. However, unless efficiency or safety is the explicit goal of standardization, any given actual standard is not necessarily the cheapest, most efficient, safest, scientifically most reliable, or technically most advanced outcome (think of the clumsiness of the QWERTY keyboard). Depending on the process of standard-setting, standards can imply a lowest common denominator of available options, the power of the strongest party in standardization, a negotiated order among some or all stakeholders, or a confirmation of how things are already done by most parties. Standardization has thus emerged as a form of regulation, and being part of the team that sets standards can be a tremendous advantage. Yet the power of standardization depends on whether standards are actually implemented.

IMPLEMENTATION OF STANDARDS

“The nice thing about standards is that there are so many to choose from” (Kelty 2008, p. 143). If many parties can and do create standards to the point that the world is awash in competing standards, standards risk remaining paper tigers unless they are widely adopted. The voluntary nature of many standards makes it difficult to develop momentum unless built-in incentives promote compliance. We already have discussed some of those incentives: Governments may require adoption of standards for regulatory purposes, trade organizations may demand that manufacturers comply with production standards in order to send their products across borders, environmental organizations may require compliance with standards to obtain certification, manufacturers may build standards into tools and products [statistical significance testing in sociology, for example, diffused largely through its incorporation in software programs (Leahey 2005)], and third parties may incentivize professional standards with payment schemes. The incentive may come from a crowd effect in which not following product standards becomes a

cost. Yet incentives alone do not guarantee that standards will be implemented and followed.

Every standard implies a “script” (Akrich 1992) that specifies the various roles of users, as well as their skills, motivations, requirements, tools, and final outcomes. At any point, any of these factors may not play out in the way the creators of standards intended, and the standard may fail or may morph into a new form. The smallest oversight can have devastating consequences—for example, the incompatibility of metric and imperial systems led to the loss of a \$125 million NASA Mars orbiter in 1999. Additionally, every standard needs to be plugged into a physical and cultural infrastructure that allows it to function. Following Latour (1988), in order for lab results to work outside the lab, the world has to be turned into a laboratory. This does not mean a completely controlled environment, but rather the transfer of sufficient conditions for standards to thrive in a variety of settings. These settings, however, are already populated by practices, tools, people, and other standards, some of which will not be specified by the standard designers but nevertheless need to be compatible with the new standard (Timmermans & Berg 1997). Changing to a new standard will introduce uncertainty as well as compatibility and switching costs, which may result in noncompliance (Storz 2007).

Metrology, the science of measurement, illustrates the amount of work required to make sure that the most elementary standards become and remain authoritative (Kula 1986). Once a consensus had been reached on how to measure electricity using the volt, ampere, and ohm, hard work continued to keep the volt standard. Rather than human opposition, the standard volt faced physical resistance from material sources that resist the transfer from one instrument to another. Many standard cells circulate around the world:

The cell that holds the volt is itself held by a box with gold-plated terminals on the front and climate control to maintain a constant temperature within. Hand-carried transportation is required for certain kinds of cells since

they cannot be tipped more than 45° from the vertical. . . . Once the transport standard arrives, technicians whisk it through security clearances, usher it into their laboratory, place it next to some of their most expensive equipment, and prepare an oil bath at the volt's favorite temperature, marked in degrees Celsius on the box. For up to four weeks the cell is allowed to settle into a laboratory. It is kept at a constant temperature, freed from mechanical disturbance, measured regularly, and expected to produce readings that are temporally constant, and which do not differ from local standards (O'Connell 1993, p. 149).

Yet even connecting the volt to a measurement apparatus generates a slight resistance that will introduce voltage drop. Standard cells are likely to maintain constant voltage if they are used as little as possible, limiting their utility as standards. Such standardization achieves authority by translating consensual technical specifications into legally binding certification mechanisms and embodying them in material devices combined with a continuous surveillance process (Mallard 1998). In this sense, the process of keeping standards universal is visualized as the creation of a massive network—its own society—of circulating measures (Latour 1988, O'Connell 1993).

To keep standards further on track, an auxiliary support army of technicians, auditors, monitors, and consultants exist to implement and evaluate standards. The ubiquitous labeling that identifies a company as ISO 9000 certified refers to quality standards issued by the ISO in 1987 aimed at building an infrastructure to integrate firms and products on an international level. The principle behind ISO 9000 is that an optimal production structure with documentation will result in high-quality products (Tamm Hallström 2004). These broadly worded standards have required intermediaries for interpretation, giving rise to consultants who can build up quality systems and other professionals who can regularly certify compliance with the standards. These consultants, in turn, require training and conduct joint audits to calibrate

their evaluations (Higgins & Tamm Hallström 2007).

If standards are voluntary, why bother with support staff? Standards are in principle voluntary, but they can become *de jure* mandatory, producing a neoliberal government-industry hybrid of governance. National standardizing bodies have had cozy relationships with their governments and have been sensitive to policy implications of standards. In most instances, governments partially fund standard-setting organizations and maintain memoranda of understanding with the organizations. Standards are integrated in governmental regulation and are often mandated or part of “gray-letter law” (Higgins & Tamm Hallström 2007). In this sense, standards created by NGOs enhance “neo-liberal rule at a distance” (Higgins & Tamm Hallström 2007, p. 698). Neoliberalism depends largely on autonomous expert communities that translate government priorities into a wide variety of locales and that provide legitimacy (Rose 1999). Standard organizations promise technical expertise without political entanglements. Yet such a technocratic governmentality without popular approval creates a fragile authority, one that, because of the self-selection of experts and inevitable formalism, remains open to challenges of legitimacy (Tamm Hallström 2004).

When the implementation of standards moves from design to procedural issues, it becomes all the more challenging to hold a standard in ways that satisfy diverse, autonomous interests. The health care field is engaged in a massive standardization movement called evidence-based medicine whereby professional organizations and regulatory entities make the scientifically best evidence available to clinicians in the form of meta-reviews of the literature, practice guidelines, assessment tools, and standardized outcome measures (Greenhalgh et al. 2008, Moreira 2007, Mykhalovskiy & Weir 2004, Timmermans & Berg 2003, Weisz et al. 2007). Yet these guidelines have little effect on actual clinical decision making (McGlynn et al. 2003), and the field has focused on the problem

of implementing guidelines (Grimshaw et al. 2001).

Making standardized protocols work requires a close understanding of how clinicians reach medical decisions. Studying depression treatment in primary care, Armstrong & Ogden (2006) found that clinicians conducted personalized clinical trials with individual patients to check the effectiveness of new drugs and to match drugs with particular groups of patients and that clinicians remained attentive to patient choice and their general relationship with patients. General practitioners also relied on senior academic colleagues for the most updated information (Armstrong & Ogden 2006). In a different study, clinicians relied on tacit knowledge based on accumulated experience when awarding and interpreting standardized outcome measures (Greenhalgh et al. 2008). Oncologists switched between various standardized research protocols based on the perceived needs of their patients rather than following one protocol for all patients (Berg 1997). Clinicians caring for diabetes patients tweaked guidelines to coax responsibility based on needs and capacities of individual patients (Lutfey & Freese 2007).

Should this continuous tinkering with procedural standards be interpreted as a fatal standard deviation that renders standardization of human behavior impossible? As Wittgenstein (1953) and ethnomethodologists have noted (Heritage 1984), no rule can adequately capture the requisite work of a prescribed action. On the ground, every standard is simultaneously overdetermined and incomplete. To coordinate diverse interests and activities, standards necessarily delegate some residual work that requires active participation and submission of people to the standard's directives. Tinkering, repairing, subverting, or circumventing prescriptions of the standard are necessary to make standards work (Lampland & Star 2009, p. 4; Star 1995, pp. 100–104). Thus, a recurring surprising finding is that loose standards with great adaptability may work better than rigidly defined standards. Moreover, users often need to work

deliberately to save the standard from falling apart under changing circumstances (Alder 1998, de Laet & Mol 2000, Hogle 1995, Jordan & Lynch 1998). Yet flexibility may tip a standard into uselessness. UNIX, an obvious choice for a standard operating system in the 1980s, failed because it remained excessively flexible. So many designers worked on different versions of the system that it lost its promise of compatibility across computers (Kelty 2008). The trick in standardization appears to be to find a balance between flexibility and rigidity and to trust users with the right amount of agency to keep a standard sufficiently uniform for the task at hand. In some settings, automation or incorporation of a standard in other technologies helps preserve the standard (Jordan & Lynch 1998).

Implementation of standards thus requires embedding a standard with its script to coordinate disparate elements in societies already saturated with countless routines and standards (Berg 1997). Standardization is an active, time- and resource-intensive process. Depending on the standard, building standard-based societies may require integration on many different levels: from national cultures with their moral orders to institutions with their conventions of work practices, organizations, and multiple layers of technologies. Standards often require an auxiliary system that provides internal or external incentives, audits, and certification. Standards may fail implementation for countless reasons, including lack of knowledge, lack of compliance, immediate conversion of standards, resistance, adaptation, or usurpation. Very few standards work as intended by the designers of standards because they are tinkered with, whether slightly or fundamentally. It would be wrong to consider these standards as failures because a standard's flexibility is often key to its success.

OUTCOMES

Countless standards do nothing. Some, however, obtain majestic results. Take, for example, the gothic cathedral from Chartres. This imposing stone structure with, for its time,

radically innovative flying buttresses, a tower of 115 m, and an overall length of 130 m was built between 1194 and 1230. Over this 36-year period, the construction was discontinuous depending on the weather and availability of resources and manpower. Builders lacked a theory of structural mechanics. There was no master architect or designer, and no original plans of the cathedral survive. How, then, was the construction of the cathedral possible? One material standard facilitating construction was a template, “a pattern or mold, usually outlined on a thin piece of wood, that a stone mason uses to cut a stone to a particular shape” (Turnbull 1991, p. 162). The template facilitated mass production with only simple geometrical rules across large numbers of builders with variable skill levels over time in a discontinuous building process (see also Alder 1998).

Even the standards that do not obtain anything materially may have an important signaling function. Measured by certification, the ISO 9000 standard is a success: In 2006, more than 775,000 firms had been certified worldwide (Storz 2007). Yet in spite of extensive auditing and consulting, many Japanese companies comply with the standard only formally, paying for the audit as a marketing move but not changing management processes according to ISO principles. ISO 9000 certification may have a strategic function even if company officials consider it an “empty shell” (Storz 2007), just as rhetorically embracing evidence-based medicine in a country that lacks a working health care infrastructure may still signify a project of professional improvement (Geltzer 2009).

Besides signaling legitimacy in global economies, standards have also proven enormously effective as dimensions of state-building. Standards extend what Mann (1993) refers to as the “infrastructural” power of the modern state: its capacity, for good or for ill, to penetrate its territories and coordinate social life. Scott’s (1998) historical account of how land, resources, and populations became knowable entities that modern states could administer is essentially a

history of multiple, overlapping processes of standardization:

How did the state gradually get a handle on its subjects and their environment? Suddenly, processes as disparate as the creation of permanent last names, the standardization of weights and measures, the establishment of cadastral surveys and population registers, [and] the standardization of language and legal discourse . . . seemed comprehensible as attempts at legibility and simplification. In each case, officials took exceptionally complex, illegible, and local social practices, such as land tenure customs or naming customs, and created a standard grid whereby it could be centrally recorded and monitored (Scott 1998, p. 2).

Similarly, Curtis (1998) has described how metrological standardization both depends on sovereign state power and extends the administrative capacities of the state, although he also emphasizes the persistence of local diversity and hybrid forms of measurement. Such processes of state-building via standardization have been quite successful in consolidating bureaucratic rule, even if, in Scott’s analysis, they often paved the way for large-scale disasters of centralized planning, the regrettable loss of useful local knowledge, or the problematic construal of the subjects of state rule as “standardized citizens” who were “uniform in their needs and even interchangeable” (Scott 1998, p. 346).

Standardization thus often seems inimical to forms of political organization that valorize local rule and respect difference. Yet it is also easy to see how standardization can promote democracy precisely because standardized processes are often more transparent in ways that are consistent with accountability. Similarly, standardization at times can be a tremendous boon to grassroots organizing campaigns that promote the power of ordinary individuals to control their lives. For example, when, in the early 2000s, health activists in South Africa sought to disseminate antiretroviral drugs to people with HIV infection, they confronted the prejudicial

belief that the uneducated inhabitants of poor countries could not be counted on to maintain a vigilant adherence to multidrug treatment. However, physicians from the advocacy group Doctors Without Borders, working together with local AIDS activists, not only challenged such views but also declared that the knowledge required to make antiretroviral therapy function “could be condensed into simple codes and distributed among nurses, laypeople, and [patients] themselves” (Steinberg 2008, p. 84). The packaging of antiretrovirals as a simple, standardized, and transportable technology was then symbolized concretely by the distribution of thousands of plastic pillboxes, their 14 compartments labeled Sunday through Saturday, morning and evening. This example reminds us not only that standardization at times can lead to the betterment of life and health, but also that it has no fixed political valences and can promote diverse interests, both autocratic and democratic.

By coordinating people and things in new configurations, standards transform, and their outcome is a transformed world. They may allow the consistent coordination of people and things in ways that would be difficult to achieve on an ad hoc basis, they may allow communication between incompatible systems, and they may create specific kinds of mobility, uniformity, precision, objectivity, universality, and calculability. The most consistent complaint about standardization is that it leads to a world of gray sameness, a technical dehumanization exemplified by Taylorism. Yet Taylor’s scientific management did not revolutionize the workplace because workers rejected time management and engaged in pacing to “express their solidarity and their hostility to management” (Noble 1984, p. 33). This is not to say that standardization always preserves preexisting diversity and leads to humanization for all humans; in fact, every standard necessarily elevates some values, things, or people at the expense of others, and this boundary-setting can be used as a weapon of exclusion (Baines 2006, Bowker & Star 1999).

If blanket dehumanization is one perceived extreme outcome of standardization, at the other extreme is the view that standardization necessarily facilitates a global economy. Considering the political alternatives, standardization in its common voluntary neoliberal guise is a rather powerless and ineffective means of international regulation that is often heavily contested and that struggles for legitimacy and authority (Tamm Hallström 2004). Indeed, standardization is referred to as “soft regulation” (Brunsson & Jacobsson 2000) that implies few effective coercive mechanisms unless third parties step up to enforce standards (Hulse & Kerwer 2007). International standards can facilitate trade by lowering national standards (Abraham & Reed 2002), or they can create trade barriers by raising standards (Murphy et al. 2006) or by imposing irrelevant standards (Storz 2007).

Somewhere between glorified globalization and dark dehumanization, each standard achieves some small or large transformation of an existing social order. Again, the specificity of the actual standard matters: Different standards will generate different outcomes for different users. Standards may simplify life by cutting down on the number of alternative courses of action but allow for greater complexity within the preferred actions. Because of the local work needed to implement standards, the uniformity achieved through standardization necessarily carries traces of the local settings. Yet other local elements will be erased through standardization. Once standards are established, they render invisible the work required to make them possible and the uncertainty and ad hoc tinkering that accompanied standard implementation. The power of standardization lies exactly in how such local erasure allows new manipulations to take place such as calculation and commodification. Thus, we can regret the loss of life’s social diversity, including multiple salient socially situated identities, when pathologists pin a cause of death down to a physiological process, but such causes of death form the basis of population mortality

tables and help set public health, legal, and social policies (Timmermans & Almeling 2009). Even when mapping such transformations, however, it is crucial to highlight how every standard inevitably implies an evaluation at the expense of some other, and often obfuscated, devaluation (Thévenot 2009).

What we can conclude with certainty is that standards do not lead to a standardized world in the colloquial sense of a uniform world. Despite an ever-widening scope of design, terminological, performance, and procedural standards and the existence of standardized patients (Wallace 1995), standardized soldiers (Gray 2003), or even a standardized human, the transformations that standards obtain are rarely enduring. Standards can stabilize some actions in a moving world, but when the world around the standard changes, the standard will quickly become outdated or altered as well.

In sum, although many if not most standards never catch on, standards still transform the world as we know it. Standards obtain results in all aspects of modern life from signaling trade credentials to nation-building within a broad area of political regimens. Standards transform by coordinating disparate elements, but the outcomes that standards achieve depend on the specific standards and the circumstances under which they are made to work. They rarely exclusively dehumanize but will necessarily have some dehumanizing consequences simply because one person's much needed standard causes another person's suffering (Star 1991). Standards also rarely harmonize or globalize, but each standard, in its own specific way, can bring some of these goals closer.

CONCLUSION

We coexist in a world filled with standards but not in a standard world. Standards and standardization are such widespread and omnipresent features of modernity that, ironically, their precise sociological significance stands at risk of vanishing out of sight. Rather than making any totalizing claims about the nature or effects of these phenomena, we argue that

their sociological import comes out most clearly through scholarship that is specific, empirical, and located in concrete social settings. Instead of linking standardization to any overarching historical trajectory (such as a tendency toward global social homogeneity), we argue for a differentiated and symmetrical approach that investigates the full spectrum of positive and negative consequences of standardization. We emphasize the variety of ways in which standards and standardization undergird diverse social, cultural, political, and economic endeavors, as well as the equally varied implication for the well-being and suffering of individuals and social groups. With those premises in mind, we have reviewed the deep entrenchment of the topics of standards and standardization within sociological work going back all the way to the emergence of the discipline.

Many sorts of scholars have studied standards and standardization, but sociologists have an important and distinctive contribution to make to such work. Sociologists are attentive to the complex political configurations that promote standards, just as they are well positioned to study the politics of resistance to standards. Through a close empirical focus on outcomes, sociologists can also follow the path of the collateral damage that standardization may cause for those who defy standardization, as well as trace the ironies of unintended consequences. If standardization is a soft form of regulation (Brunsson & Jacobsson 2000), it can also be viewed as a soft form of stratification, employed by myriad stakeholders to elevate some at the expense of others. Yet such stratification cannot simply be assumed from the presence of standards. Standardization is an active process that aspires to stability and order. Any order is a hard-won achievement that requires the submission of diverse actors. Standardization consists of building a society around a standard with an implied script that brings people and things together in a world already full of competing conventions and standards.

Just as a sociology of standards can make an important contribution to the interdisciplinary study of standards, so sociologists who work on

any of a wide array of other topics would find their efforts enhanced by viewing their topic through the lens of a sociology of standards. Clearly, the study of standards is important to subfields of sociology that deal with issues of economic activity, scientific and professional practices, and knowledge and expertise. But the intersection with sociological topics is much broader than that. Sociologists of race and ethnicity, for example, are necessarily concerned with the politics of standardization of racial and ethnic categories by federal agencies (Omi 1997), and urban sociologists would likely benefit from understanding the standardization of methods of credit scoring that underlie bank lending practices (Poon 2010). More generally, sociologists who study standards in any single domain stand to enrich their work by

understanding how standards operate elsewhere. Although there is no single sociological story to be told about standards, there is still much to be learned by juxtaposing scholarship on standards across multiple arenas of social life.

Standards' ubiquity gives them an obvious character, but it is exactly this obviousness that sociologists should critically interrogate. Just as the choice of one standard over another signals a preference for a specific logic and set of priorities, so the choice of standards of any sort implies one way of regulating and coordinating social life at the expense of alternative modes. When examining the emergence of standards in new and varied domains, sociologists need to ask how social life became organized through these specific standards as well as how it could have been done differently.

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