

Desperate Measures: Global Crises of Measurement and Their Meta-Theoretical Solutions

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Abstract: Measurement infrastructures come in many forms and impact our lives in many ways, from the intimacy of psychometrics and biometrics, to the anonymity of econometrics and global climate change indicators. This paper explores the need for meta-theoretical approaches that address measurement infrastructures in terms of the ethical, political, and metaphysical aspects of our current global crises of measurement. This term—global crises of measurement—is meant to convey the fact that, despite appearances, the majority of our global challenges revolve around measurement infrastructures. For example, the recent economic crisis was largely the result of inadequate and deceptive econometric practices (e.g., the ratings applied to collateralized debt obligations), while the ecological crisis continues to revolve around disputes over, and innovations in, measurement (e.g., calculations of global temperature changes). Measurement infrastructures function to generate (and impose) a shared understanding of the world, and in so doing literally create realities; whether these realities are true, good, and beautiful is another matter. Measures and their related standards also facilitate complexly coordinated social actions and set the terms by which a wide range of evaluative judgments are made, from those about the self (bathroom scale; IQ) to those about whole countries (GDP). Recent decades have brought a rapid proliferation of measurement infrastructures and related forms of standardization, which impact the most intimate details of our lives and the most significant planetary initiatives. A meta-theoretical approach is needed that can expose the false realities created by inadequate and oppressive measurement practices as well as inform the creation of new approaches to the representation of complex global realities, including transactions involving non-monetary value, psychological interiority, and non-linear dynamical systems. This paper takes the first steps toward outlining just such a meta-theory of measurement, drawing heavily on the work of Ken Wilber and Roy Bhaskar.

The Invisible Infrastructures That Shape Our Lives and Why Social Justice Demands They Be Made Visible

No matter where you live on the planet, measurement infrastructures and related standards impact your daily life in countless ways (Busch, 2011; Stein, 2014). For example, the average American begins their day waking up to an alarm clock. They flip on the light, put on some clothes, walk into their kitchen, open the fridge, and prepare breakfast.¹ They are not usually aware of the complex history of measurement practices and technologies that facilitate their simple morning routine. Nor do they suspect the massive global reach and ethical implications of the measures and standards that they take for granted every day.

The alarm clock involves the standardization of time measurement, which is a relatively recent occurrence, especially the mass-production of cheap accurate clocks. Theorists such as Lewis Mumford (1934) have argued that the standardized measurement of time should be understood as *the* most important invention leading to the industrial revolution and the rapid advancement of capitalistic modes of production. Electricity that flows at the flip of a switch is the result of recent advances in the ability to measure and regulate electrical currents, as well as international standards for voltage, wiring, and safety. Take a look at your electric meter and you can see just how precisely and constantly your electricity use is measured. Measuring something is usually a necessary condition of your being charged money for it. Monetization an essential motive for measurement, a point to which I will return. Every light bulb, fixture, and appliance is

¹ There are of course, many other morning routines that could be discussed, which might represent a more diverse slice of human life on the planet. For example, waking up in a slum in Calcutta to the sun, climbing out of a self-made structure of shipping packages and sheet metal, etc. I choose the average American, in part because it is so familiar, but also because the post-modern west is by far the most measured and standardized social-cultural epoch in history, so it serves as a very good example.

standardized to assure interchangeability and functionality. Clothes are all explicitly measured and standardized according to a variety of more or less reliable indices of size. This is a relatively recent way of standardizing mass-produced clothing, which has had a profound impact on the self-understanding and body image of millions (Lampland & Star, 2008). The size of the doorways of your bedroom and kitchen are likely to be standardized, as are the lengths of hallways, walls, and the dimensions of windows (all stemming from the coordination of massive national construction interests). Every item in the refrigerator is marked according to volume or weight. Certain nutritional qualities of the food have been measured and the results are displayed on the container. One might see various other standards of quality on food packaging (itself usually a standardized box or carton), such as USDA Grade A, Organic, Free-Range, or Non-GMO, all involving the development measurement and standardization procedures.²

So measures and standards impact nearly every aspect of our given *lifeworld*—they are a part of the daily feeling of taken-for-grantedness that underpins our psyche and relationships. The advantages and power of standardization and measurement are clear,

² Throughout this paper I will be talking about measures and standards, and on a larger scale, about measurement infrastructures and standards-based regulatory practices and regimes. These are distinct but related aspects of our contemporary technoscientific society. Measures are instruments of various types that reliably differentially respond to specific qualities of interests and thus establish systems of categories and other types of classificatory schemes. Classic examples are thermometers, clocks, and tape measures. But other measures include: standardized tests used in schools, medical diagnostics used in hospitals, tax forms used by the IRS, and quality control checklists used in factories. Standards are different yet inseparable from measurement. They function to put measures in context by giving meaning to results produced by them. A standard is a codified ideal; an explicit account of how certain processes, objects, and people *ought* to be. Classic examples are standards for food quality, educational standards, or standards for car fuel-efficiency and emissions. Once a standard is determined, measures are used to determine the degree to which the standard is being met. So while a measure can exist without a standard, a standard without a measure has no teeth and cannot be enforced in any rigorous way. Standards and measures work together to create realities and shape experience. As will be explained, measures and standards usually have long and complex histories. In post-modern societies measures and standards are proliferating at a breathtaking rate, addressing everything from psychological disease to the biochemistry of endangered wetlands. The implications of this increased standardization and measurement are reverberating through culture and personality structures. To foreshadow the minimalist integral meta-theory of measurement built below, standards and measures can be made to address realities in any of the four quadrants, and a standard or measure institutionalized in any one quadrant has ramifications in all the rest. There is a small but growing literature on these topics (see: Busch, 2011; Lampland & Star, 2008; Brunsson & Jacobsson, 2002; Tavernor, 2007; Kula, 1989; Duncan, 1984).

and they are often rightly touted as codifications of scientific advance, public welfare, and economic progress. Without contemporary advances in measurement practices there would be no medical diagnostics, no auto-safety regulations, no building codes, no indices of the quality or amount of food products. The list of ways that advances in measurement and standardization have increased human welfare is very long, and as the example discussed here shows, we unconsciously depend on the proper functioning of global measurement infrastructures a great deal in our everyday life.

Yet, these global infrastructures for measurement and standardization also implicate each of us in a great deal of political and ethical complexity, just by getting up and getting ready for the day. Consider only the alarm clock. Put aside the history of time measurement (e.g., it was the Mesopotamians that gave us the 24 hour day and 7 day week, etc.), and focus only on the alarm clock's size, shape, and construction. The plastics that the clock is made from are the end result of global supply chains mediated by measures and standards at every step, from qualities and quantities of materials, to labor regulation, international trading standards, and complex accounting practices. Here is where it gets important to pay attention. Because of *standards* enforced by labor contracts in factories in China, as well as inaccuracies in *measures* of raw material's toxicity levels, whole populations are being poisoned and exploited, and its all being done *by the book*. That is, industry standards and scientific measurements are being used, often very carefully, yet their very use sanctions and legitimizes injustices—this is a very civilized form of barbarism (Harvey, 2005).

Probe deeper into who designs, implements, and enforces these standards and measures and you find scientists, businessmen, and politicians who will likely never set

foot in the factories most impacted by their decisions. Yet they will be able to monitor and surveil those factories from a distance through the abstract optics of their measures, which is one reason for their creation. It becomes clear just how many people are alienated from a sense of having any form of control over many essential aspects of their lives, such as safety and livelihood. The workers being poisoned and exploited are radically disempowered relative to the measurement regimes that subjugate them. Especially the scientifically complex measure of toxicity, where the average workers are literally unable to understand the instrumentation and chemistry involved. The claim of *scientific expertise* (and the display of accompanying technologies) which back large-scale measurement practices often contributes the anti-democratic ethos that surrounds the world of international standards and measurement (Busch, 2011).

All this follows from a simple look at the measures and standards involved in producing the plastics in an alarm clock. I won't even get into the rest of the average American's daily morning routine. However, the point to remember is that when you touch your alarm clock in the morning to shut it off it appears to you as simply *ready-at-hand*, a taken-for-granted part of the lifeworld; it is not seen as an outcome of a complex system involving injustices facilitated by official and scientific standards and measures. As long as everything works, fits, or otherwise adds up, we do not notice the multitude of measures that structure our lives. Their very taken-for-grantedness—their seeming invisibility—is at the core of their power and importance, as well as their danger and susceptibility for use as instruments of injustice.

Measures and standards are implicated in social justice because they quite literally *structure* our lives in profound ways, impacting the ways that we understand ourselves

and the social world, and the nature of reality itself. They quite literally give shape to the physical environments we inhabit and the temporal durations that constitute the rhythms of our lives. They make some things possible and others impossible; they reveal certain aspects of reality, while concealing others. Measures and standards facilitate cooperation and trust at a distance and across cultures, while they also enable complex institutional processes that are often exclusionary, exploitative, and oppressive. They constitute what the great moral theorist John Rawls would call, *basic structures* (Rawls, 1971; Stein, 2014). Basic structures are social structures we enter into by virtue of entering into society at all. We are born into institutions and other social inventions and infrastructures that are not of our choosing and they shape our life prospects from day one. Because measurement infrastructures are basic structures they are intrinsically implicated in issues of social justice.

As I will explain, the history of measurement has been a history in which the privileged and empowered have been the creators and institutionalizers, while the oppressed and powerless have had no choice but to use their master's tools and definitions of reality (Kula, 1986; Scott, 1998). This is a pattern that continues to this day, perhaps best exemplified by current trends in educational "reform," where in the United States, billionaires who never set foot in a public school growing up, and who send their own children to private schools, swayed federal legislation toward the creation of a vast technologically intensive testing infrastructures that now dominates the entire public school system (Ravitch, 2013). New tests and measures are being forced upon teachers; if they do not use them they can be fired. Educators are being disempowered, deskilled, and rendered without voice when it comes to some of the most *essential* aspect of their

professional practice, i.e., assessment drives curriculum and pedagogy. Meanwhile for-profit industries are poised to make billions off the privatization of one of the oldest and most inspiring public institutions in American history. There are important pockets of resistance to these hegemonic practices (Hogopian, 2014), but the trend is global, as Asian economies increasingly copy and exceed our test-obsessed approach to schooling, while efficiency-oriented, testing-intensive, and market driven educational projects head the list of World Bank and Gates Foundation funded “reforms” throughout the developing world (Sahlberg, 2012).

But education is only one example. This is a ubiquitous pattern in the evolution of civilizations: the creation and institutionalization of measures and standards is a lopsided affair, where power is wielded by a few over the practices and definitions of reality that shape the lives of many. In recognizing this reality about the profound impact of measurement infrastructures and standards-based regulatory practices, new possibilities for resistance and for re-visioning social realities emerge. Bringing invisible infrastructures to light, allows us to see if we are structuring our lifeworld so that social justice and human dignity reign.

In particular, and in keeping with the theme of this conference, when thinking about how to orchestrate global impacts and activism inspired by Integral Meta-theories, one focus should be on the re-design of standards and measurement infrastructures of global reach. At the very least this would involve the democratization of global standards-based regulatory practices, as well as absolute transparency and credibility in measurement science and practice. There is a future in which planetary justice exists, but to get there we must use the master’s tools to dismantle the master’s house—and

measures and standards are some of the most powerful tools around.

So this paper is essentially a call for education and activism around the pivotal role of our increasingly diverse and rapidly expanding measurement infrastructures and standards-based regulatory practices. Focusing on these as basic structures and institutions is a unifying political strategy for those interested in progressive global action toward a more just world order (not be the anti-globalization movement; the movement for global justice). A narrative around the reform of measurement and standardization could serve to orchestrate a *decentered unity* of diverse political actors and organizations.

What do agricultural innovators, education reformers, climate-change activist, anti-capitalist organizers, free-the-web techies, and holistic medical and psychology advocates all have in common? They all want to see *radical* changes in the basic measures, definitions of reality, and standards of practice that shape large-scale social projects. They are looking for a change in the *structural DNA* of society, a revolution in the source code. To re-design measures would be to rearrange the basic structures by which live and work. It would not be the first time in history that a wholesale revolution in measurement fueled the fire of wholesale political revolution (Tavernor, 2007; Kula, 1986).³

Below I begin with a broad historical survey of how measures and standards have played a role in the evolution of civilizations. I deal with the philosophy of measurement in particular, and build a minimalist integral meta-theory of measurement. I explain how measurement infrastructures shape our perceptions of reality, our sense of what is true and false, real or illusion; they also impact how we view what is good and bad, just and

³ I am referring here about the relation between the metric system and the French revolution. Part of overthrowing the crown and aristocrats was overthrowing their measures, which had long been used as instrument of injustice. I will discuss this further in the next section.

unjust. Measures and standards are implicated in our group practices and cooperative endeavors as basic structures and tools, showing up across all the planes of social being and each of the four quadrants (i.e., every measurement instance is a bio-psycho-socio-cultural affair, Wilber, 1995; Bhaskar, 1993). I bring the story up to date and look at our current *global crises of measurement*, providing examples from domains as diverse as education, climatology, economics, and medicine. These are all domains where measures and standards are deeply politicized and thus subject to corruption, ideology, and often just plain bad science. I close with some speculations about preferable futures for global measurement infrastructures and standards-based regulatory practices, seeking to inform the creation of new approaches to the representation of complex global realities, especially transactions involving non-monetary value, measurements of psychological interiority, the probabilistic modeling of non-linear dynamical systems.

Origins: The Mysticism, Mythology, and Politics of Ancient Measurement Practices

The relationship between social justice and measurement goes back to the origins of human civilization. Humans have almost always been engaged in measurement practices of various types, even prior to the creation of cities, agriculture, and complex divisions of labor. The very earliest human artifacts showing evidence of tool making and complex cooperation all show that even pre-historic humanity practiced basic forms of measurement. Constructing a spear, arrowhead, or shelter, creating a musical instrument or article of clothing, all require engaging in measurement practices. These earliest forms of measurement were often informal, intuitive, and conducted by simply referencing the dimensions of one's own body (e.g., palm span, arm length, foot, etc.). In fact, all ancient

cultures had measurement practices that were modeled on the dimensions and proportions of the human body. That the common root of all measurement can be found in the relationship between the human body and the natural world accounts for the intriguing coherence and seeming mystical unity between architectural sites of ancient cultures that are widely dispersed in time and space (Michell, 1972). The simple elegance and beauty of many ancient structures can be attributed to their conformity with certain idealized proportions of the human body, usually inspired by (also cross-culturally common) mythologies about the parallels between the dimensions of the human form and the sacred structure of the universe itself.

Early in human history these anthropocentric measures became institutionalized and made part of the dynamics of religious authority and political power, especially in the first great empires that emerged in the Nile, Tigris, and Indus river valleys (Mumford, 1967; Tavernor, 2007). It was trade, massive construction projects, and agricultural planning that fueled these first large-scale standardizations and enforcements of measurement practices. The basic units of measurement still made reference to the human body, but they were no longer allowed to vary according to each individual's unique body and context. Instead, a single measure came to be decreed as valid throughout the land. For example, this often involved making the length of one specific foot (typically understood to be that of the King) into *the official foot*.

While it was sometimes literally true that these sanctioned units were actual representations of the physical dimensions of the King's body, more often it was symbolic and mythic. The institutionalization of measures referencing the King's body modified and reinforced the myth of the sacred political microcosm-macrocosm: the body

of the king and the body politic form a mystical unity, so the kingdom is built and run according to his bodily specifications (Kula, 1989). “The union of mystery and authority in one body was essential to the survival of kingship, and measure was a physical manifestation of both” (Tavernor, 2007 p. 34). From the construction of the Great Pyramids to the building of Roman highways (straight as an arrow, with perfect uniformity of width), empires are built on standardized measures and their enforcement, accompanied by ideologies suggesting that the official measures are of legitimate and unassailable (even divine) origin. The close connections between empire, measurement, and ideology continue to this day, a theme I will explore further below.

Taxation and marketplace transactions are also dependent on measures. This is another reason measurement practices have been codified and enforced by centralized political and religious powers, beginning early in the ancient world. Bushels (of oats), bales (of hay), areas (of land), and dimensions (of houses), have long been essential factors in determining rates of taxation and equity of exchange in the marketplace.⁴ In ancient urban centers known for their trade and commerce, there were usually officials sanctioned by the powers ruling the city to regulate measurement practices in the marketplace. Tax collectors were always equipped with official measurement tools in

⁴ It should be noted that one of the functions of *money* is to reduce all other measures used in the marketplace to one universal measure of value. While it is easy to exchange like-for-like (2 bushels of my oats is equal in value to 2 bushels of your oats), it is hard to exchange dissimilar commodities, especially when they involve different basic units of measure (how many bushels of my oats is equal to 3 gallons of your wine?). Money serves as a kind of meta-metric that facilitates cross-metric value exchange (5 bushels of oats is equal to 20 dollars, which is equal to 3 gallons of wine). Suffice it to say that the power of money to reduce all measures to one is also the source of its greatest danger. Money homogenizes value, and renders many important differences between commodities invisible. Also, the quantitative structure of money encourages the quantification of value, which promotes the proliferation of value measurement, even in areas where value is impossible to represent in simple quantitative terms (i.e., turning things into commodities that are not best understood as commodities, such as human lives and labor). Innovations in measurement that allow for non-monetary representations of value are discussed below. Money is also discussed below where econometric indices are considered as an aspect of the current global crises of measurement. However, a full discussion of the connections between measurement and money is beyond the scope of this paper (for more on this important topic see: Eisenstein, 2011; Harvey, 2014; Marx, 1867).

order to resolve disputes over the size of bushels or the area of a farm field. Certain cities and their administrators became known for fair and just measurement practices, others for unjust ones. The connections between measurement and justice were apparent to the ancients, so much so that many of the first written legal documents (e.g., the constitutions of the Greek city-states) included extensive references to the regulation and standardizing of measures (Kula, 1989).

Given the primacy of measurement in early civilizations, it is clear why measurement tools and practices became seen as markers of justice and civility. Measurement instruments often embodied in their construction the most sophisticated technologies of their day (incredibly precise metallurgy is needed to make scales and standard weights, as well as rods and other measures of length). Measures also played an essential role in the construction of monuments that (still) stagger the imagination. They also enable the coordination of trade and fostering fairness and mutual understanding in the marketplace. The difference between civilization and barbarism came to be seen as the difference between who has good measures and who does not.

It is no surprise then that ancient religious texts (especially the Bible) abound with reflections on measurement and the ethical significance of good, true, and just measures. The Talmud is explicit: “an unjust measure is an abomination to the lord.” (Proverbs 11:1). The New Testament also contains important reflections on measures and justice, such as when Jesus knocks over the scales and measurement tools of the corrupt moneylenders who had set up shop in the temple. Further examples of ancient sacred texts that address the connections between measurement and humanity’s sacred responsibilities can be listed, including examples from Eastern traditions such as the

Hinduism and Confucianism (see: Kula, 1989; Busch, 2011). They all amount to the same message: the reign of justice and truth on Earth depend upon humanity's establishing just and true measures.

This religious theme was often deepened through explorations of the esoteric connections between measurement, sacred geometry, numerology, and archetypal imagery. It has long been believed that certain lengths, dimensions, and ratios are of sacred or divine origin. It was a common belief in the ancient world that God(s) bestowed to humans the tools of measurement and the exact lengths and weights that facilitated the emergence and growth of civilization. The Egyptians traced the birth of measurement to Thoth and the Greeks to Hermes, while monotheists traced their measures to God, typically through a specific prophet (Tavernor, 2007). In this framework, the just and true measure was thought to be the first, primordial, and divinely sanctioned measure. Isaac Newton himself expended great effort to determine the true length of the original “Solomonic cubit”—the basic unit of length used to build the temple of Jerusalem according to God’s blueprint, as provided to King Solomon. Knowing its true dimensions would allow for accurate reconstructions of the Temple and of Noah’s Ark, the measurements of which are both described in detail in the Talmud. It was thought that building these according to exact specifications would implicate humanity in the creation of divine structures of tremendous power, creating a mystical home for God on Earth, thus ushering in the reign of Heaven. The mysticism of measurement, and the religious aura and power surrounding measurement practices, is often overlooked in accounts of the history of civilization and human culture.⁵

⁵ From such a perspective, in this paper I am arguing that activism addressing the re-design of measurement infrastructures and standards-based regulatory practices should be understood as a kind of *sacred activism*. It is an

Modernity and Metrology: From Sacred Measurement to Scientific Measurement

Modernity began with a series of revolutions: the American, French, Scientific and Industrial—all during roughly a half century (1760-1810). This revolutionary political and scientific climate also produced a profound revolution in measurement practices. The metric system, today known as the International System of Units, or the *Système international d'unités* (abbreviated SI), is an invention that embodies all the ideals of the Enlightenment, and in many ways represents the best of “the dignity or modernity” (Wilber, 1995). The motives for its creation were complex, including scientific, economic, and ethical concerns. The result was the first global measurement infrastructure, an overthrow of anthropocentric measures, and eventually the widespread disappearance of regional and cultural differences in measurement practices.

When the scientific revolution began, Europe was in a state of great confusion and conflict concerning measurement practices. The Middle Ages brought a decline in centralized political regimes with the power to set official measures, which led to a proliferation and fragmentation of local measures. This became a serious impediment to the expansion of trade, and also caused problems for the burgeoning international collaborations taking place in many rapidly advancing sciences. It was a social justice issue as well, as measures were often under the control of the local guilds and property owning lords, and thus subject to corruption, leaving peasants and commoners open to

endeavor to make measurement practices sacred again by reclaiming ancient ideas about role of measurement in the creation of basic structures that align with natural realities as well as human aspirations for justice, truth, and beauty.

measurement-enabled exploitation.⁶ In the decades leading up to the French Revolution, major efforts were being made to address these issues.

Measurement was one of the chief agenda items dealt with by the first scientific organizations ever created, the Royal Society in England, and the Academy of Science in France. The need for greater regulations in measurement practices, universally standardized measures, and international coordination were clear, even if just to assure the progress of science. What was not clear was how to go about determining what the new measures should be, and how they could be broadly institutionalized. It was decided that in the wake of Newtonian science, which marked the emerging dominance of a science based on abstract universals and non-anthropocentric ideas, the basic units of measurement should not be based on the dimensions of the human body. Instead it was agreed that measurement should be based on something abstract and universal. In the end, a decision was made by the French Academy to have the length of the meter be a fraction of the length of the Earth's circumference. There was to be a global basis for a global measure. This decision is a fascinating glimpse into some of the first manifestations of world-centric consciousness.

⁶ A classic example of measurement-enabled injustice from this time involves millers, who owned the local mill; the only place local farmers could take their grains to be processed. Millers would collect grains to be milled in bushels (of a size they controlled) and return processed flour in sacks (also of a size they controlled). It was not uncommon at certain times of year for a miller to increase the size of the bushel while decreasing the size of the sack, thus leaving him with a larger surplus of flour, which he could then use or sell. There was no way to prosecute these kinds of metrological corruptions, because there was no centralized power regulating measurement practices. This was such a common problem that many medieval religious parables include stories of bizarre punishments in the afterlife for millers and merchants who engaged in underhanded measurement practices (see, Kula, 1989, for dozens of comparable examples, from bartenders with variably sized "pint" glasses, to pimps with watches that run fast). As I discuss, one of the great benefits of modern forms of standardized measurement is that they eliminate these kinds of simple measurement-enabled injustices. Of course, now we have measurement-enabled injustices of a much more complex and subtle nature. But at least we can trust that a pint is a pint no matter what bar you go to, and that a gallon is a gallon, regardless of the gas station.

However, it turns out that precisely determining the true dimensions of the Earth is extremely difficult. At the time long standing debates about whether Earth is a perfect sphere were still being engaged. So the French Academy sponsored one of the largest scientific expeditions in history, with the goal of measuring the meridian between Paris and Barcelona using highly advanced surveying technologies and techniques. The project took 7 years, but was eventually completed, and hailed as one of the great scientific achievements of the era. On August 1st 1793 the length of the meter was legally designated as the length equal to the ten-millionth part of the arc of the terrestrial meridian contained between the North Pole and the Equator. Years later, after the metric system had been spread far and wide, it became clear that critical errors had been made and that the meter was not truly related to the dimensions of the Earth as it had been claimed. The intricacies of this crucial moment in the history of science and measurement are beyond the scope of this paper. The point is that the meter is as arbitrary a length as any previously institutionalized foot, and perhaps even more so, given that it is not even tied to the dimensions of the human body (see: Adler, 2003; Tavernor, 2007).⁷

Beyond these scientific difficulties, it was the political and cultural challenges posed by traditional measures that proved the greatest challenge to the success of the metric system. As discussed in the next section, measurement infrastructures are uniquely

⁷ I am focusing on *length* here as matter of convenience and clarity. The metric system also standardizes units for volume and mass, but these are based ultimately on the length of the meter (the details of the conversion of length into weight and volume are too long to go into here). Interestingly, during the height of the metric reformer's ambitions they proposed a metric standard of time, which would have decimalized time measurement, creating a 10-month year, a 10-day week, and a 10-hour day. This was part a broader revolutionary plan to de-Christianize the calendar and make it scientific. These efforts at reforming time and calendrical measurement failed, in part because of the power of the clock and watchmaking guilds, but mostly due to the profound disruptions it required of deeply set traditional rhythms of life, work, and holiday.

difficult structures to change once they have been in place for a time.⁸ In fact, it would require a wholesale revolution in social and political life (the French Revolution) to create an opening for the wholesale reform of measures. A revolutionary chant echoed through the streets of Paris: “one measure, for all people, for all time!!” The large-scale standardization and re-design of measurement was a part of the rallying call of the revolution. Old measures were associated with the *Ancien Régime*. Eventually supporting them would be cause for beheading during the Reign of Terror. The metric system was institutionalized by bayonet and guillotine.

The spread of the metric system coincided with unprecedented processes of standardization across whole swaths of social and institutional life, especially in industry (Porter, 1995; Busch, 2011; Scott, 1998). Fueled by global trade and shipping on a scale never before imagined: railroads, steam engines, ocean liners, skyscrapers, and eventually cars and highways. And they were all built according to levels of exactness in measurement never before achieved. This was the result of new standards-based regulatory regimes of global scale, the first of which began in 1856, with the meeting of the International Association for Obtaining a Uniform Decimal System of Measures, Weights, and Coins. This organization’s first president, the international banker Baron Rothschild, saw the clear result of international standardization as an assurance of quality control, interoperability, and efficiency in production on a global scale. A series of

⁸ This is a phenomenon known in sociological literature as *path dependence* (Busch, 2011; Luhmann, 1995). Once a complex system is far enough along down a particular path, it becomes cheaper and easier just to stay on that path. Once a measurement infrastructure is in place it creates condition around itself (called layering or interoperability); as infrastructures become geared into one another they become very hard to change. This is one of the reasons that the United States does not use the metric system. The US had already gone too far down the road of standardizing its own measures and fostering industrialization to retrofit all railroads and factories in the country. I will return to a discussion of path dependence below.

organizations lead eventually to the formation of the International Bureau of Weights and Measures, as well as the International Standards Organization, which I will discuss more below.

Following from these efforts of *haute finance* came the emergence of complex global industries, such as pharmaceuticals, weaponry, energy, and large-scale agriculture, which thrived on the new planetary infrastructures of measurement and standards-based practice. As a result of this seemingly miraculous mixture of industrialization, scientific progress, and cultural modernity, standardization and measurement became part of the moral worldview of an emerging global order. Part of what transpired during this cultural transformation was the disenchantment of measurement, its domestication; the scientization and bureaucratization of measurement functioned to remove its auratic connections with religion and ancient forms of un-scientific power.

However, the connections between measurement, power, and mystery can never be broken, they are simply reproduced at a higher level. As numerous commentators have demonstrated (Mumford, 1967; Wilber, 1995), tremendous power and mystery came to surround the cult of science:

The meter took on a new significance and it was accorded mythological, even sacred status. The installation of the definitive prototypes in the underground vault in the ground of the International Bureau [of Weights and Measures] at Sèvres on 28 September 1889 took the form of a ceremony of deposition. This was to be re-enacted every six years, a procedure more familiar to a religious sect or secret society than a rational scientific organization. It involved four keys of admission that were distributed among the foreign signatories of the International Committee. When they meet sexennially, the four delegates are required to bring the key, enter the underground vault, and inspect and confirm the safe condition of the prototype standards.... To insure its longevity—for all people, for all times—scientist-custodians [keep the “true” meter] out of reach of common humanity at large, controlling the metric system independently of nations.... On 14 October 1960 it was agreed to return to a truly “natural” and scientifically verifiable definition of the meter based on the orange-red light emitted by the radioactive krypton-86 atom, so that the meter would equal 1,650,762.72 wavelengths in a vacuum.... Since 1983 it has been defined more simply (though no easier to

comprehend) as the distance that light travels in a vacuum in the fraction of time of $1/299,792,458$ of a second.... While a fundamental unit for all times had been settled on, it is one that can be comprehended only by scientists and verified only in a laboratory under their control.... It [the meter] has no relation to human form, the shape or extent of the earth, or to any form at all.... It is a measure of everything and nothing. It is culturally removed from the mainstream experience of society. It is a measure of total abstraction. (Tavernor, 2007 pp. 149-151)

Towards a Minimalist Integral Meta-Theory of Measurement

Humanity must find a way beyond measures of total abstraction. While universalistic and scientific approaches to measurement brought much of the dignity of modernity, they also brought disaster. The metric system set the tone and tenor for the developments we see before us today: the wide spread use of measures that are indifferent to interiority and incapable of capturing the dynamic variability of the local, contingent, and unique. Universalistic and scientific measures dominate global and local life across nearly every sector of experience and society—from agriculture to education to healthcare. Practices are seen as if they need to be standardized and measured, even if they never were before, even if they defy standardization or would better be understood as personal and unique. This is an age of hyper-measurement, as more and more is measured every day in greater and greater detail.

Make no mistake: many standards and measures are good and necessary. We must not throw out the baby of rigorous measurement with the bathwater of modernity's disasters. The integral meta-theory of measurement being developed here aims to transcend but include pre-modern, modern, and post-modern perspectives on measurement. Nevertheless, taking an integral approach to measurement does mean overcoming the simplistic (and usually mindlessly quantitative) measures used today,

which *are* the legacy of modernity. So-called “modern measurement” has fractured and diversified during the maelstrom of post-modern planetization. Today’s measures still suffer from the abstract universality of modernity. In addition they also suffer from a new post-modern form of standardized differentiation (Busch, 2011). The universal is displaced by post-modern fragmentation and a diversification of measures ensues. Yet this new set of measurement-enabled standardized differentiations is equally as abstract and artificial as the single universal that was displaced.⁹ The post-modern landscape of measures is one in which a hyper-measured self is shaped by a network of mostly superficial or fictional measures. While there are some true and just measures that must be protected, the best measures have yet to be built.

Before going on to look at measurements and standards in post-modern society, and at the shape of our contemporary global crises of measurement, I want to bring together some insights from history and do some meta-theoretical work. In a series of other papers I have outlined my stance on meta-theory (Stein, 2015; 2013; 2010). I adopt a pragmatist’s view of meta-theory, and engage in meta-theorizing that is problem-focused and action oriented, and that errs on the side of conceptual simplicity. That said, my approach is aligned with Critical Realism (Bhaskar, 1993) and Integral Meta-theory (Wilber, 1995), and I will here be drawing on some of the essential ideas shared by these two traditions of meta-theorizing and integral philosophy. The problem that focuses my

⁹ Consider the realm of psychological measurement, just as an example of how the move from modern to post-modern is a move from the standardization of a single abstract universal to the standardization of differences. In the early decades of the 20th century there was one test that really mattered, the IQ test. It claimed to measure a single index of your mental worth, and was broadly institutionalized as such across a wide array of gatekeeping institutions. Today there are literally hundreds of distinct psychological measurement techniques, (thousands depending on your definition of testing). Instead of taking one or two high-stakes IQ tests, children take dozens of high-stakes standardized tests (hundreds depending on which state in the US you live in). Many of these new tests are just as illusory and ideological as early IQ tests, yet their sheer quantity and diversity impact the shape our lives and our self-understandings—the hyper-measured self is a uniquely post-modern phenomena I discuss more later on.

meta-theoretical explorations here is the impact of measurement infrastructures and standards-based regulatory practices on personality structures and culture. So I will hone in on the meta-theoretical centrality of interiority and consciousness, as well as the simple bio-psycho-socio-cultural portrayal of reality provided by Wilber's quadrants and Bhaskar's social cube. I provide the figures and graphs for a Wilberian all quadrant analysis of measurement in the Appendix.¹⁰ I will summarize the general results here.

Measures and standards can be built to address realities in any of the quadrants. That is, we have measures for physical realities (the metric system), systems of things (econometrics), cultural patterns (political polling), and psychological realities (standardized tests). These parentheticals are only examples; each quadrant can serve as the focus of any number of measures and standards. The vast majority of existing measure and standards address realities in the right-hand quadrants, i.e., physical realities and properties of physical systems. But more and more new standards and measures are being used that target interiors and cultural patterns, especially advertising and social network metrics, standardized testing, and political opinion research and polling.

Importantly, a measure or standard built addressing a reality in any one quadrant will have impacts on all the other quadrants. This is to say that no matter what quadrant a measure *focuses on*, the measure itself is an all quadrant affair. Just because a measure focuses on some physical reality does not mean it has no psychological impact. And vis-à-vis: measures of mental and cultural phenomena often result in very real physical impacts. For example, standardized tests (understood as measures of interiority) result in whole schools being closed and a wide array of other physical results (such as your being

¹⁰ The Appendix will be circulated at my talk and then integrated into later versions of this paper.

granted the right to walk into one college as opposed to another). Going the other way: measures of global temperature rise (complex physical measures) have profound impacts on personalities and culture.

Because of this ontological complexity, all measures can and should be evaluated beyond their objectivity and reliability, beyond their usefulness for efficiency, quantification, and monetization (all right-hand quadrant qualities overvalued in contemporary measurement). Instead, all measures and standards should be viewed also in terms of their alignments with justice and beauty. It is never enough to only know how accurate a measure is, although accuracy is important. We must also know the degree to which it serves justice and beauty to use the measure. This is an ancient idea about measurement, which we should try to remember today.

Modern and postmodern measures are predominantly instrumentalities of flatland (Wilber, 1995), focused on exteriors and objectivity, neglecting rich representations of interiority. Yet they nevertheless impact interiority. Measurement infrastructures are tied into the very fabric of the lifeworld, a basic part of the background consensuses and agreed upon definitions of reality that allow us to get along and cooperate. Picture a transaction at a gas station or grocery store, and now imagine it without agreed upon measures, a situation wherein every exchange is contestable to the level of disagreement as to what the unit of measure is. You can run this same thought experiment in a scientific laboratory or construction site. Without measures and standards of practice, nothing will get built and there will be no mutual understanding. Measures are basic structures in all quadrants. Instituting a measurement infrastructure or standards-based regime creates structures and habits across all the quadrants.

Four additional principles are needed to round out this initial sketch of a minimalist integral meta-theory of measurement. Firstly, *measurement practices enact realities*. They serve as lenses and function to represent aspects of the world in ways that garner consensus, thus profoundly shaping individual and cultural perceptions of reality. They also function as technologies and tools enabling the literal physical construction and regulation of new realities, be they physical or social. Measures and standards are part of the reason we think and act the way we do. They are part of the reason why the modern world of houses, cities, cars, and institutions has the physical shape it does. From the size of doorways and alarm clocks, to the pitch and angle of highways, the organization of large-scale agriculture, and the safety inspection of your car; the world looks and moves the way it does because we use certain measures and standards and not others.

Secondly, *measurement is intrinsically related to power*. Those who have the power to create and institutionalize measures and standards control society. This is in part because standards and measures are unavoidably normative. They say how things *ought* to be, how practices and products *should* look. Therefore, instituting them is an act of power, because doing so means exercising control over people and things. People, in particular, are controlled through measures and standards. They are controlled not only in terms of their perceptions of reality, but also in terms of how their cooperative endeavors are structured and trust between them is enabled. “In our [post-]modern world [measures and] standards are arguably the most important manifestation of power relations” (Busch, 2011 p. 28). Measures and standards are powerful because they involve “*the ability to set the rules that others must follow, or to set the range of categories from which they may choose* (*Ibid*, emphasis in original). This is a kind of anonymous power that is quite

unlike the power of a tyrant or dictator—it is a subtle, hardly noted power, sometimes only seen when basic social expectations are violated or technologies break.

Thirdly, *measurement induces reflection*. We see ourselves through our measures and standards. Measures have always been one of the ways we keep records, from tax collecting to the census. They allow us to systematize and quantify things we care about, and often these things concern us intimately. Medical diagnostics, standardized tests, and tax forms are only a few of the measures that have us reflecting on who we are and what we are doing. There is a historical correlation between the availability of bathroom scales and incidents of anorexia, beginning with their widespread introduction into homes in the 1950s. There are also correlations between the rising number of diagnostic categories in the DSM and the rising numbers of individuals diagnosed as mentally ill. Climate change crusaders seek to change our whole conception of culture and self based on some very complex and breathtaking numbers. An increase in the GDP of a nation is enough to spark celebrations of pride. All measures provide us with information; some do so about things that are deeply implicated in our personality and the ways that we regulate self-esteem. To measure something is to make it exist, and to think you see it clearly. This can be empowering, or dangerously misleading. The hyper-measured post-modern self is engaged in kaleidoscopic self-reflection, mediated by dozens of self-related measures. I discuss this new hyper-measured self further below.

Fourthly, *measures determine what counts as research and science*. Measures create the most basic systems of categories in terms of which scientific research is conducted. There are important standards that regulate scientific practice, including peer review practices, and rules of statistical inference, which are all implicated in crucial

standards-based regulatory regimes, such as FDA drug trials and environmental policy research. You cannot ask the right question if you do not have the right measures at your disposal. You also frequently cannot use existing data critically because presuppositions are built into the ontology of the existing measures. Measures are at the crux of paradigm shifts and cross-paradigmatic disagreements (Kuhn, 1962), another theme discussed further below. New measures bring with them new sciences, and new sciences often require the invention of new measures (Peirce, 1866). Thus part of re-designing measures is epistemological, as innovations in measurement lead to adventures in truth. To make a new measure is to catalyze an expansion of what can be known, as well as what “counts” as known from a social systems perspective.

There is much more that needs to be said about this minimalist integral meta-theory of measurement, especially concerning the prescriptive and political implications of the theory. However, I must go on for the sake of space. Moreover, for the meta-theory to make sense additional context is needed. So I will explore contemporary post-modern measurement infrastructures and the future of measurement as a way of further elaborating the meta-theory of measurement outlined here.

Measurement Proliferates During Post-Modern Planetization

Sociologists have converged on the little noted fact that today standards-based regulatory regimes and measurement infrastructures constitute some of the only existing rules and regulations that are implemented on a global scale (Busch, 2011). “Most standardizers [and metric makers] are private sector organizations or private persons. They are particularly common and important on the global stage, where they meet less

competition from other rule setters; there is no world state with legislative power.... Rather than being controlled by states, many standardizers want to influence and control state polices.... Many of these standardizers are also highly successful” (Brunsson & Jacobsson, 2002 pp. 1-4). The list of the Non-Governmental International Organizations that function as standards-based regulatory regimes and the administrators of measurement is long: World Wide Fund for Nature (WWF); UNESCO; International Women’s Rights Watch; the International Standards Organization (ISO); OECD; International Labor Organization, and so on (see: Busch, 2011; Brunsson & Jacobsson, 2002). This is cursory overview leaving out whole realms such as finance, education, and ecology (each of which I discuss below).¹¹

All this standardization and measurement amounts to an unprecedented state of affairs. This movement towards a hyper-measured humanity began right after WWII, but started picking up steam around 1970, as standards-based regulatory regimes and measurement infrastructures have been part and parcel of neoliberal global policies toward increasing efficiencies in planetary trade and communications (Harvey, 2005. Busch, 2011). Today the post-modern world is overrun with measures and standards. And although we may not realize it, much of the anomie and injustice of the post-modern lifeworld is a result of the proliferation of measures and standards. Importantly, today we do no face the pathology of the one-dimensional modern human, the distortion of individuals when they are all aligned against one abstract standard (although in some places and institutions, we still face that). The post-modern condition involves the

¹¹ And, of course, there have always been public sector and state run standards-based regimes and measurement infrastructures. These peaked with modernity, and have since been supplanted by non-governmental international organizations as the dominant players in large-scale standardization and measurement (Brunsson & Jacobsson, 2002).

fragmentation humanity, a multi-perspectival personality, refracted through a prism of standardized differentiations and mass-customizations (Harvey, 1990).

The hyper-measured self is a result many things, but largely of the recent increased emphasis on measurement in education and human capital management systems. For example, ISO9000, the human resource and management standards issued by the ISO impact the lives of millions of workers, as the largest quality control body for human capital management in the world. Not surprisingly, those most impacted by the standards (the millions of workers) have no say in the creation of these standards. They are created by a group of experts, with ties to most major international corporations. ISO9000 exemplifies trends in measurement intensive accountability and efficiency oriented standards for post-modern organizations. These trends, now global, began with Fredrick Winslow Taylor (1911), in the 19th century, whose simple use of a stopwatch (a crucial innovation in measurement technology), would allow him to optimize workflows and rebuild entire industries around the principles of measurement intensive scientific management. Today more sophisticated versions of the system sciences are applied to organizational governance and development, and they are always measurement intensive. Most people involved in institutionalized life are thus subject to a whole array of measures over which they have little or no control.

Let us return to our morning routine example from the introduction and have our average Joe or Jane go school, work, shopping, or a doctor's appointment. We would see the further implications of post-modern standards-based regulatory regimes on the formation of human personalities and cultural patterns. The move from modernity's homogeneity to postmodernity's standardized diversity is a move from less to more

measurement, in terms of both sheer numbers of measures and in terms of magnitude of impacts. Post-modernism is about difference, and marking out more differences requires more measurement. Our late-capitalist commodity intensive life-styles are caught in a web of standardized differentiation. We are not being unified and homogenized as we were during modernity; we are being divided and isolated into a pastiche of mass-customized personalities via measurement intensive standardization practices, from marketing to service industries, therapy, medicine, education, and fashion.

Global Crises of Measurement: Whose Measures, Whose Future?

To help gain an overview the situation with regards to post-modern planetary measurement infrastructures, I'll follow a common trope in critical meta-theory, from Habermas (1973) and Bhaskar (1993) to Harvey (2014), and talk in terms of a series of crises. What follow are best understood as crisis because they are systemic, endemic, and signal a need for deep structural *transformation* (in the strictly Wilberian (1995; 1999; 2006) sense of the term, as a need for vertical structural transcendence and reorganization). All of these crises are interconnected, ricocheting between the system and the lifeworld, and around the quadrants and planes of social being. I cannot detail each of the six crises here due to limitations of space, so I offer only overviews and allusions.

Economic crisis: poverty, inequality, and econometrics

It has been known for some time that GDP (Gross Domestic Product) is a simplistic misrepresentation of the health of any national economy; it is also a poor index of cultural modernity, human rights violations, and democracy (Sen, 1982). Yet GDP continues to be discussed in a serious manner and continues to drive national economic agendas. Similarly, most representations of *profit*, the so-called bottom line, are also gross simplifications of what makes a company valuable. In both cases a simplistic quantitative index is used in summary, and in place of richer qualitative analysis, or even just a more complex quantitative analysis with multiple parameters.

One important thing missed by summary indices of economic systems (like GDP, or simple calculations of profit) is intra-systemic inequalities—the differences between the most well off and the least well off are disguised. Highly profitable companies and nations with rapidly rising GDP often have staggering inequalities of wealth. In fact, in many organizations the rate of profit and the rate of exploitation (and thus increasing inequality) are correlated (Bowles & Gintis, 1998; Harvey, 2006). The less you pay workers, the more you skim off the top, and the more profits go up. GDP is similar, in that it is the perpetual expansion of the economy that drives numbers up. GDP goes up as things that used to be free are brought into the market and given a price. This means that we would be *lowering* GDP, for example, by teaching people to grow their own food, or treat simple ailments with herbs they grow themselves, or start a free neighborhood parent group that shares childcare. On the other hand, opening a childcare center, herbal company, or commercial farm expands the economy and makes the GDP go up. Take something people can do or get for free and sell it back to them, that is what makes for

economic value according to simplistic growth-oriented measures like the GDP (see Eisenstein, 2011).

Importantly, there is vast and contested terrain beyond the debate over GDP and the distortion of human cooperation due to the hypertrophy of the profit motive. Consider, for example, the role of credit and financial rating agencies, and the dozens of other standards-based measurement intensive activities involved in high finance. The recent economic crisis was largely the result of inadequate and deceptive ratings applied to collateralized debt obligations (or CDOs)—most of predatory high-finance runs on deceptive “metrics” (George, 2013). The pretense of having reliable and “true” measurements of risk and return was used to distort perceptions of reality and create whole realms of fictitious capital (Harvey, 2006). Of course, all measurement-enabled fictions, or measurement-induced demi-realities (Bhaskar, 2002) eventually come crashing down, especially when they run up against the actual limits of the biosphere.

Ecological crisis: the politics of measurement and complex systems.

The ontology and epistemology of the climate change debates have been explored in depth from the perspective of integral meta-theories (Esbjörn-Hargens, 2010). Less explored are the ways that measurement and quantification impact climate epistemologies and contribute to the increasingly pluralized ontologies of the climate debate. Knowledge is made by metrics, especially quantitative and scientific knowledge. Moreover, the climate change debate has become so deeply politicized that trustworthy measures are hard to find. At the heart of every climatological debate is the interpretation, use, or placement of a measurement instrument (or thousands of them, as in the case of global

temperature readings, where thermometers are tracked over decades, dotted across the entire surface of the earth). The nightly news abounds with results and percentages gleaned from measures we know very little about. Sometimes the numbers put us at ease, but more often they cause us distress. The mass media is engaged in uncertainty management through manipulations in measurement and the representation of quantitative data (Chomsky, 1990). There is, of course, a lot to say on the science and politics of climate change indicators, which is an important sub-plot in the recent social and political history of quantitative objectivity (Porter, 1995).

More important, I believe, is the fact that as the climate crisis deepens there will be a proliferation of standards and measures related to sustainability, ecological accounting, and environmental law. This brings to mind the specter of an eco-fascist dystopia of hyper-measured and standardized humans, radically curtailed in their freedoms due to the precarious ecological limbo in which they find themselves. The need to *strictly* enforce future environmental regulations due to extreme climate disruption and delicate ecosystem balances will create conflicts around measures as simple as ounces of water and particles of Co2. In the context of a future where humanity is engaged in a reflective and delicate balancing act with the biosphere, environmental standards-based regulations and related measures will be some of the most important and politically contentious issues on the world stage.

As the ecological crisis deepens we must remember that there are *unjust* ways towards sustainable futures. Sustainability does not entail justice; sustainability is a lower-right quadrant, systems idea, and can be achieved by means of any number of socio-cultural forms. We must make a moral commitment to the idea that sustainability

requires social justice. The future of ecological regulations, standards, and measures must be democratized and made integral, as I discuss further below. Of course, Wilber (1995) noted some time ago that the ecological crisis is better thought of as a crisis of consciousness—the noosphere is the problem, not the biosphere—what we see is truly a crisis of decision-making, resulting from erroneous and demi-real worldviews. So education is near the heart of the solution to the ecological crisis.

Educational crisis: testing, standards, and marketization.

I have already discussed this in several places above, and have a forthcoming book on the subject (Stein, 2014). What I will say here is that the great critical theorist of education, Michael Apple (2001), pointed out well before Bush's No Child Left Behind and Obama's Common Core Standards and Assessments that American schools could much more easily be turned into a marketplace if there were national standards and national tests. This is because there would then be a single clear axis of competition and comparison. His words were prophetic. The US educational system is undergoing a transformation into a largely market driven and privately run collection of enterprises. Things have changed so rapidly and radically that even mainstream one-time-conservative policy makers are beginning to take note (Ravitch, 2013). And standardized testing is at the center of this sweeping revolution in mass education.

The entire movement towards marketization is based on the presumption that testing can be used to quantify and thus monetize educational value. As I have argued elsewhere (Stein, 2014), this involves an oversimplification of educational value and an overvaluation of tests as measures of educational processes—that is, it is a thoroughgoing

non-integral, flatland policy. Nevertheless, we will see in the next 10 years a testing-based overhaul of the US public schools. State run schools will largely be replaced by a diverse and socio-economically stratified educational marketplace, with tests and standards playing a major role towards ensuring that vouchers are spent on schools that meet state testing benchmarks.

Large-scale standardized testing should be seen as perpetrating a form of injustice that has long and complex roots in the control and categorization of urban populations, especially laborers and the poor (Gould, 1996). Testing has forever been part of the scientization of education, as well as the commercialization of psychology (Spring, 1989). Today testing is being used to surveil and discipline whole schools and districts that are yearly threatened with being shut down and replaced by privately run charter-school chains. The people most impacted by the tests (teachers and students) are the farthest away from influence over the nature and content of the tests (Stein, 2014; Hogopian, 2014).

Preferable futures for educational assessment involve the democratization of authority structures of schools and the elimination of all high-stakes practices and policies in favor of formative, developmental, and transformative approaches—a move toward truly authentic assessment. There are real possibilities for justice-oriented approaches to assessment and student evaluation (Neil, 2015), as well as use of the learning sciences and diagnostic technologies to improve student learning (Dawson, 2015). Of course, we cannot get sweeping education reform in a democracy unless we change how people vote and the means by which laws are made.

Political crisis: voting, polling, and the representation of interiors.

The ancient world provides accounts of many different voting technologies used in the city states along the Mediterranean (Duncan, 1984): the volume of clapping hands in an assembly; the weight of pebbles dropped in different buckets by a crowd; hands raised; and of course, casting paper ballots. Still other peoples decided to have arguments, to debate and have a jury of deliberators, with rules of evidence and discourse. These are different technologies for measuring the mood of a people. Discourse and argumentation and decisions by juries are good, because they are more participatory and qualitative. But the benefit of a simple vote is its straightforward quantitative right/wrong determination. Whereas arguments can always be questioned, a vote seems cut and dry. Voting is also anonymous and can easily scale beyond the assembly to the city or country as a whole. Nevertheless, voting is a crude technology invented thousands of years ago, and does not do a good job of representing the complexity and stratified nature of human interiorities. It is not a good basis for the election of officials or for the creation of law.

Political polling currently supplements voting as a window into what *the people* are thinking. But these are also crude tools that oversimplify thoughts and feelings to numbers and statistics. Again, this is not wrong in principle (numbers are essential); it is just a very partial view of things, especially interiorities. Opinion polls and large-scale survey based profiles of populations can often be manipulative and misleading precisely because of their quantitative clarity (Scott, 1998). They are composed on what survey builders call selected response items (or multiple choice questions), so they literally put words in your mouth. The instrument itself is ridged and forces a wide diversity of thought and feeling into a very constrained set of possible responses. Moreover, the

sample size and demographics of the populations claimed to be representative are usually not (e.g., most political polling is restricted to ground-line phones, and is rarely done on cell phones; a random sample of ground-lines is very different from a random sample of cell phone holders, both generationally and socio-economically). Details of survey design and sample construction aside, voting and polling provide a form of democracy where the people only get to say yes or no, or rate it on a scale from 1-5.

This is very different from what is often called *deliberative democracy* (Habermas, 1996), where instead of spectatorship and voting, citizens are engaged in discussions and cooperative decision-making. This is essentially a transition from a quantitative to a qualitative representation of interiorities (from voting to discussing), and a very important deepening of the truest aspects of our great democratic traditions. But while it works wonders at the level of the local cooperative (Buck & Villines, 2007) going to scale requires leveraging new web-technologies that deal with qualitative argumentation in quantitative ways (e.g., gathering text-analytical meta-data on deliberative forums as a means of emergent policy creation). We must use technology as a way to lift and make visible *all* the voices. This means finding ways to deal with “big data” about human interiority. The future of deliberative democracy is web-based and localized, and predicated upon the aforementioned educational prerequisites, as well as freedom of information, and basic guarantees for health care.

Health care crisis: biometrics, diagnostic categories, and the future of medicine

Similar to education, medical diagnostics can be used to improve science and treatment, but they can also be used to bureaucratize organizational processes toward the

delivery of care under the headings of profit and accountability. Ideally medical measures and standards would be driven by science and be used to expand understanding and provide increasingly accurate and specialized care. However, the shadow of medical diagnostics is long (Illich, 1976; Nelkin & Tancredi, 1989). Today official standards (such as the *DSM*, and *Merck Manual*) have been built by profit-oriented organizations, and public oversight commissions (such as the FD) have been shown to be infiltrated by the very companies most in need of oversight. Moreover, as the healthcare system continues to expand the politicization of medical measurements, standards of practice, and record keeping will continue to increase.

Of course, the measurement of the human body for medical purposes is a very old practice. So is the use of medical measures to stigmatize, institutionalize, and oppress alternative populations and deviance in lifestyle (Foucault, 1973). Diagnostic categories define who is sick and who is not. They define what is a disease (and thus what is covered by insurance) and what is not. Diagnostic measures always reveal some things while hiding others. In particular, they typically characterize ailments as discrete disease entities, amenable to a specific localized and targeted fix. Compare this to diagnostics in Eastern medicine, where an ailment is put in the context of a whole body energy system. Medical diagnostics often too formally standardize the human body and life course, and can result in misunderstandings about the nature of disease and individual differences (Capra & Luisi, 2014). Without a major reform in measures and standards in medicine, future health care systems will continue to become increasingly counter-productive, resource intensive, and the source of iatrogenic disease. Of course, the mind and body are

connected, so it would make sense that crises in health care systems would correlate with crises in personality systems.

Personality crisis: the hyper-reality and hyper-reflectivity of the over-measured lifestyle

This has been discussed above, and I have elsewhere theorized about the current species wide identity crisis in which humanity is embroiled (Stein, 2015). We have been fractured into a thousand imagines of humanity, with competing worldviews and competing definitions of human origins, the human self, soul, and mind. Our species is playing out an identity crisis on the world stage, and for the first time we are collectively facing the fact we do not know what it means to be human.¹²

In the post-modern west, where lifestyle and worldview pluralism reigns, you can pick your self-related measure (intelligence, money, credentials, titles, fitness, etc.), and you can find a group that hypertrophies it. There are a wide variety of new technology enabled self-related measures, from Facebook “likes” to smartphone apps that track your steps and calories. It should be noted also that the automated data sorting done as a routine part of government surveillance as well as the complex psychometric advertisement-generating backends built into social media and online marketplaces are measurement infrastructures; and they shape our experiences in ways that are beyond our

¹² To avoid any misunderstanding, it should be said that humanity has *never* known its true identity and purpose. This is not something we once knew and have forgotten, or something we lost and must now find. No doubt, certain cultures have previously been *convinced* of a particular identity and purpose for all humans, and there have been visionaries who’ve offered their stunning guesses at the riddle of our being. The difference now is not ignorance—we’ve always been ignorant—the difference is that now there is wide spread knowledge of our ignorance and an unprecedented groping toward truly new answers; answers that are post-dogmatic, post-disciplinary/academic, post-conventional, and trans-national/ethnic. Don’t misread the recent upwelling of fundamentalist religion as a sign to the contrary. This reactive—and often violent—grasping and entrenchment of tradition is driven precisely by the now inescapable and hegemonic force of *alternative stories* about the meaning of humanity. The biggest sacrilege—and what looks to fundamentalist cultures like godlessness—is really the “storylessness” of post-modern culture, which stems in part from its (pseudo)-scientific basis; a non-foundationalist, open-ended, “choose your own adventure” worldview that glibly dismisses ancient traditions by citing the latest scientific headline, and then dismisses that headline when a newer study is released.

control. We are over-measured and super-standardized, caught in a web of complex self-shaping infrastructures. All this right at the moment when we are least sure of what the shape of our humanity ought to be. The old stories about human identity—the old ideals and standards of human character, health, and livelihood—they have dissolved. In their place is a pastiche of ideals and lifestyles, standardized differentiations, without an overarching form or narrative.

Integral Meta-theory offers a complex multi-dimensional model of the psyche, which allows practitioners to create a constellation of self-related measures as part of a unique integral psychograph (Wilber, 1999). I have previously argued for an integral metrological pluralism in the realm of psychological measurement (Stein & Hiekkinen, 2009). It is a natural outcome of a model of the self that involves levels, lines, states, stages, and types (each has its own marketplace of measures). Beyond this plurality of representations, there is the Unique Self, which is beyond any and all measures. Uniqueness is the apocalypse of measurement; respecting it is one of the goals of Integral Metrology.

Tomorrow's Metrics: Toward a Global Cooperative Forum on Integral Metrology

I have briefly reviewed six of the global crises of measurement that are currently unfolding in the context of post-modern planetization. These have been set in the context of an integral meta-theory of measurement, which focuses on the impact of measurement infrastructures on interiorities, as well as the all quadrant nature of any metric's enactment. Pre-modern and modern forms of measurement were also discussed, and they clarified the meta-theoretical principles that measurement is intrinsically related to power,

and that measures create realities and structure reflection and decision-making. The goal of these explorations has been to shed light on the inner structure of socio-cultural evolution, and especially late-capitalist global society, in order to reveal some of the basic structures that shape our lifeworld. I believe that if we continue looking beneath the surface at these kinds of basic structures we might begin to hack the source code of socio-cultural evolution. This is only the first word, but as a way of completing this admittedly limited picture, I want to conclude with some reflections on global futures for measurement, especially what will be needed to assure a more just and integral civilization.

From a scientific perspective, the heart of the issue is the long awaited paradigm shift towards the new sciences of chaos, complexity, and emergence (Capra & Luisi, 2014; Wilber, 1995). Measurement is fundamentally different in these sciences, which assume non-linearity in growth and behavior. When trying to understand a truly complex or chaotic phenomena one or two measurements taken about one or two variables will never be enough. Complex dynamical systems can only be studied by use of multitudinous measures across multiple time scales, tracking non-linear dynamics in the growth and behavior of the system. The old paradigm¹³ thinks in terms of linear growth, averages, and summary statistics; this is the heroic modernity that brought us the metric system, IQ testing, and one-size-fits all medical care. The new paradigm thinks in terms

¹³ Importantly, the use of the term *paradigm* in this context is precise and appropriate. As Wilber (1995) has pointed out, when Kuhn spoke of paradigms he was speaking of scientific injunctions, and often literally of measurement instruments and measurement practices. The term is widely used in a broader way to mean worldview or cultural outlook, but it is really more about the methods, equipment, and the presuppositions that allow a certain form of everyday conventional science. The measures used in one paradigm are often literally non-transferable into others, which is why a reality that exists (can be detected and seen) in one does not exist in the other. Changing the very instrumentalities of scientific practice (changing the tools used to do measurement) is quite literally changing the paradigm.

of non-linearity dynamic growth, uniqueness, and stratified ontologies (intra-systemic complexity requiring multiple measures); we have yet to see what a society built on these kinds of metrics would bring.

Another way to think about this is as the difference between a science of averages and statistics and a science of the individual and of dynamic modeling—the so-called “new science of the individual” (Rose, Rouhani, & Fischer, 2013), or the sciences of uniqueness (Stein & Gafni, forthcoming). The basic idea is that *simplistic summary statistics are totally inadequate for the task of mapping dynamic systems*. Note that all the systems that are in crisis are dynamic, complex, and non-linear: economies, ecologies, human minds, and human bodies. None of these can be understood based on assumptions of linearity or measures that track only a single variable but claim to capture the majority of important variance. The future of measurement must go from the linear and simple to the non-linear and complex. This would mean that if we only have tools for tracking linear growth and behavior, we should not talk and act like we have a handle on what is going on.

Along with the indeterminacy and complexity of these new measures would be an opening toward a more detailed and nuanced tracking of interiorities, worldviews, emotion, and consciousness. New abilities for accurately measuring interiorities should bolster democracy and education, allowing our institutions (schools, governments, companies) to begin listening and responding, instead of classifying, categorizing, and monetizing. We live in a world where there are enormous numbers of people whose lives are shaped by institutions of enormous scope (health care, education, transportation, food systems, etc.). These organizations are usually governed by standards-based regimes that

are not accountable to those most impacted by their policies. Most large organizations are far from democratic and limit discussion of interiority to human resource retreats. Myers-Briggs tests and leadership profiles are used as an after thought, and little is made of the internal states of the vast majority of employees. Their internal lives, thoughts, and emotions have no impact on the future of the policies that impact their work and lives (e.g., ISO9000). Innovations in the measurement and representation of interiority are necessary for the future of the democratic regulation of large-scale organizations.

Along with these new representations of interiors, we need new representations of value to facilitate the emergence of a post-capitalist socio-sphere. With structural unemployment an inevitable outcome of technological advance (Greenhall, 2015), there will emerge a large opening for the pursuit of unpaid labor in economies of care, environmental stewardship, volunteer service, and other opportunities for human innovation and initiative, beyond the limits of the measurement and reward of value through money. These opportunities will remain closed so long as money is the only representation of value that enables exchange and reward for service. Alternative currencies and time-and-skill sharing cooperatives are only the first wave of the emerging post-capitalist, post-money economy (Harvey, 2014; Eisenstein, 2011). Without money as the dominant metric governing society, what alternative hierarchies of value might emerge? Again, by re-designing the basic measures a whole new realm of social possibilities comes into view.

Part of this measurement-enabled re-description of the economy would also involve the inclusion of justice-oriented economic indices, such as the so-called “Gini coefficient,” which many economist prefer to GDP as a measure of the economy of a

nation (Piketty, 2014). This could be deepened in terms of an even more explicit inequality index, a dynamic integral measure of the alethic truth of inequality, including indices of interiority, health, education, and human rights. The work of Nussbaum (2006) and Sen (1982) in these directions is promising, as are proposals for a global graduated income tax to redistribute ever-widening inequalities in wealth (Piketty, 2014).

Beyond these specifics the meta-theory suggests that all measures and standards should be evaluated in terms of impacts across all quadrants and planes of social being; all measures should be judged on their truth, goodness, and beauty. This means that discourse about metrics needs to be expanded beyond the experts behind closed doors. Only by seeing into the lived experiences those most impacted by the measure can you get a sense of the degree to which its use engenders justice and beauty. This is another strand in the arguments unfolded throughout this paper in favor of democratizing the creation of measurement infrastructures and standards. Of course, many (even in the Integral scene) view democracy and expertise as necessarily in conflict. This has been a long-standing misconception since the end of WWII: the dominion of experts over society somehow precludes democratic participation (Beck, 1986; Busch, 2011). In fact, this is a narrow and educationally simplistic way to think about decision-making in our complex technoscientific society. Emerging research around civic data and participatory and deliberative forms of democracy suggest another way forward, where experts handle some aspects of measurement and standardization, while deliberative democratic decision-making determines the parameters of use, as well as the ethical and policy implications.

Another clear outcome of the integral meta-theory of measurement is the centrality of *uniqueness* as an aspect of measurement practice. We must learn to respect the irreducibility of subjectivity and the ineliminable ineffability of the sacred and unique in every object and person. Measurement is about what things have in common: weight, price, length, and so on; all mark out dimensions of *sameness*. But measurement also provides parameters in terms of which an object can be located as unique. To stick with physical measurement (although the same truth applies in other realms), every object in the forest beyond my window has a weight and length, so in this way they are all the same. But every object would yield a unique combination of length and weight; there are no two trees or rocks or flowers that are the same (you can take the “every snowflake is unique” principle and generalize it to basically all of nature, especially living systems). The point is that measures reveal sameness, and can be used to standardize or homogenize perception. Or measures can be used as a way to literally reveal and see uniqueness, to display individual differences, and (ideally) to valorize the immeasurable. To use measures as a matrix to reveal uniqueness you need enough of them to mark out a state-space with complex dimensionality—integral metrological pluralism can yield a *constellational* unity in diversity, a representation of uniqueness.

Even from these first initial insights, it is clear that integral meta-theories could be used for mobilizing a social justice movement around measurement and standards-based regimes. Few other issues are as encompassing of as many global issues, or as amenable to meta-theoretical interventions—measurement infrastructures are a deep-structural lever, especially at the international level. Moreover, nearly all major progressive activist camps are calling for the re-design of measures, from education, to healthcare, the

environment, and Wall Street. What would be the impact of an international movement to organize for new global standards-based regimes? There have been some so-called “global constitutions” put forward by those seeking to lift planetary consciousness, but they have no teeth. What we need is a clear call for international law at the level of standards and measures, and a call for the democratization of decision-making about these crucial infrastructures.

With a great deal more to say I leave off here, in the hopes that in future work I will have a chance to explore concrete and specific opportunities for impacting the shape of global futures through the radical reform of measurement infrastructures.

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