Book Review

Robert Tavernor

Smoot's Ear: The Measure of Humanity

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"Of all things the measure is man..."
Protagoras

Introduction

According to Robert Tavernor, a flaw that plagues contemporary life is the lack of belief in the idea expressed in these words of Protagoras, the pre-Socratic philosopher and original Sophist, of whose work only a few fragments, such as the one quoted above, survive. The humanistic culture of which he was a participant in founding no longer survives in a vital way in the modern world. Yet Protagoras is one of the few significant figures relevant to the history of Western measuring systems whose thought has not been brought to bear on the topic in this fascinating, and, ultimately, moving book by Robert Tavernor. Conspicuous by their absence, perhaps the familiarity of Protagoras's words argued for their exclusion from this closely argued book, whose goal is to take one of the most prosaic and familiar of all modern human tools, the metric system of measurement, and suggest the depth of meaning that lies dormant in treating this subject solely in an instrumental fashion, as an aspect of technological advancement. His title clearly echoes the famous aphorism while suggesting a sly inversion of its meaning. Yet it may be Protagoras's reputation as the precursor of relativism that places him outside of Tavernor's concerns, for in the history of measurement precision of mutually agreed upon standards has perforce always been the goal, and any confusion on this issue would be counterproductive.

It is through Plato that we understand Protagoras as the purveyor of a relativistic world view.¹ It is in opposition to this teaching that Plato offered his own version of a transcendent and objective reality as the source of truth, an objective truth to which the eighteenth-century inventors of the modern metric system clearly aspired. Though Protagoras seems to have emphasized that how man understands, or "constructs," his world is determined by the nature of human subjectivity, he would have been no proto-Postmodernist. He understood that the wresting (or wrestling – he explicitly used this metaphor) of truth from the situated character of man's knowledge of the world requires a dialectical process which always remains provisional – a notion which not even the scientific method, as we understand it thanks to Karl Popper, can escape. Tavernor is clearly on the side of Protagoras, and his book is a plea for the re-humanization of a world,

which, in the eyes of its author, has been dehumanized by a misunderstanding of the role of science in the affairs of men.

Measurement and modernity

Smoot's Ear is not a book for specialists, but aspires to a popular audience. Indeed, its mission is to call for a culture-wide reassessment of the meaning of measurement, or rather, of whether there even exists a cultural meaning in measurement. Tavernor claims a major cultural role for systems of measurement and argues that, ultimately, their symbolic impoverishment impacts even liberty itself. Unlike, then, a variety of competing books treating the history of measurement within the field of popular science writing, Tavernor states explicitly that it is the "idea of measure that is the focus of this book" (p. 13).² He wants to make the case that measures are never simply instrumental quantities, but always have a symbolic value alongside their practical one. In this, I fear, he is waging an uphill battle in addressing his presumed popular audience. It is commonly accepted that a defining aspect of modernity is the unresolved tension between the purely instrumental view of human motivations characteristic of an increasingly technological, globalized society and a view which values the multiplicity of world cultures. Modern cultural anthropology looks beyond what men say to see in their actions and products a "material culture" in which every action and every resultant object is imbued with meaning. These objects and the processes by which they were shaped constitute "texts" which provide direct access to the thinking of the past and our own and other cultures which are no less privileged than their verbal statements. The anthropologist sees no point in the attempt to characterize motivations as either rational or irrational – there are only the motivations of human subjects who can not help but find meaning in every aspect of life. But is this not one of the definitions of being human? To this end Tavernor briefly invokes the work of several twentieth-century philosophers including Martin Heidegger, a central figure in the development of hermeneutics, the study of meaning and its interpretation. Yet Tavernor's ulterior motive – to argue against the metric system as "meaningless" – is perhaps a bit overstated. The metric system is not without symbolic meaning – nothing can be. It can, however, be argued that it represents the wrong meanings.

What may perhaps be most compelling for the general – or any other – reader is the way in which the structure of the book assimilates great chunks of seemingly dissimilar material while skipping across vast swaths of history, both ancient and modern. This juxtaposition in and of itself is interesting and compelling and is the book's chief attraction. Tavernor crafts his story by selecting common strands weaving through three main subject areas. The first part constitutes a rapid review of the role of the human body in measurement systems in the West from ancient times through the Renaissance, with a brief nod to the now esoteric tradition of perfect number and proportion descended from Pythagorus and Polykleitos. The second recounts the history of the development of the metric system in revolutionary France, an explicit attempt to create a "rational" measurement system, and the subsequent reaction in the Anglo-Saxon world, a story of human aspirations and their often unintended consequences that is quite compelling. The third shifts the focus abruptly to selected twentieth-century artists, architects, and philosophers who have seen the potency of the idea of man as measure as a tool to counter the dehumanization of modern life, concluding with a few notes about pertinent symbolic gestures made in the context of the US space program. This material is bracketed by a preface and an epilogue that introduce yet additional subject matter: the appealing story of Mr. Smoot of the title begins

the book; a reflection on symbols of liberty in the harbor of New York City – the Statue of Liberty and the to-be-constructed Freedom Tower – brings things to a close. The book gives pride of place to the linear measurements of extension, arguing that other measurements of weight, capacity, and the like were frequently derived from these. Throughout Tavernor handles his smorgasbord of intrinsically compelling material with admirable clarity and economy.

The body and God

Oliver Smoot's unusual story begins with a 1958 fraternity initiation ritual at the Massachusetts Institute of Technology. His group of initiates was tasked with measuring the Harvard Bridge from Boston to Cambridge with one of their bodies as a living measure. At 5 feet 7 inches, Smoot was the shortest and was therefore selected in order to prolong their labors. In the end the length of the bridge was determined to be 364.4 "Smoots" +/- an "Ear," a prescient bit of hilarity by which these future members of the American intellectual elite acknowledged both the inability of escaping man's body as he measures the natural world and of the ultimate impossibility of attaining absolute precision in any endeavor. As sometimes happens, this bit of improvised ritual struck a cord, and successive fraternity initiates ever since have been required to refresh twice yearly the tic marks that the original group made to mark the progression of Smoot's body across the bridge. A plaque placed on the bridge to commemorate the event was replaced upon reconstruction of the bridge in the 1980s. As for Smoot himself, he went on eventually to become the President of the International Organization for Standardization!

The refreshing naiveté and spiritedness of this story beautifully sets the stage for what follows. In contrast, Tavernor's explanation of the nature of traditional body-centered measuring systems, and particularly their application to architecture, traditionally the field of man's largest constructions, lacks the same sense of unselfconscious inevitability. He begins well with a story of how, in ancient Greece, Thales' matter of fact use of the shadow of his own body to measure the height of the pyramids leads directly to Eratosthenes' surprisingly accurate estimation of the circumference of the earth with equally minimal means. It is Tavernor's explanation of the cult of perfect number and proportion in Western antiquity and the Renaissance that might strike the non-specialist reader as dry and intellectual, lacking the easy conviction with which the book began. It is not his goal in this book to argue the benefits that might accrue to anthropomorphic measurement systems. Tavernor simply assumes that the reader will agree with his assertions on this score, that the use of symbols rich in human content leads inevitably to a more satisfying and humane life for all. Left unsaid is perhaps a more compelling exposition of the assumptions behind ancient notions of measurement.

A measurement system is perforce a modular system. The basic unit – a foot, a meter, a Smoot – is the module and all other units are whole unit multiples or divisions of this base unit. Every measurement is a sum of whole unit multiples or divisions of these modules. Building is essentially impossible without a modular/measurement system. In spite of those proponents of "Sacred Geometry" who believe that traditional societies built predominately according to geometric procedures, simple arithmetic ratios have always been essential to the building craft. (Anyone who doubts this might try building their next home improvement project without the use of a tape measure.) In the absence of society-wide standards, typical of traditional cultures, it is essential to the construction process to establish a module – a basis of measurement – for each project.

On one hand, the human body is the most readily available approximate standard in the most primitive cultures – or any other for that matter. We all are familiar with the sales lady at the fabric store who measures the length of ribbon by the reach of her arm measured from the center of her body (located at her nose) – nominally a yard, which in ancient times was two cubits (the distance from the elbow to the tip of the middle finger, also the distance back to the center of the chest). On the other hand, traditional societies tend to recognize the human body as the greatest creation of the gods. The Jewish book of Genesis tells us that God made man last, in his own image. Man is the most perfect exemplar of God's design for the world. As it so happens, a male human body is generally six of his feet tall. The span of his outstretched arms is also six feet – hence Leonardo's famous illustration of the Vitruvian man in the circle and square (both dimensions also equal four cubits, so there are three feet for two cubits). Further analysis revealed to the ancients that the human body is full of whole numbered multiples and divisions of body parts such as these. And why not? For them the human body is both the clearest record of God's sacred method in the creation of the world, and the most convenient tool by which to transfer God's plan to the physical world of man.

That the source of these relationships was the divine plan was demonstrated conclusively for the ancient Greeks by the discovery, reputedly by Pythagorus, of the basic theory of music. The mathematical ratios of frequencies that define the primary consonances of the octave, fifth, and fourth are 1:2, 2:3, and 3:4, the same simple ratios found in the body. This was the first realization of an awestruck mankind of the invisible mathematical laws that underlie sensory reality.

It is this confluence of the practical and the sacred which made the human body the source of a measurement system par excellence. A notion of respect and appreciation for bodily experience embedded in a humanistic tradition, heightened in the past, of which Tavernor writes, is not the cause but the result of the function of the body in these circumstances. In spite of his professed agnosticism, Protagoras wrote in the context of his time. The statement "man is the measure" was in fact a commonplace of his culture, and his use of it is a conscious play on the accepted meaning of the phrase. Protagoras asked his audience to extend their understanding that man indeed was the useful and appropriate measure of God's world to a deeper understanding of man's relationship with that world and that his knowledge of it is given shape ultimately by the limitations of his abilities.

The body and liberty

By the eighteenth century individual nations as well as the world as a whole were still without shared standard units of measure. Learned men across Europe agreed on the need for a rational, shared system. Tavernor's tale of the creation of the metric system and the world's reaction lies at the heart of his book and makes a very compelling story indeed, filled with both the excitement of grand history-making endeavors and the ironies that can attend the results of even the best of intentions. He begins this story with the development of the modern scientific outlook with figures such as Galileo and Newton. He includes John Locke, for whom an understanding both of Newton's scientific achievements and his fierce belief in a disembodied God – and measure – served as a basis of his own effort to establish a philosophical basis for human liberty.

Locke's political theory provided the basis for the revolutions of the following century. When revolution broke out in France in 1789, it was initially directed against the landed

nobles and enlisted the cooperation of the king in support of the people. The situation in France was extreme. At the time it is estimated that there were between 800 and 900 different customary units of measure coexisting in the country (p. 50); apparently the legal system was similarly complex! Each noble had the right to set the standards for his own lands, and the abuse of this power added to their profits, “usually at the expense of the peasants” (p. 48). It is difficult now to imagine how commerce was even possible within France itself, much less with other nations. One of the first rallying cries of the Revolution was understandably “one king, one law, one weight and one measure!” (p. 60).

For the Revolution, then, there was a very real and direct relationship between the fixing of invariable standard units of length and weight and the issues of equal rights and even freedom for all citizens. Accordingly, one of the first acts of the Revolutionaries was to strip the landed nobles of their powers in this regard and to authorize a scientific search for a new, unified and rational system of weights and measures. A provisional version of the metric system was put in place in 1793, but it was not until 1799 that a final determination of the length of the meter was presented to the authorities and 1800 when the new measure became obligatory throughout the land. A sticking point had been the debate over the basis for the new standard – the leading contenders having been a pendulum swinging at the interval of a second or the circumference of the earth, both of which presented problems both theoretical and practical. In the end the meter was defined as a fraction of the circumference of the earth, but for a variety of reasons this could never be defined as accurately as desired. In the meantime, the king had become a victim of the guillotine, decisively separating the new regime of government as well as measure from that of the divinely sanctioned rule of the monarchy and a measurement system symbolically based on his royal person – the *pied du Roi* (the king’s foot).

After the immense effort in France to establish a rational basis for the length of the meter, and after nearly two hundred additional years of increasingly sophisticated effort, the goal of relating the meter to a symbolically charged feature of the natural world such as the dimensions of the earth itself has been abandoned. Currently the meter is defined as the distance that light travels in a vacuum in $1/299,792,458$ of a second, as disembodied a standard as one can imagine! (p. 151). Originally, the Anglo-Saxon world as a whole resisted infection by the contagious doctrines emanating from revolutionary France. Two hundred years later, the only major nation on earth not to have adopted the metric system is the United States. Though those of us living in the U.S. may rejoice that our day-to-day life in what we congratulate ourselves to be the most technologically advanced of societies is still enriched by constant contact with traditions extending back to antiquity, it remains a question how long we may be able to hold out. (It comes as a shock to realize that in Philadelphia, where I write, there are actually two legal feet that are currently in use!)

Bodies in space

In the last section of his book, Tavernor touches on the compelling actions of a diverse group of individuals in the past century who reacted to the hole they saw in contemporary life caused by the absence of a symbolically charged measurement system that related the shared experience of the human body to the larger world. The artist Marcel Duchamp is revealed to have had a heart hidden, to this writer, by the ironic posturing for which he is known. The architect Le Corbusier, whose gargantuan role in the history of modern architecture remains far from universally admired, believed more strongly in the relevance of the ancient anthropomorphic proportioning traditions, to which he gave a new and

clever twist, than a century's worth of classicists. And the plaque which the scientist Carl Sagan and others caused to have affixed to the side of the Pioneer 10 spacecraft in 1972, in order to appraise potential extraterrestrial civilizations of the makers of the spacecraft, related the nude figure of a woman (alongside that of a nude man) to the dimensions of the solar system and galaxy through the radio wavelength emitted during the "hyperfine transition of neutral atomic hydrogen" (p. 187).

Tavernor concludes *Smoot's Ear* with an epilogue that, instead of recalling dear Mr. Smoot of the preface, attempts to relate human freedom itself to the dimensions of the Statue of Liberty, the gift of France in honor of shared revolutions in the name of liberty, and the proposal of Daniel Libeskind to replace the World Trade Center, destroyed by anti-Western terrorists, with a new symbol, the Freedom Tower, whose height of 1776 feet symbolically recalls the promise of liberty announced at the beginning of the American Revolution. Few of Tavernor's readers are likely to deny the ills of modern life – that there are ills is one consensus that spans the political spectrum – but many will likely be surprised at the powerful argument that he makes for the role of measurement in our collective search for meaning in our lives, meaning that will set us free. Though this argument is cloaked in the humanistic lore of the West and the secularism that is presumed to be its progeny, Tavernor hints gently but insistently throughout his book that the issue is really the loss of faith in the divine. That "man is the measure" is neither the cause nor result of the death of God or his representatives on earth, but rather, as even Protagoras understood the intent of this statement, it is the result of man's understanding of the divine plan. Even Newton believed in the spiritual in life. That man is no longer our measure reflects not just man's loss of faith in himself, but in his Creator as well.

Notes

1. See Plato, *Protagoras* and *Theaetetus*.
2. Recent general publications on the history of measurement include Andrew Robinson, *The Story of Measurement*, Thames and Hudson, 2007; Ian Whitelaw, *A Measure of All Things: the Story of Man and Measurement*, St. Martin's Press, 2007; Adam Parfitt, et al., *A Measure of Everything: an Illustrated Guide to the Science of Measurement*, Firefly Books, 2006, in addition to at least nine books in English since the mid-1970s listed in Tavernor's bibliography.

About the reviewer

Michael R. Ytterberg received undergraduate and graduate degrees in architecture from Rice University and a Ph.D. in the history, theory, and criticism of architecture from the University of Pennsylvania. He teaches urban design and the history of architectural theory at Drexel University in Philadelphia. He is a registered architect in a number of US states and a design principal and member of the executive committee of BLT Architects, a 100-person firm headquartered in Philadelphia. Currently under design are high rise residential towers in Philadelphia and Newark, NJ, and a new casino resort on the strip in Las Vegas. His research interests include Hadrian's Villa, the subject of his Ph.D. dissertation, architectural theory before the eighteenth century, and the changing relationship of material culture – and architecture in particular – to the society it serves.