

Title

Historical Attempts to Bridge the Two Cultures: Natural Science and Social Science

By

Libb Thims

Article for Talk at 22-24 Jun 2020 International Conference on Thermodynamics 2.0 at Worcester Polytechnic Institute, Worcester, Ma.^{N1}

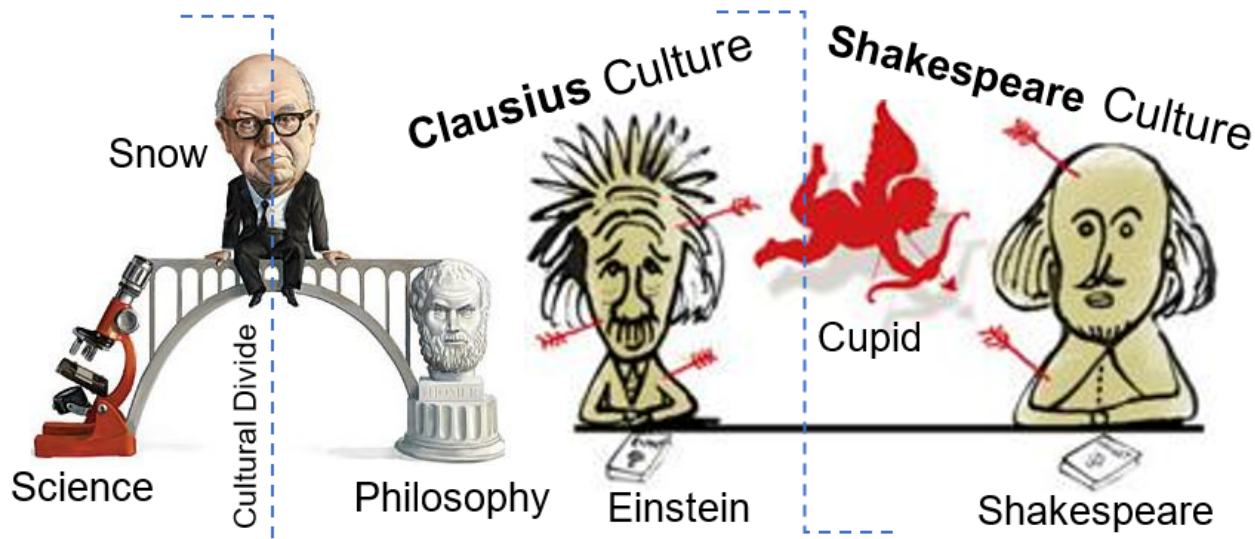
Draft date: 10 Jun 2020

Abstract

A short overview of recent historical attempts, in the last two centuries, to bridge the so-called *natural sciences*, e.g. physics and chemistry based knowledge, with the so-called *social sciences*, e.g. arts and humanities; the presentation being centered around Charles Snow's 1959 two cultures division of the presumed highly-educated class of humans, between those who understand Clausius and those who understand Shakespeare.

Introduction

In 1959, Charles Snow, an English physicist, gave a now-famous Rede Lecture, at Cambridge, entitled 'The Two Cultures', wherein he surmised that the mass or culture of *highly-educated people* in modern society were divided between 'illiterate scientists', ignorant of the humanistic writings of English writer William Shakespeare, and 'illiterate intellectuals', ignorant of the thermodynamic writings of German physicist Rudolf Clausius. Artistic illustrations of this educational cultural divide are as follows, the gist of which being that what separates Einstein from Shakespeare is Cupid!¹



In other words, what separates the 'Clausius culture', those educated in the classics of science, namely Rudolf Clausius and the second law of thermodynamics, from the 'Shakespeare culture', those educated

on the classics of literature, philosophy, and humanities, is physical chemistry, or the explanation of the bigger questions of love, meaning, morality, purpose, etc., in the terms of modern physics, chemistry, and thermodynamics, the first and second law of thermodynamics, specifically, which defined the operation of the universe, as we presently understand things.

The central quote from the Snow two cultures lecture, printed in full in the 51-page book *The Two Cultures and the Scientific Revolution*, is as follows:¹

“A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought **highly educated** and who have with considerable gusto been expressing their incredulity at the **illiteracy of scientists**. Once or twice, I have been provoked and have asked the company **how many of them could describe the second law of thermodynamics**. The response was cold: it was also negative. Yet, I was asking something which is about the scientific equivalent of: Have you read a work of Shakespeare's?”

— Charles Snow (1959), “The Two Cultures”, Rede Lecture, Cambridge, May 7

The message, in the decades to follow, struck a chord with many in the so-called ‘highly educated’ crowd, some defending Snow, particularly the scientists, other denouncing him, particularly those in the arts, arguing that they did not need to know the second law. To cite one example, from the latter group or culture:

“What is important about technology is that it works and that people make good use of it. For neither of these is it necessary that people know how it works. What is important about Shakespeare and music is that they are appreciated with understanding. So, it is important that people know their Shakespeare, but **NOT important that [people] know the second law of thermodynamics**, or how a telephone, or indeed a jet engine, works. It is important that someone knows how they work (otherwise we would not have them) but I can’t see why we all should.”

— Dereck Matravers (2005), ‘Are Two Cultures a Bad Thing?’

Here, according to Matravers, an English philosophy professor at Open University, it is important that people, in general know their Shakespeare, but not important that people know the second law of thermodynamics?

Here, we see the two-culture divide *par excellence*. If the second law pervades or rules by law every thing in the universe, one should think it important to understand how this law pervades or rules by law the things we call human and societies or cultures of these humans? Those who see, understand, and appreciate this factoid, are what we might call ‘Snow literate’, which we guesstimate to be extant in the modern population at a frequency of one per hundred or one per thousand of a given modern first-world population. Those who do not, we might call ‘Snow illiterate’.

Two Cultures Calls

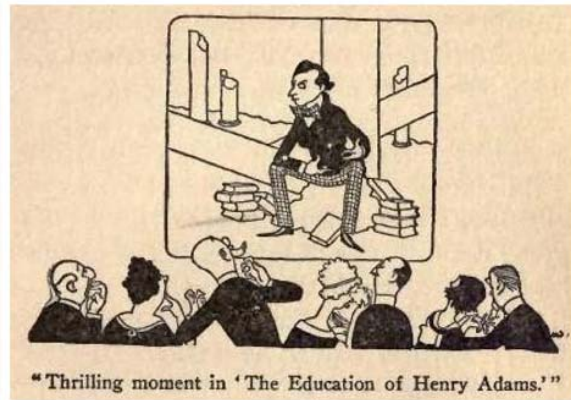
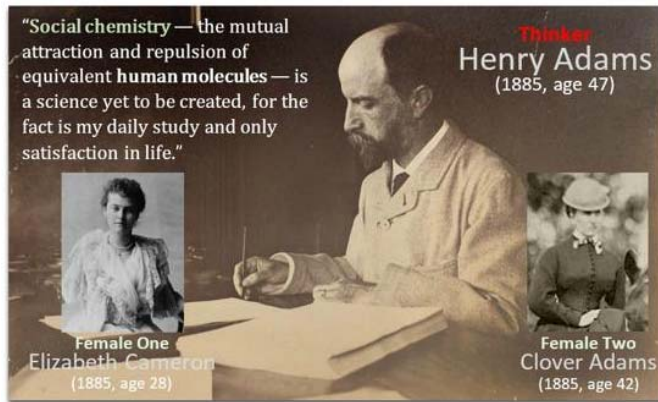
The following gives an overview of the historical calls, commentaries, or statements, related to efforts or the need to bridge the two cultures:²

"How I look forward to the effect that this [physico-chemical based] novel [*Elective Affinities*] will have in a few years on many people upon rereading it."

— Johann Goethe (1809), comment to Karl Reinhard

"Now that the human mind has grasped celestial and terrestrial physics, mechanical and chemical, organic physics, both vegetable and animal, there remains one science, to fill up the series of sciences or observation—**social physics**. This is what men have now most need of; and this it is the principal aim of the present work to establish."

— Auguste Comte (1842), Positive Philosophy

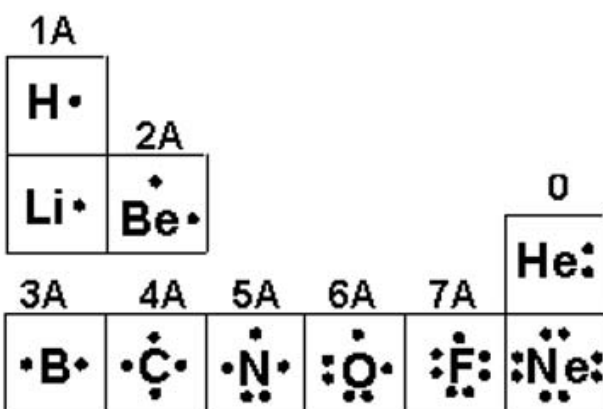


"The time may come when human affairs may be described no longer by words and sentences, but by a system of symbols or notation similar to those used in algebra or chemistry ... then it may be possible, as Adams suggests, to invent a common formula for thermodynamics and history."

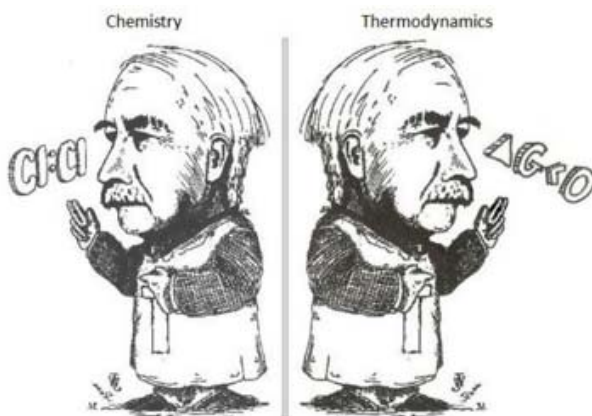
— William Thayer (1918), Annual Report of the American Historical Association

"The most familiar attempts to explain how evolution takes place are restricted to special aspects of evolution, and are often epitomized in personal names, such as Darwinism, Lamarkism, Weismannism, Mendelism. Among us there are naturalists, morphologists, physiologists, and psychologists; breeders, experimentalists, and bio-chemists. And surrounding us on all sides are the physicists, chemists, geologists, and astronomers, with whom we must reckon, for their domains and their subject matter overlap ours in countless ways. But unfortunately, between all these workers there is little common understanding and much petty criticism.... We shall use the terms morality, behavior, conduct, or constructive action in the same broad way. It may sound strange to speak of the morals of an atom, or of the way in which a molecule conducts itself. But in the last analysis, science can draw no fundamental distinction between the conduct of an animal, a bullet, or a freshman, although there may be more unknown factors involved in one case than in the other."

— William Patten (1920), AAAS address "The Message of the Biologist" + The Grand Strategy of Evolution: the Social Philosophy of a Biologist



Culture A



Culture B

"Suppose that this hypothetical experiment could be realized, which seems not unlikely, and suppose we could discover a whole chain of phenomena, leading by imperceptible gradations from the simplest chemical molecule [H_2] to the most highly developed organism [human molecule]. Would we then say that my preparation of this volume [*Anatomy of Science*] is only a chemical reaction?

Perhaps our genius for unity will some time produce a science so broad as to include the behavior of a group of electrons [or molecule] and the behavior of a university faculty, but such a possibility seems now so remote that I for one would hesitate to guess whether this wonderful science would be more like mechanics or like a psychology."

— Gilbert Lewis (1925), *The Anatomy of Science*

"**Why should no social chemistry ever been developed?**" He states that "nobody would suggest that the social scientists should imitate meteorology, for this discipline does not appear to have got very far ... but what about chemistry? A sociology based on chemistry [has] in fact been called for, but, significantly, [this call has] found no echo. It would have been easy to take up this suggestion and

develop it further. An intending social chemist would have found it one whit more difficult to manufacture a sociological parallel to the Boyle-Charles law than Haret did to the Newtonian propositions. But the experiment appears never to have been tried. Why?"

— Werner Stark (1962), commentary on Thomas Huxley's 1871 call for the development of the field of social chemistry

"Adapting thermodynamic ideas to the study of culture is limited by a very simple fact: nobody has yet figured out what might be the cultural equivalent of heat or energy ... nobody has yet found the 'heat' or the 'energy' in cultural matters ... the concepts of 'cultural temperature' to refine our understanding of 'cultural heat' have not yet appeared. This is one of the most pressing problems for the next generation of anthropologists, and the difficulties are profound."

— Paul Bohannan (1995), *How Culture Works*

"There seem to be 'laws' [of] social systems that have at least something of the character of natural physical laws, in that they do not yield easily to planned and arbitrary interventions. Over the past several decades, social, economic and political scientists have begun a dialogue with physical and biological scientists to try to discover whether there is truly a 'physics of society', and if so, what its laws and principles are. In particular, they have begun to regard complex modes of human activity as collections of many interacting 'agents'—somewhat analogous to a fluid of interacting atoms or molecules, but within which there is scope for decision-making, learning and adaptation."

— Philip Ball (2003), "The Physics of Society", talk delivered at the London School of Economics

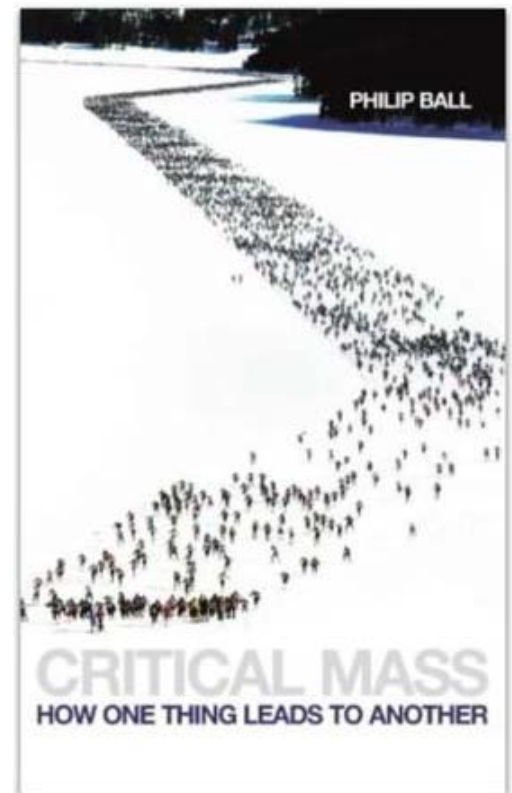
"We firmly believe that thermodynamic ideas, in particular those of Clausius, may find an application outside of thermodynamics, even outside of physics, namely in the fields of economics and sociology. It is interesting [however] to note that socio-thermodynamics is only accessible to chemical engineers and metallurgists. These are the only people who know phase diagrams and their usefulness. It cannot be expected, in our society, that sociologists will appreciate the potential of these ideas."

— Ingo Muller (2005/2007), *Energy and Entropy + A History of Thermodynamics*

"Consolidation—of thermodynamics currently taught in physics, chemistry (general and physical), and chemical engineering (material and energy balances and a separate thermodynamics course), which often may involve a wide disparity in nomenclature, conventions and rigor—is recommended to be handled by the chemical engineering faculty ... with simultaneous and substantial incorporation of the thermodynamic [discussion] of the creation of order and complexity due to [seeming] purposive processes observed in biology, sociology, and economy."

— Edison Bittencourt (2007), "Thermodynamics of Irreversible Processes and the Teaching of Thermodynamics in Chemical Engineering"

"In contrast, other fields, such as **biology, economics, health sciences**, among other, have found practical applications of complexity in their disciplines. The purpose of this work is to show some possible applications of complexity, not necessarily in the traditional field of chemical



engineering, but where **clearly chemical engineers can uniquely contribute due to our formation and basic elements of thermodynamics**, and processes analysis, compared to other disciplines, in matters of study that are not the classical chemical engineering applications, but where their application is necessary, even not being chemical processes.”

— Jaime Arias (2014), “Chemical Engineering and Complexity, an Undissipated Structure ... Yet”, 20th Brazilian Congress of Chemical Engineering, Florianopolis, Brazil, Oct 19-22

Here we see a consortium of historical ‘calls’, over the last two-centuries, uniting in thematic echo that the hard sciences of chemistry, physics, thermodynamics, and engineering, being able to uniquely contribute, in a universal manner, to the atrophied and wanting-to-be so-called sciences of the humanities and the arts, are in dire need of established university curriculum, which has to this very day been an unrealized success. We will but touch on a few historical attempts, in this direction, in the sections to follow.

Before Two Cultures

To put the presumed classification of two cultures into historical context, according to the following quote, the 13th century was the last era of human kind to have a bridge between the two cultures:

“**Roger Bacon** (1214-1294)—the founder of English philosophy whose knowledge of chemistry and mathematics led him to recognize the value of deductive reasoning, establish a scientific method, and invent spectacles—who has been called the last man to know everything, **the last man to bridge the two cultures.**”

— Rushworth Kidder (2003), *How Good People Make Tough Choices*

Certainly, we may contest this quote, and argue for a different century, as two when our previous one culture split into two, e.g. with prolonged discussion of the historical debates as to who was the ‘last person to know everything’ or with reference to the ‘age of Faust’, but this would carry us too far beyond the aim of giving a 15-30 min talk.

Clearly the Greeks, apexed with the all-encompassing mind of Aristotle, had a one culture model of things. This was carried forward, to some extent, into the intellectual minds of the Romans, as seen in the works of Cicero, Ovid, and Marcus Aurelius. With the fall of Roman empire, we enter the dark ages. The atomic theory models of Epicurus, in the 16th century began to bring us out of the dark ages, and into so-called enlightenment era.

The early 18th century, began to see reformed attempts at a new one culture view of things, such as seen in the works of Descartes, Hobbes, and Spinoza. These Aristotelian-breaking models, while an improvement of the former view of things, were hindered by their retainment of the underlying premise that the ‘soul is the moving principle of humans’, whereas ever other things in the universe are based on a ‘matter and motion principle’ of objects moving through unit distance. Hence, a dualism, or two cultures model became a basis of the conception of all things.

In 1809, Goethe, following is decade previous communication of with Friedrich Schiller, and previously discovery of proof of evolution or metamorphosis of animals to humans, via his finding of the intermaxillary bone in animals, penned his *Elective Affinities*, wherein he explained human interactions according to the physico-chemical reactions of affinity chemistry. Some two decades later, Goethe, in 1827, aged 78, five years before his cessation, commented that ‘not many kind words were vouchsafed me’ concerning his *Elective Affinities*. The issue here, is that Goethe’s natural science based novella, was many centuries ahead of its time. Even in the present day, not many kind words ‘will be vouchsafed one’ who attempts to base or connect the social sciences on or with the natural sciences.

In the late 18th century and early 19th century, we began to see an atheistic monistic or one culture view of things, such as seen in works such as: *The System of Nature* (1770) by Baron Holbach, *Matter*

and Motion (1855) by Ludwig Bucher, and 1890s energy-based monism of Wilhelm Ostwald, which were breaks with the theistic dualisms of Descartes and Hobbes. The following is a synopsis of Ostwald's efforts:⁵

Monistische Sonntagspredigten
(Monistic Sunday Sermons)

von
Wilhelm Ostwald

Erste Reihe
Bibliothek-Besitzer.



1910
Leipzig
Monistische Verlagsgesellschaft m. b. H.

"I am made from the **C-H-N-O-S-P** combination from which a Bunsen, Helmholtz, Kirchhoff came."
— Wilhelm Ostwald (1926), *Lifelines: an Autobiography*

In 1906, Ernst Haeckel founded the German Monist League, in Jena, a **free-thinking** organization centered on promoting a one-nature world view, anchored on a mix of Goethe's 1809 metamorphology, Darwin's 1859 evolution, and Ostwald's 1898 energetics.



Erste Predigt.
(Sermon one)

Warum sind wir Monisten?
(Why are we Monists?)

Dreizehnte Predigt.
(Sermon thirteen)

Der energetische Imperativ.
(The Energetic Imperative)

Sechzigste Predigt
(Sermon sixty)

STOFF, KRAFT, GEIST UND ENERGIE
(Matter, Force, Mind, and Energy)

"Ostwald, who was the most **'radical atheist'** among these scholars [Marx, Buchner, Fourier, and Weber], used the instrument of the **'Monistic Sunday Sermons'** to spread his ideas on rationality."
— Gird Spittler (2010), "Beginnings of Anthropology"

Both Buchner and Ostwald, we note, lost their university teaching posts, as repercussion of their efforts to 'bridge the two cultures', Bucher aiming to make a force-based model of everything, Ostwald aiming to establish an energy-based theory of everything. Herein, in this 2020 Thermodynamics 2.0 conference, as most of the participants are aiming to make or establish a thermodynamics-based model of everything social and economical, i.e. and energy and entropy based theory of the humanities, some would be wise to be keen to the possible historical pattern that a loss of one's teaching post might be a possible outcome to such an endeavor? While we will not digress on the historical details of this pattern, we simply bring this up as a matter-of-fact in respect to why the two cultures, historically remain divided, to this present day.

Nightingale | Oxford Chair of Social Physics (1874/1891)

In 1874, Florence Nightingale, an Italian-born English social reformer, trained in social theory by her mentor Adolphe Quetelet (1796-1874), the Belgian statistical mathematician and astronomer, author of the 1835 *Essay on Social Physics*, began to propose and lobby that a readership or chair of social physics be established at Oxford University:



"I propose that a **chair in 'social physics'**, and their practical applications, be established at Oxford."

— Florence Nightingale (1874)



The following are some of her statements in this end:

"The only fitting memorial to Quetelet would be to **introduce his [social physics] science in the studies of Oxford**, the science of which he was the discoverer, upon which alone social and political philosophy can be founded, which as he said himself ought no means to be limited to the administrative or legislative domain but should be the interpreter of all theodike, all the government and its laws embracing the smallest and the most accidental to the greatest and most universal actions and phenomena of our moral physical life."

— Florence Nightingale (1874), 'On the Passing of Adolphe Quetelet', Feb 21

Moreover:

"Quetelet gave me his *Physique Sociale* and his *Anthropometrie*. He said, almost like Sir Isaac Newton: 'These are only a few pebbles picked up on the vast seashore of the ocean to be explored. Let the exploration be carried out'. I think **the [following] needs doing: [we need] a scheme from someone of high authority as to what should be the work and subjects in teaching 'social physics' and their practical application**, in the event of our being able to obtain a statistical professorship or readership at the University of Oxford."

— Florence Nightingale (1891), 'Letter to Francis Galton', Feb 7

Nightingale, in short, proposed the chair in 1874, offered money towards the chair, and lobbied for a number of years, up until 1891, to get the chair and or a readership established at Oxford, working in coordination with a number of individuals, including: Oxford administrator Benjamin Jowett, who offered to leave money in his will for the chair, suggesting that it be named after her father, English anthropologist Francis Galton, who guided her in drawing up an outline of topics to be addresses for such a course, English economist Alfred Marshall, who said the "government ought to do it", among others. In 1891, Nightingale, in her discussions with Galton, offered to give £2,000 (pounds), the equivalent of 100,000 USD in modern currency. Galton, however, was only prepared to use the money on a few essays, and Nightingale withdrew her offer. The project dead-ended after this point.³

Here, to add some commentary, in respect to the query: 'what should be the work and subjects in teaching social physics and their practical application?', we will point out, firstly, that 129-years have passed, since this last and final call by Nightingale, and, as far as the author is aware, there is no extant course on social physics at Oxford.

Secondly, in respect to what 'work and subjects' should form the basis social physics, supposing it was to be taught at Oxford in 1874, 1891, or 2020, while Adolphe Quetelet's 1835 *Essay on Social Physics*, is certainly a starting point of an attempt at a 'science of man', as he terms things, wherein he probes queries such as:

"The forces which characterize man are 'living forces', in their nature; but do they act in constant manner, and has man, in all epochs, possesses the same quantity—in a word, does there exist anything analogous to the active or living forces in nature? What, moreover, is their destination? Can they influence the progress of the system, or compromise its existence? Or, perhaps, like the internal forces of a system, may then not modify in something its progress, or the condition of its stability?"

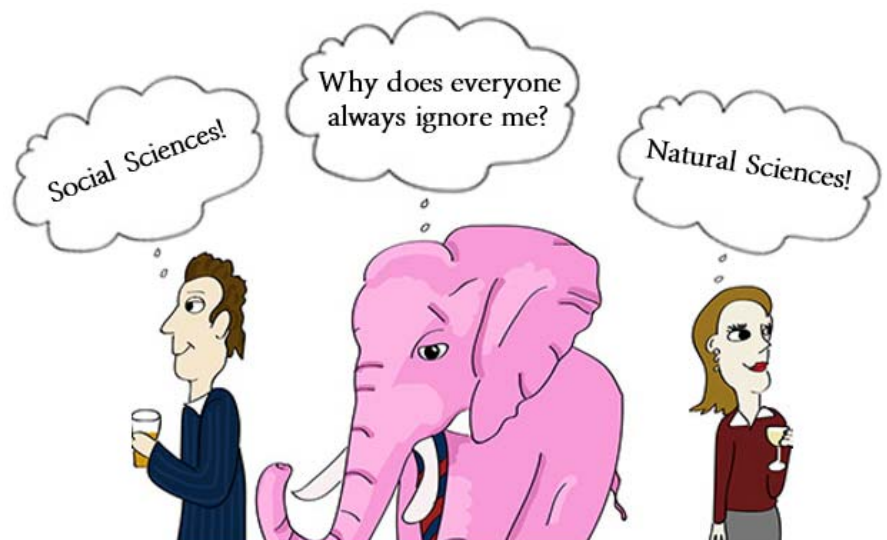
Analogy leads us to believe, that in the social state, we may expect to find in general all the principles of conservation observed in the natural phenomena.”

— Adolphe Quetelet (1835), *Essay on Social Physics* (pg. 7)

His essay, itself, limited as it is, given its time period, would seem lacking in the ability to base an entire college course? Quetelet’s work, in short, while probing in the right direction, is largely but the use of large numbers of statistics of human data factoids, such as birth, death, crimes, ages, etc., of bulk populations, employed to attempt ferret out some type of ‘morality of mankind’ based on population trends. Where Quetelet falters is his attempt to rug sweep the question of individual nature of choice, will, and morality, under the rug of large numbers population trends and regularities; a weak compatibilism attempt at subsuming ancient religious dogma within or under a newly-proposed statistics-based scientific umbrella.

Invisible Pink Elephant

In respect to Nightingale’s efforts to have a two-cultures themed course of *social physics* established at Oxford, we will address what has been referred to as the *invisible pink elephant in the room problem*. Namely, any and all attempts to establish a physics and or chemical based system of teaching of the humanities or the arts, as history has shown, will invariably result to wake up an invisible dormant sleeping elephant in the room wherein this attempt is made, the elephant being either related to religion or some type of peculiar anthropomorphism.



In particular, in 1849, about two decades before Nightingale’s call for social physics at Oxford University, in an Oxford moral philosophy class, taught by William Sewell, a reverence and semi-rector, the newly-published *Nemesis of Faith* (1848), by James Froude, which advocates the following motto:

“What is man the wiser or the happier for knowing how the air-plants feed, or how my centuries the flint-stone was in forming, unless the knowledge of them can be linked on to humanity, and **elucidate for us some of our hard moral mysteries?**”

— James Froude (1848), *Nemesis of Faith* (pg. 86)

was thrown into the fire and burned in front of a classroom of Oxford students in a moral philosophy course. The owner of the book, Arthur Blomfield, a student in the class at the time, describes the book burning as follows:

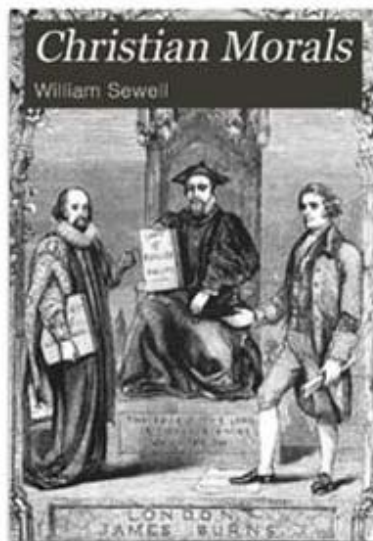
“I had just bought the *Nemesis of Faith*, or as it was called ‘Faith with a Vengeance’, when on Tuesday morning, Feb 27, 1849, I, an undergraduate of Exeter College, attended a lecture in hall. The reverend William Sewell, sub-rector of Exeter College (not ‘Dean of the Chapel’) was lecturer. He declaimed loudly against Froude’s *Nemesis of Faith*. Hearing, on my own confession, that I possessed it, he requested me to bring ‘that book’ to him. No sooner had I complied with his request (Sewell was my college tutor) than he snatched the book from my hands and thrust it into the blazing fire of the college hall (not ‘quadrangle’).

I see him now, with hall poker in hand, in delightful indignation, poking at this, to him, obnoxious book. In a few hours this ‘burning of the book’ was known all over Oxford. As your article justly remarks, ‘the burning only served as an advertisement’.”

— Arthur Blomfield (1894), retrospect commentary on Froude book burning

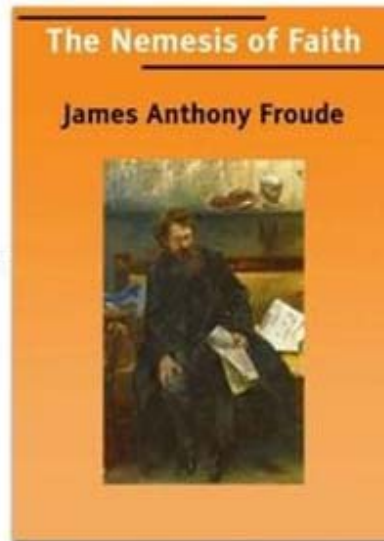
Froude’s *Nemesis of Faith*, was the last book in human history to be burned in a public university. The content and message of this book, is what presently separates the so-called ‘two cultures’ as envisioned by Snow.

Froude’s book short, tells the tale of a person losing their Christian faith in favor of a natural physico-chemical based belief system, such as espoused in Goethe’s 1809 *Elective Affinities*, wherein people are evolved chemicals governed by the forces of chemical affinity, whose interpersonal reactions are determined by the principles and laws of affinity chemistry, specifically Torbern Bergman’s 1775 *A Dissertation on Elective Attractions*. Eight years prior to this book burning, Sewell, in 1841, and published *Christian Morals*, below left. Five years after this book burning, Froude, after resigning from his fellowship at Oxford, over this event, did the first English-translation of Goethe’s *Elective Affinities*, below right, albeit done anonymously:

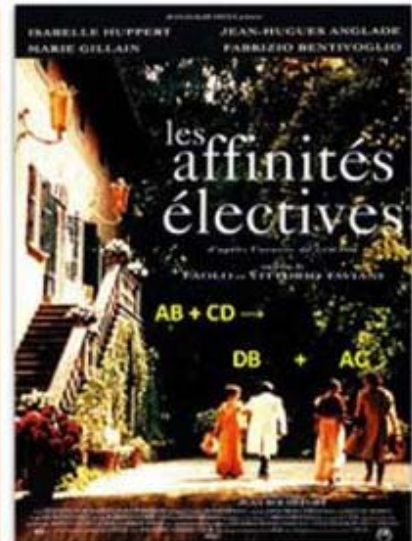


1841

VS



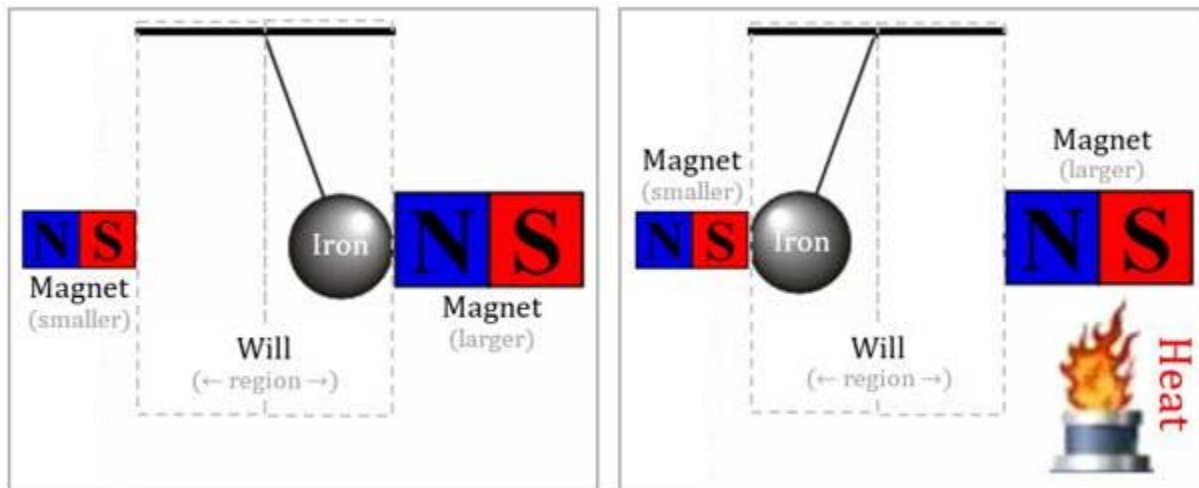
1849



1854

To give but one example, from Froude’s *Nemesis of Faith*, as diagrammed below, he says that people and their presumed free ‘will’ can be likened to that of the will of an iron ball, which when fitted between two alternative draws of attraction or force, namely a small and a large magnet, below left, will naturally be ‘willed’, so to say, to the larger magnet:⁴





If, however, we heat the larger magnet, as Froude tells us, it the magnet will lose its attractive power, after which the so-called ‘will’ of the iron ball, attached to a freely-swinging rope, will attract to the smaller magnet. Froude says that human will operates in exactly the same manner as the will of the iron ball, giver or take some higher levels of complexity.

Here, in short, we see a clash or collision between Christian morals and physico-chemical morals, the result of which, being a book being thrown into a fire, therein undergoing a combustion of reactants transforming into products, governed by the laws of chemical thermodynamics. The fact that we now, the world-over, believe that paper burns, as defined by chemical thermodynamics, wherein products must be at a lower state of Gibbs energy than the reactants, in order for the reaction to proceed, whereas we now, the world-over, in 99.9+ percent belief adherence believe that Gibbs energy has nothing to do with social processes transforming from reactants to products, is what presently divides the two Snow cultures.

Winiarski | Social Mechanics | University of Geneva (1894/1900)

In 1890 to 1923, at the University of Lausanne and University of Geneva, there was a certain overlap of interaction between economists Leon Walras and Maffeo Pantaleoni, engineer Vilfredo Pareto, and sociologist Leon Winiarski, to construct a science of economics and sociology based on rational mechanics, physics, chemistry, mathematics, and thermodynamics:

1890-1923	Economics	Economics	Engineering	Political Economics Social Mechanics
University of Lausanne + University of Geneva				
	Leon Walras (1834-1910) Chair of political economy	Maffeo Pantaleoni (1857-1924)	Vilfredo Pareto (1848-1923) Chair of political economy	Leon Winiarski (1865-1915)

The foremost example of this effort was the work of Winiarski, who, from 1894 to 1900, at the University of Geneva, taught a course called ‘Pure Political Economics and Social Mechanics’, which used the Clausius integral for the equivalence-value for all compensated transformations in a reversible social heat cycle, as a basis for the course, as explained in his 1898 *Essay on Social Mechanics*:

$$\oint \frac{dQ}{T} = 0$$

This, as far as the author is aware, off the top of his head, is the only known sociology textbook used in any university, throughout recorded human history, that makes an attempt at the application of the Clausius inequality to the domain of social and economic sciences. The following quotes gives some flavor to the Winiarski model of things:

“Turning to the dynamic part of the problem, we gave a definition of social-biological energy in two forms: potential (hunger and love) and kinetic (economic, political, legal, moral, aesthetic, religious, and scientific). This led us to the principles of thermodynamics, including the third, the Clausius same time explains the progressive spiritualization any closed social aggregate to show a decrease in potential. This dissipation of entropy that occurs is the same in the social world as in the physical world.”

— Leon Winiarski (1900), ‘The Teaching of Pure Political Economics and Social Mechanics in Switzerland’

Winiarski’s *Essay on Social Mechanics*, at present, is still in need of a full English translation. This Winiarski model, taught at the University of Geneva, whatever the case, if the foremost historical example of two cultures united in an under graduate college curriculum.

Herrick | Humpty Dumpty Students | University of Chicago (1930)

In 1930, Judson Herrick, an American auto-characterized: neurologist, zoologist, pathologist, evolutionist, biologist, and anatomist, was asked to give a dedication speech for the newly-built Social Sciences Research building at the University of Chicago:



Herrick, keen to fact that the ‘social sciences’ were completely severed from the departments of the ‘physical sciences’, took this opportunity to basically ridicule and mock the entire state of affairs, via a very ripe and accurate speech entitled: ‘Humpty Dumpty and His Great Wall: The Scientific Study of Man and the Humanities’, the gist of which being that modern university students, owing to the growing fragmented divided of university departments, had, in effect become fragile weak-shelled Humpty Dumpties. The core statement of the speech is as follows:

“Humpty Dumpty’s wall stretches, vast and impenetrable, from east to west across the main quadrangle. It is invisible, to be sure, but one has only to stand on 58th Street and look across the quadrangle to see where it is. To the south there are the homes of the humanities in imposing array, to

Aristotle, Lucretius, Bruno, and Darwin, upon which Humpty sits, built by the bricks of telos, atoms, and stars, around which peculiar concepts of meaning, spirit, and purpose hang in the air, so to say:



The term ‘spirit’ was a key term for Herrick. To him, the natural sciences were ‘uncontaminated by spiritual values’, whereas the humanities, such as economics and sociology, are ‘rooted in spiritual values’. The concluding point of Herrick’s speech, is that the future will need to see tear down this wall of Humpty dumpty, which presently divides the social sciences from the natural sciences, and that we must begin to study social forces via the tools and techniques of the natural sciences:

“If the great underlying social forces, the mainsprings of human motivation, are outside the realm of natural law and therefore inaccessible with the technique of natural science, then I affirm that the social sciences are misnamed. They are pseudosciences, and the whole movement is a stupendous bluff.”

— Judson Herrick (1930), dedication speech to opening of the University of Chicago’s new Social Science (SS) Research Building

The reader is encouraged to go online to read the entire speech, which quite compelling, bold, and sound.

Henderson-Wilson | Harvard Gibbs-Pareto Circle (1932/1942)

In 1913, Lawrence Henderson, an American physical chemistry, biochemist, and physiologist, in his *The Fitness of the Environment*, began to grapple with the concepts of purpose and order in terms of physics, chemistry, and Darwinian ideas on fitness; the following is a telling quote:

“Matter and energy have an original property, assuredly not by chance, which organizes the universe in space and time.”

— Lawrence Henderson (1913), *The Fitness of the Environment* (pg. 308)

In 1917, Henderson, in his *The Order of Nature*, began to incorporate the energy and entropy ideas of Willard Gibbs to explain states of equilibrium found in evolution; the following are representative quotes:

“Pavlov's researches on the glands of digestion, the study of internal secretions and hormones, Sherrington's investigation of the integrative action of the nervous system, Cannon's study of the emotions, and many other independent lines of investigation have cleared the ground, and at the present moment the physico-chemical treatment of the problem of organization is widely if somewhat vaguely recognized as the ultimate goal of physiological research.”

— Lawrence Henderson (1917), *The Order of Nature* (pg. 80)

“Science owes more to the steam engine than the steam engine owes to science.”

— Lawrence Henderson (1917), *The Order of Nature* (pg. #)

“No one, not even the vitalist, doubts that **the organism is a Gibbs system.**”

— Lawrence Henderson (1917), *The Order of Nature* (pg. #)

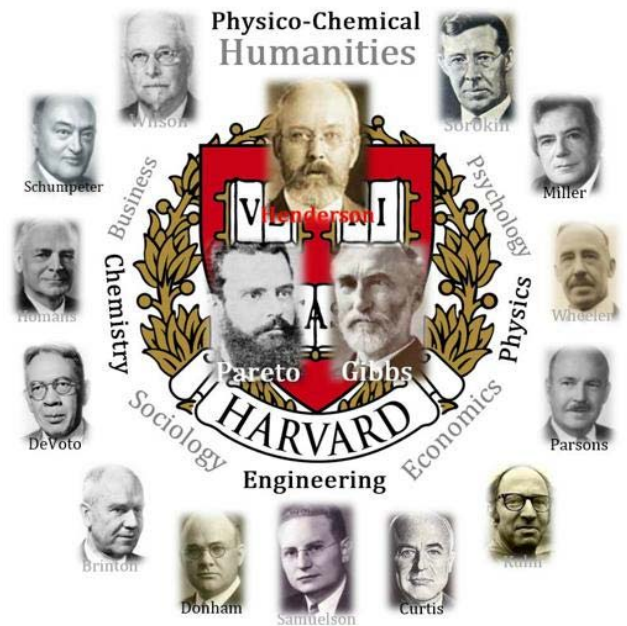
A human, along with all other organisms, according to Henderson are Gibbs systems. A very-forward thinking statement, to say the least.

In the 1920s, Henderson, while recovering in the hospital in Paris, from some sort of attack, was visited by his friend William Wheeler, an entomologist, who gave him a copy of Vilfredo Pareto's *Treatise on General Sociology* as reading material to occupy him while he recovered.

Greatly taken with Pareto's sociological treatise, over the next two decades, Henderson went on to form the so-called Harvard Pareto Circle, which involved the minds of over two-dozen prominent thinkers, from a variety of fields, as listed below, wherein he unified all departments of Harvard, economics and sociology in particular, under the umbrella of a Gibbs+Pareto based humanities.

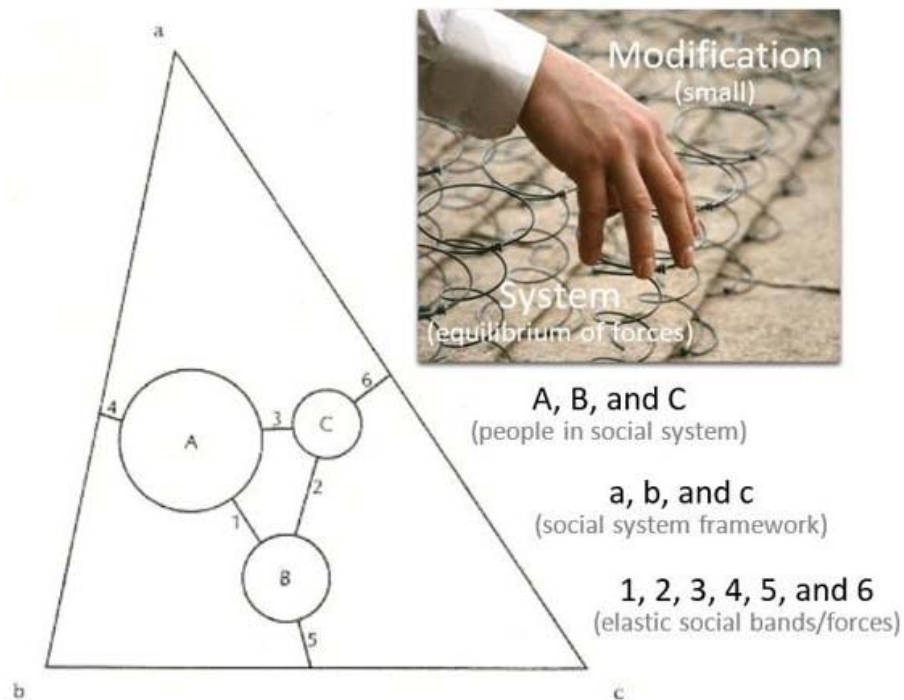
Harvard Paretians (Hendersonians)

1. [Lawrence Henderson](#) [Physical chemist](#)
2. [Talcott Parsons](#) Sociologist
3. [Joseph Schumpeter](#) Economist
4. [Charles Curtis](#) Legal historian
5. [George Homans](#) Sociologist
6. [Bernard DeVoto](#) Historian
7. [Wallace Donham](#) Business scholar
8. [Crane Brinton](#) Historian
9. [Pitirim Sorokin](#) Sociologist
10. [Bernard Barber](#) Sociologist
11. Elton Mayo Industrial psychologist
12. Fritz Roethlisberger Business scholar
13. Conrad Aiken Poet



- | | |
|-------------------------------------|--------------------------|
| 14. Chester I. Barnard | Businessman |
| 15. Eliot D. Chapple | Anthropologist |
| 16. Conrad Arensberg | Anthropologist |
| 17. Robert Merton | Sociologist |
| 18. Thomas Kuhn | Paradigm scholar |
| 19. C. Wright Mills | Sociologist |
| 20. Henry Murray | Psychologist |
| 21. Clyde Kluckhohn | Social anthropologist |
| 22. William Wheeler | Entomologist |
| 23. Edwin Wilson | Polymath |
| 24. Paul Samuelson | Economist |
| 25. James Miller | Psychologist |

All of this effort, resulted in a thermodynamics-based ‘Mathematical Economics’ course, taught by Edwin Wilson, and a Gibbs-based ‘Sociology 23’ course, taught by Henderson. We will but cite one model from Henderson’s course, namely his so-called equilibrium of forces model of social change, where A, B, and C are people, a, b, and c are the social system framework, and 1, 2, 3, 4, 5, and 6 are elastic social bonds and or social forces:⁹



In 1942, Henderson passed away, i.e. ceased to exist, and so did the ‘Sociology 23’ course along with him, as he left no student intellectually able to carry forward the intellectual depth of the topics in question. While some have argued that WWII and the switch from focus on Pareto to Marxism, is what led to the demise of the Harvard Pareto circle, here we will simply conclude with the fact that head of

such a course of education, such as Henderson or Winiarski, has to be able to see the big picture, educationally and intellectually. With no Henderson or no Winiarski, there can no guiding movement towards a Snow-type one culture.

Princeton School of Social Physics

In 1939 to 1955, physicists John Stewart, Percy Bridgman, and John Trimmer, coordinated with sociologists Stuart Dodd and Raymond Bassett, to form a fledgling social physics project or department of sorts, ran out of the astrophysics building of Princeton, with funding from the Rockefeller foundation:¹⁰



The following, from the *Princeton Alumni Weekly*, is a synopsis of their social physics program:

“In the early phase of their efforts, Professor Stewart and his colleagues in this enterprise confined their efforts to mass human relationships. They treated large aggregates of individuals as though they were composed of social molecules, without attempting to analyze the behavior of each molecule. They then attempted to describe demographic, economic, political, and sociological situations in terms of such physical factors as time, distance, mass, and numbers of people.”

Stewart speculated, in a thermodynamic sense, that there are "working bodies" (thermodynamic system), i.e. ones wherein different kinds of energy: thermal, kinetic, electrical, gravitation, chemical, etc., are converted one to another, receiving, storing, and emitting energy, in human relations, according to which persons in organizations are like atoms in a molecule, that can be treated like a working body, with an input, stored energy (internal energy), and output.

In 1953, Stewart, present his ‘Remarks on the Current State of Social Physics’, given at an AAAS meeting paper, wherein he asserted isomorphisms between thermal, electromagnetic, and chemical energy and, respectively, human meaning, feeling, and authority, as well as an isomorphism between mechanical work (kinetic, elastic, and gravitational energy) and decision-making.

This statement, that their group was attempting to employ the logic of thermodynamics, electromagnetics, and chemical energy to explain ‘decision making’, however, did not sit well with Warren Weaver, and American mathematician, who was in charge of signing the group’s funding checks from the Rockefeller Foundation. The following is a statement of Weaver’s religious beliefs:

“I was brought up in a religious home. Not only did I go to Sunday school and church, I was taken to Wednesday-evening prayer meetings as well. With one part of my mind and heart I accepted all this. I think that god has revealed himself to many at many times and places. I think, indeed, that he keeps continuously revealing himself to man today. Every new discovery of science is a further ‘revelation’ of the order which god has built into his universe”

— Warren Weaver (1955), “Can a Scientist Believe in God?”

The social physics project at Princeton, in short, was defunded because Weaver believed that decisions were the domain of human free will governed by the rule of god, in short. Stewart was an energy-based monist, Weaver was a theological-dualist:

Social Physics | Funding Issues



John Q. Stewart

Funder
Scholar



Warren Weaver

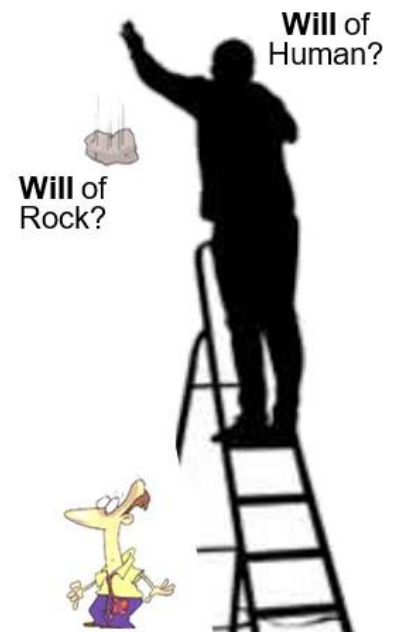


Some of Stewart’s social physics efforts did, however, continue forward in the 1960s work of his protégé William Warntz, who went on to develop a number of social gravity based population potential models.

Scott | University of South Dakota (1959/1973)

In 1959, George Scott, an American physical chemist, then at the University of South Dakota (USD), as he retrospectively explains, in his chapter “Snow Drifts in the Heart of Texas” (a play on C.P. Snow’s *Two Cultures* [1959] lecture), of his *Atoms of the Living Flame* (1985) (pgs. 133-39), was chosen as “research director” to oversee the distribution of funds of a grant from the NSF totaling over a quarter of a million dollars, distributed annually over a period of ten years (1959-1969), to support a summer research program for cross-campus departments, including: chemistry, physics, geology, biology, experimental psychology, the behavior of monkeys. In the course of this, Scott worked with Roger Davis, student of Harry Harlow, the monkey mother love behaviorist.

Scott also, during this period, co-taught an interdisciplinary course, with social psychologist George Breed, noted for doing some research on eye contact in human interactions, entitled “Disorder in Nature and Human Affairs”, relating behaviorism and physical science. During one course, Scott did a rock vs human scenario, of him standing on a ladder dropping rocks on people, themed in some way on the Skinner model of pigeons dropping bombs on the Germans, so to argue that people have free will, whereas rocks don’t; which he summarizes as follows:



“During one of our ‘Disorder in Nature and Human Affairs’ courses, I can still remember one fine afternoon, when I tried to explain the difference between human ‘acts’ and deterministic ‘acts’, described by physical natural laws, by describing a street scene in which I carried a rock onto a ladder above a sidewalk and allowed it to drop while people walked underneath. ‘If I had dropped it from the right height and instant, I might have hit someone in the head and killed them. The fall of the rock should be deterministically calculated from Galileo’s formula: $h = \frac{1}{2}gt^2$, and the rock will fall according to physical natural law, but the height and timing of the initiation of the fall would be my own ‘free will’ choice!”

— George Scott (1985), *Atoms of the Living Flame* (pgs. 135-36)

Scott also polled his 16-students with the following:

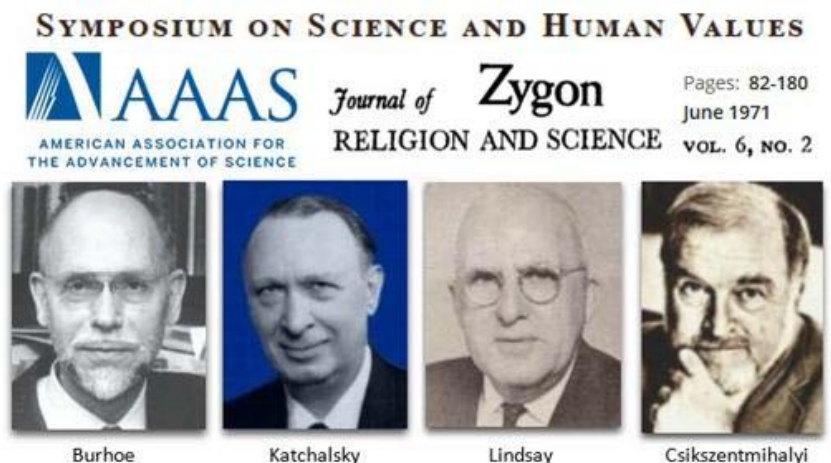
Question	Yes	No	Undecided
Do you believe you have <u>free will</u> ?	10	2	4
Is a man a <u>machine</u> ?	2	13	1
Is man a <u>physical</u> system?	3	12	1

In 1974, Scott, while on sabbatical at the University of Texas, attempting to draft his "two cultures" aiming *Atoms of the Living Flame* book, started to attend the lectures of Ilya Prigogine, who was lecturing on campus. Scott then began to read his books, and understand more of Prigogine, particularly after he won the Nobel Prize in 1977. Scott, thereafter, while not making Prigogine the basis of this book, does include some dissipative structure logic; Scott argues, e.g. that “the action of potential waves on the bubble thin membranes of the nerve cells [which] are the most fundamental control activity in human behavior” are of nonequilibrium thermodynamic phenomena of the sort that could chaotically amplify indeterminate events at the micro level.

AAAS Symposium on Science and Human Values | Chicago (1970)

On 29 Dec 1970, the annual meeting of the American Association for the Advancement of Science (AAAS) was held at Chicago, Illinois, described as a Symposium on Science and Human Values, focused on “human values in the context of thermodynamics” held under the auspices of the Section of the History and Philosophy, sponsored by the Alfred Sloan Foundation, chaired by theologian and meteorologist Ralph Burhoe (1911-1997), wherein presentations were made by: Aharon Katchalsky, noted for his coherent presentation of chemical thermodynamics, derived from first principles, Bruce Lindsay, noted for his models of purpose redefined according to thermodynamic potentials, Mihaly Csikszentmihalyi, the thermodynamics based flow theory psychologist.¹¹

The core minds of the conference were Katchalsky and Lindsay. Katchalsky's presentation, however, was weak, amounting to an attempt to spin Ilya Prigogine's dissipative structures theory, mixed



with other related melting pot theories, e.g. Zhabotinsky reaction, Alan Turing's chemical morphogenesis, his own work on clay substrate theory origin of life, etc., to loosely argue for some general unstated idea, without actually touching on "human values" in any sense of the manner. Lindsay mostly rambled on to conclude with a restatement of how his version of the thermodynamic imperative should be the new golden rule.

Stephan-Barrett | Western Washington University (1977/1995)

In 1977, Ed Stephan, the chair of the sociology department of the Western Washington University, began to make efforts to understand population distributions via physics, when after giving a talk about his research on size density to members of the science department of Western Washington University, the physics department chairman Louis Barrett began to discuss with him ideas on the physics behind the forces shaping populations, speculating on questions, such as: 'whether humans were fermions or bosons', later giving Stephan a copy of Arthur Beiser's textbook Concepts of Modern Physics, to pursue the study further.

In 1980, Stephen and American chemist George Gerhold began to ponder how the Gibbs fundamental equation, of the form, where E is the energy, S the entropy, p the pressure, V the volume, μ the chemical potential, and N the number of particles of the system, applies to sociological systems of people:

$$E = ST - pV + \mu N$$

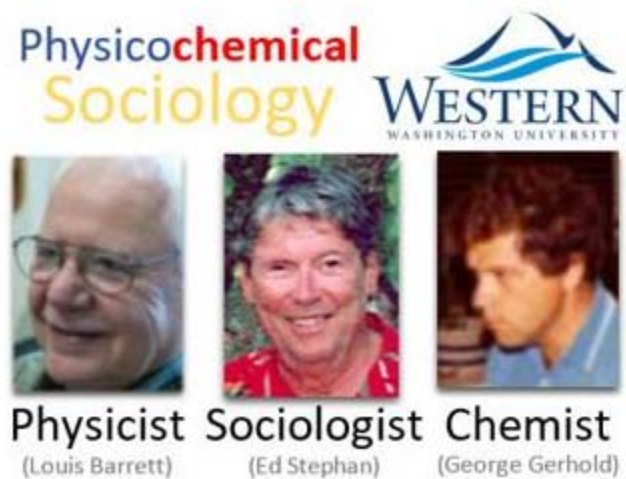
In reference to this equation, they discussed the following sorts of questions:

“What is the total time in a social system? At the level of particles, temperature is just velocity of movement. I sense an analogy between temperature in physical systems and the technology of transportation and communication in social systems. Modern societies are 'hotter'. Big cities (high interactance centers) are 'hot': People, commodities and ideas move around faster. 'Hot' regions subdivide territory more thoroughly than 'cool' ones.

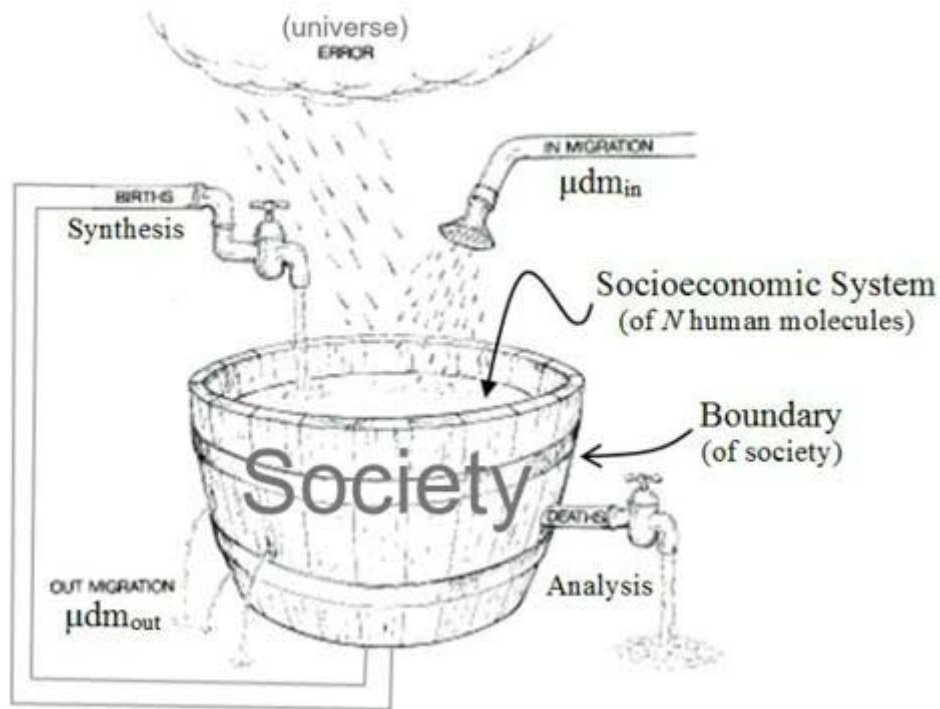
And what is entropy — unpredictability? is that what we call freedom? What is the social equivalent of the product entropy-times-temperature? Freedom of movement? What do pressure and volume suggest, if anything?

Could the raw product kNT be given some sociological meaning? **Do humans have something like chemical potential**, some sort of (bonding) potential? Maybe the last two terms in could be combined into something with a meaning specific to sociology. Combining them into $-N(1 + \alpha)$, with N as a population — what would be the sociological significance of the factor $-(1 + \alpha)/\beta$? Could the value for β computed above in the case of urban population distributions ($\beta = 2v/x\mu$) have any application?”

Here we see two cultures connections at work, in a pristine manner. The head of the sociology department (Stephan), the head of the physics department (Barrett), and a newly minted physical chemistry professor (Gerhold), of the same university, all digging into the deeper questions of what the big picture laws of the universe have to do with human affairs.



Some of this interaction synergy resulted in Stephen publishing *The Division of Territory in Society* (1995), wherein he introduced his so-called leaky rain barrel model of society, as shown below, wherein he quantifies migration into the system in terms of the chemical potential times the mass of the individual entering a given society, which is something rarely seen in sociological literature, or any literature for that matter:



It is not known if this Western Washington University two cultures interaction produced any students, undergraduate or graduate, but it is a ripe historical example of two cultures attempts to bridge the social sciences with the natural sciences.

Savoiu-Siman | Econophysics and Sociophysics | Pitesti University (2007-)

In c.2005, Gheorghe Savoiu, a Romanian economist, opened up a dialogue with Roman physicist Ion Siman, both professors at the University of Pitesti, on the implications of physics for economics and sociology, having been recently released from the forced socialism teachings of Marxist-Leninist models, in 1989. In 2008, Savoiu and Siman initiated their yearly Econophysics and Sociophysics Workshops, hosted at the University of Pitesti.

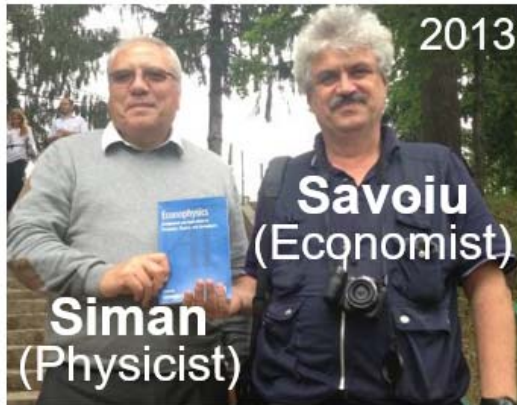
In 2011, they launched *Econophysics, Sociophysics, and Multidisciplinary Sciences Journal*, thereby spearheading the Romanian school of physical socioeconomics into solidity.¹² In 2012, Savoiu and Siman published *Econophysics: Background and Applications in Economics, Finance, and Sociophysics*, in which, in their chapter 10: 'Sociophysics: a New Science or New Domain for Physicists in a Modern University', penned a section 10.5: 'Why Sociophysics is Necessary in a Modern University', as shown below, right. The following is a noted quote:

"The apparently common field of sociology has the potential of producing and proving that the laws of physics can be reproduced as laws in human interaction, in social constructions, and even in relationships. In sociophysics, the first objective is the treatment of individuals, somewhat analogously to particles, or to atoms in a gas, and this allows for the application of statistical physics methodologies. **Why [is] sociophysics necessary in a modern university?** [Because] entropy

and syntropy [energy organization] realities prove that econophysics is virtually the most necessary science discipline in a modern university."

— Gheorghe Savoiu and Ion Siman (2012), "Why Sociophysics is Necessary in a Modern University"

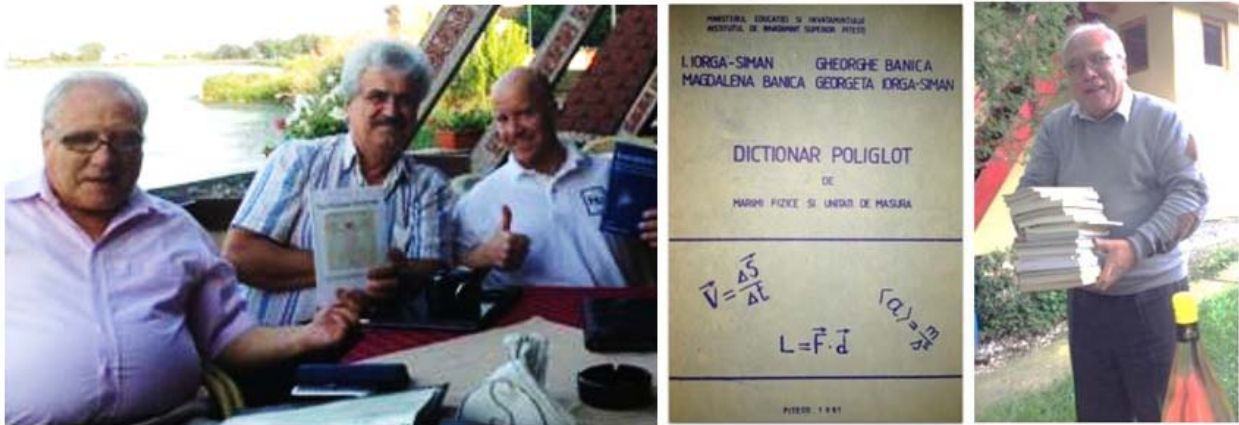
In 2013, the Savoiu and Siman *Econophysics and Sociophysics* book, their journal, and message of their chapter 10, shown below, prompted the author to travel to Romania to meet Savoiu and Siman, in person and to study and observe their newly-made two cultures connecting university in person; photo below left taken by the author:



Chapter 10 Sociophysics: A New Science or a New Domain for Physicists in a Modern University	149
<i>Gheorghe Săvoiu and Ion Iorga siman</i>	
10.1 Introduction	149
10.2 A Brief History of Sociophysics	150
10.3 Definitional Issues of Sociophysics.....	153
10.4 Contemporary and Future Trends and Activities.....	156
10.5 Why Sociophysics Is Necessary in a Modern University?	160
10.6 Conclusions	165
10.7 A Final Remark	166
References.....	166

Econophysics: Background and Applications in Economics, Finance, and Sociophysics (2012)

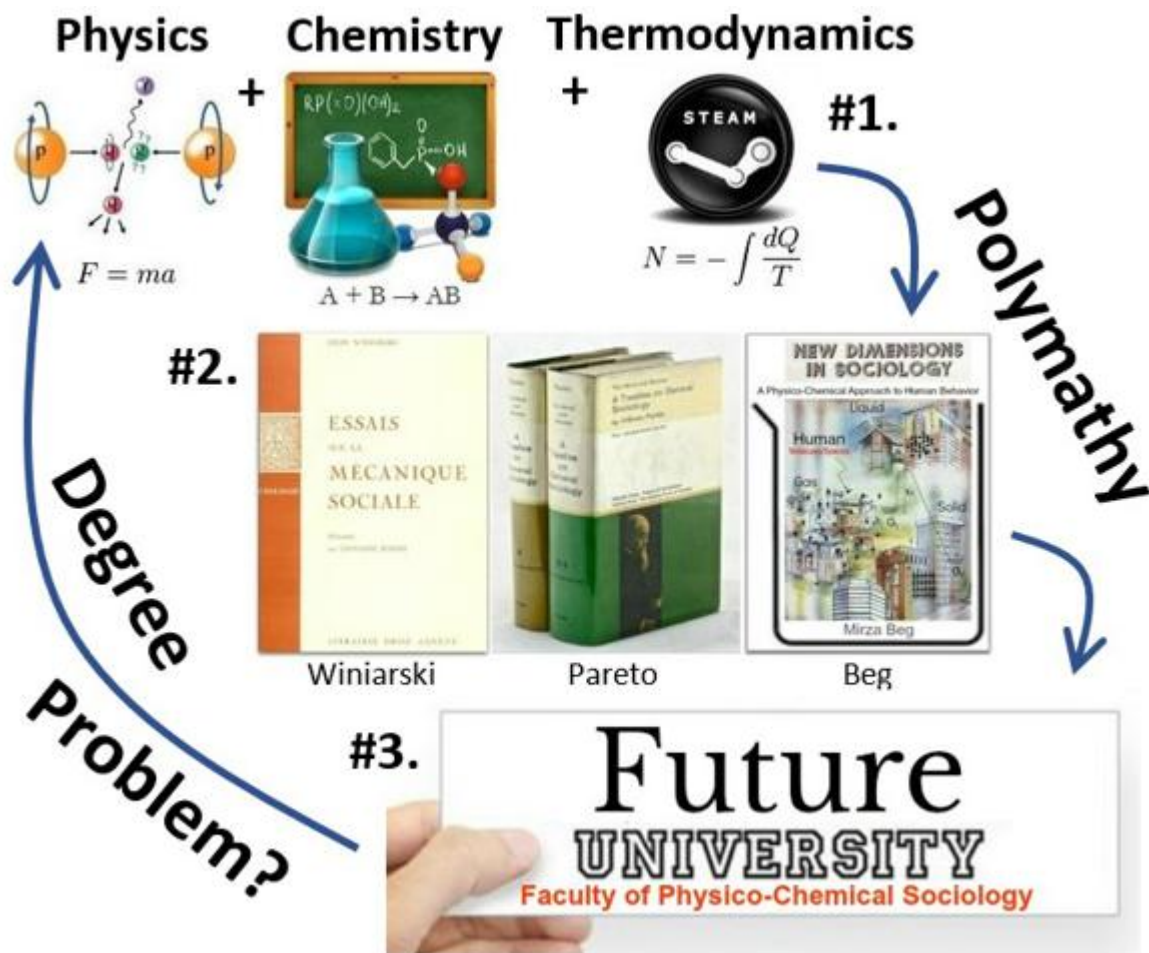
The author observed that the physicist and the economist each have a different stack of books, e.g. the physicist stack of books shown below right, each of which employing a different language, but one that must meet at the common ground of reality of the laws of the universe as we humans presently understand things:



This seems to be the excellent connection seen in the Siman-SavoIU attempt to establish a one culture university department, in Romania.

Discussion | Summary

As this article was hastily written in the course of one day, owing to extant circumstances, we will but conclude with one summary point, which has been categorized as the 'polymathy degree problem'.¹³ In particular, in order for the fragmented two cultures or three cultures to become one, the following feedback loop has to be actuated or realized, multi-generation ally:



Specifically, when someone comes along, with a unique focus of interest in physics, chemistry, thermodynamics, and the arts, humanities, and social sciences, such as Winiarski, Pareto, Henderson, or Mirza Beg, whom have produced what might be classified as proto-types to future ‘Social Principias’, this is not enough to make the wheel of educational feedback turn. When Henderson passed, as we have stated, so passed Harvard’s Gibbs-based Sociology 23 course.

In order, in short, to make the polymathy degree wheel turn or rotate through generations, educational investment has to be focused on finding those top students able to easily grasp physics, chemistry, and thermodynamics (step #1). The minds of these unique students must thereafter be funneled through the proto-social principia works of those such as Winiarski, Pareto, Henderson, Beg, along with the other 40 or 50 or so works of the social newton (step #2).¹⁴ Upon reaching this point, these new ‘Hendersons’ or ‘Winiarskis’, so to say, must become the head or chair of this new university department (step #3). It becomes their job, thereafter, to establish a mechanism that realizes the iteration of steps one to three. Only then, will future students, of tomorrow, begin to understand the ‘why’ of education process, and in turn the ‘why’ of existence, being, and becoming.

Notes

N1. A 30-min talk on “historical account of efforts connecting natural science and social science” was requested by Ram Poudel on 24 May 2020.

References

1. <http://www.eoht.info/page/two+cultures>
2. <http://www.eoht.info/page/Two+cultures+calls>
3. <http://www.eoht.info/page/Nightingale+Chair+of+Social+Physics>
4. <http://www.eoht.info/page/James+Froude>
5. <http://www.eoht.info/page/Monistic+Sunday+Sermons>
6. <http://www.eoht.info/page/Essay+on+Social+Mechanics>
7. <http://www.eoht.info/page/Herrick%E2%80%99s+Humpty+Dumpty>
8. <http://www.eoht.info/page/Harvard+Pareto+circle>
9. <http://www.eoht.info/page/Sociology+23>
10. <http://www.eoht.info/page/Princeton+Department+of+Social+Physics>
11. <http://www.eoht.info/page/Symposium+on+Science+and+Human+Values>
12. <http://www.eoht.info/page/Romanian+school+of+physical+socioeconomics>
13. <http://www.eoht.info/page/polymathy+degree+problem>
14. <http://www.eoht.info/page/social+newton>
- 15.