Toward Living History without Historical Mechanics

Eric Dammer
Dr. Strahorn
Historical Epistemology
December 4, 2001
Introduction

Complexity is a property of life. For human life as we know it, there are specifically linguistic complexity, social complexity, and structural complexity beyond well-defined social bounds, not to mention the physical complexity of biology in itself. Insofar as she strives to study written and other hermeneutic vestiges of such life, the historian must consider the contributions of each in order that peers might consider her an effective interlocutor of the physical and epistemological past. For the time being, it is worthwhile to suspend any disbelief in history as a removed or unknowable set of circumstances, precisely because our own experience is just such a set of circumstances of which we retain some memory at least. The historian claims no more than this, but for a very large set of experiences incorporating sets of circumstance which overlap and together provide the most general definition of this field of study. Suitably related and compared, disparate circumstances communicated to the historian by evidence can corroborate, or correlate with, historical events, if not also establishing sequences or chronologies of many such events sin the process.

At this point, the stage is set for an analysis of the historian’s craft in terms of complexity in general, and in particular, the flexibility and determination of meaning from language, sociological heuristics, and structures of power. These particulars all change with a function of time as verifiable by individual experience, while the function itself is argued here to be our complex human biology. The one or more variables that may complete a theoretical relation of biology to history ideally should be induced in a logical manner if there is a chance at convincing historians adherent to any given rational philosophy; but as a preliminary approach, it is worthwhile to note that historical records of the most primary or direct kind, if not a more accurate kind, may be biological, as memory itself is. And where memory of historical events is
possible, it is more likely that past interpretations of memorable language or social arrangements can be reexperienced and reinterpreted with even greater clarity. This class of subject matter is the highest order of primary evidence that contributes to the dialectic synthesis of all persuasions of history with any social component or concern.

The theory that history and biology necessarily `constructively interfere’ so far avoids analogy; however, in terms of history as the union of all individuals’ experience and agency, it is necessary to consider that there ideally are necessary parallels between human history and organic memory—between history and learning. While the statement may appear to be nothing more than a rehashed validation of history in educational curricula, recent progress in physical science and the philosophy of science provide unique syntax and meaning for the occurrence of history as a discipline. This new layout of knowledge can explain an inherent unpredictability and determination of events simultaneously as a model of understanding, rather than the logical incongruence with which philosophy has increasingly burdened the understanding of history, increasing as it has with the Enlightenment drive to arrive at models of human behavior in order to outline common properties of sequential events or trends through time, while for some, going farther to predict or impose trends of social or other structural organization on general patterns of history. The first category includes Hegel, Fernand Braudel, Émile Durkheim, Jürgen Habermas; the latter, Giambattista Vico, Marx, Friedrich Nietzsche, and for some interpreters, Michel Foucault. Neither persuasion can be independent of the other’s effects on understanding evolution of the past; this too, is also hinted by a set of philosophers of science, where the nonexclusive categories of infrastructure and superstructure, quantification and qualification, are less a concern because of the verificationist methodology of scientific method. It may not be a surprise to the historian that later we shall find an uncertainty like this invading scientific
induction, and how those at the forefront cope. For now, it must be sufficient that this is the argumental space into which we shall back this vehicle.

**Epistemic Grounds for Determining Historical Pursuits in Biological Terms and Learning as a Prerequisite History**

It is not an original concept that neural structure is involved with language, or that human physiology may determine social behavior between individual persons. When either the production of language (generally limited to intended meaning) or a social action has occurred, a prerequisite of any historical event, as it has happened or as it is transmitted to historians, has just been met.

Focusing first on language, a spectrum of evidence can be cited, from social to scientific observations. At one end, there is the effectiveness of sign language while at the other, biological psychologists study cases of aphasia and alexia (specific impairments of language in people) which correlate with trauma to particular brain areas. These cases demonstrate there are unique and separate capacities for the naming of things, and the structuring of sentences, for example—there is a biological difference between correctly naming something (the use of nouns in sentence formation) and describing what is named (the use of prepositions, one could say ‘pre-position’).

It is macabre to invoke biological studies of brain-damaged patients in making this point but in understanding language, the thing itself cannot necessarily be analyzed with any degree of certainty without some other recourse—parallel to the reason why we now consider language in analyzing history. Noam Chomsky in 1971 put forward:

As the study of language has revealed since Ferdinand de Saussre’s pioneering work, the sounds of language enter into systematic relations in accordance with restrictive principles. More remarkable still is the fact that the systematic structure of sound patterns is revealed most strikingly when we consider, not the sounds themselves in the physical aspect, but rather an abstract sound pattern that is mapped into a physical
representation by ordered rules of a narrowly constrained type, rules which, applying in sequence, convert an abstract underlying representation of sound into a physical structure that may not bear a close point-by-point resemblance to the underlying mental representation.¹

As mentioned, biology turns out to be related to the restriction of meaning to structures of language, which as a fact, though conjecturable, allows us to consider in plain language any principles that arise or do not arise from this knowledge of biologically influenced structures of meaning. What we are in fact left with is a broader metaphysical quandary where “[a]ny theory of attained concepts or of the basis for the acquisition of a system of concepts will, to be sure, be underdetermined by evidence—the task is not a triviality.”² A purely linguistic analysis should not be expected to explain the nature (or mechanism, if one prefers) of learning.

In fact, David Hume attributes “experimental reasoning,” as it plays out in an individual’s acceptance of knowledge, to a “species of instinct or mechanical power, that acts in us unknown to ourselves; …[such reasoning] is not directed by any relations or comparisons of ideas, as are the proper objects of our intellectual faculties.”³ With language and reason alone as a closed epistemology, this conclusion would remain at the forefront of our understanding of learning, and for one pursuing a sound underpinning for historiographical endeavors, a void is left by this shrinking acceptance and increased limitation on the validity of empiricist rationales to not go beyond past events prior to one’s own experience, not to mention the practical issue of

¹ Noam Chomsky, Problems of Knowledge and Freedom (New York: Pantheon Books, 1971), 25. The author goes on to cite examples of such restrictive principles in rearrangements of sample sentences, which may be convincing in themselves, but such examples cannot with certainty represent validity across the sum of all such cases, including myriad exceptions inherent in the English language, not to mention among languages at large.
² Ibid., 15.
³ David Hume, Enquiries Concerning the Human Understanding and Concerning the Principles of Morals (Oxford: Clarendon Press, 1902), 108, quoted in Chomsky, 5; Bertrand Russell is likewise quoted in agreement in Chomsky, 9. This is with the intention of further eroding claims of empiricism, as did Russell in the first half of the twentieth century, that only direct experience of a fact or event can be soundly considered by empirical enquiry. Recapitulating at this point, Chomsky states, “It is, in fact, possible that insight into or understanding of these matters lies beyond the scope of conscious human knowledge. No contradiction follows from assuming this to be so, though we may hope that it is not.” On p. 17 returning to the matter to refocus it on meaning in language, having just questioned empirical assumptions behind Leibnitz’s and Descartes’ logical frameworks, he states that meaning from experience of words is a “misleading” idea.
geographical isolation of participants in any given historical event from non-participants, including historians in most any of the historical cases of which they write.

In the realm of social relations which a historian may study and apply in understanding historical events, biology has already been invoked as a precursor. Twentieth century behaviorism left open the interpretation that such relations derive from individual action and the probability of any action in the present given a set of determining events in the past experience of that individual. This approach to understanding individual motivation in behaviorist pathology led to morbidities like shock therapy, which turned out to have little medical value. Rather than cutting their losses, though, we see scientific philosophers’ discussions moving into the second half of the twentieth century organize around `behavioral sciences’ in universities like Cambridge and Stanford.4

Pessimistic views as to human nature, presupposing such a nature as related to biological evolution, seemed to be endemic to many such discussions. In the case of Arthur Koestler’s `ghost’ in the biological `machine’, a discussion of the limits of individual biological adaptation balloons into a search for causes of tension in society historically.5 The reasoning that Koestler uses to validate the endeavor is his own construction of the concept of a `holon’, which is analogous to natural structures such as the atom, but in the social sense is made out to represent the person as functionally, assertively a complete, unique individual, while socially dependent and integrated to some arbitrary extent.6 With the dualism of tendencies to self-assert or “self-transcend,” social instability and inefficiency are seen as primarily caused by the organization of

---

5 For example, in Koestler, 240, history is compared to a symphony, but with a monotonous drumbeat which he has been exploring within an expanded biological understanding.
6 Ibid, 50-54.
transcendent groups, superceding individual priorities. The author identifies this understanding with his own past in which having a political position under Stalin in the 1930s made him party to a social psychology that successfully avoided unpleasant or undermining truths about the political system he supported, for example, a lack of productivity from confiscated properties.

Koestler admits to a “fusion of concepts” in his notion of a holon, particularly open systems, hierarchic order and cybernetics. In expanding on the concept in terms of how human activity may be considered under certain circumstances, observations on nest building in birds which follow steps to soundly structure nests is cited in support of the general concept that “a holon on the /n/ level of the hierarchy is represented on the /n+1/ level as a unit and triggered off as a unit.” It was along these lines that a study of triggered mating behavior in a particular species of fish won Nikolaas Tinbergen the 1973 Nobel Prize in physiology or medicine.

It is not straightforward to link this attempt at understanding human endeavors, past or present, to that not well understood “instinct” for inductive reasoning with which Hume and Bertrand Russell had been concerned; however, for current philosophers, open systems and hierarchies are central in their discussions of epistemology and human understanding, so we can find new perspective which may not lead to the pessimism of implicit determinism, which Koestler in the cited work and many current biologists have not been favorable towards as an ethical rationale, while linguists explaining how we understand meaning are more likely to positively welcome determinism of the process with which they are concerned at some level.

---

7 Ibid, 234, 245, 251.  
8 Ibid, 261-263.  
9 Ibid, 220-221.  
10 Ibid, 72. For the explanation in terms of nest building, see pp. 74-76.  
11 Among direct statements to this effect elsewhere in the text, in Koestler, 76, the author correctly sees his notion of triggered hierarchies of independent behavior as mechanistic, no doubt, but as a nail in the coffin of the ultra-mechanistic behaviorist view; for the view of Chomsky, see note 3 above; also, Gordon E. Slethaug, Beautiful Chaos (Albany: State U. of New York Press, 2000), 25, characterizes the mainstream views of biologists today.
Arriving at more recent philosophy in search of how understanding emerges from behavior and, presumably, vice versa, the French philosopher Michel Serres, speaks to and for his readers:

I thought that the exchangers were intermediaries, that interference was on the fringe, that the translator was between instances, that the bridge connected two banks, that the path went from the origin to the goal. But there are no instances. Or more correctly, instances, systems, banks and so forth are analyzable in turn as exchangers, paths, translations, and so forth. The only instances or systems are black boxes. When we do not understand, when we defer our knowledge to a later date, when the thing is too complex for the means at hand, when we put everything in a temporary black box, we prejudice the existence of a system. When we can finally open the box, we see that it works like a space of transformation. The only systems, instances, and substances come from our lack of knowledge. The system is nonknowledge. The other side of nonknowledge. One side of nonknowledge is chaos, the other, system. Knowledge forms a bridge between the two banks. Knowledge as such is a space of transformation.

This whole question is fractal.

…I am saying the same thing of the process of knowledge.12

Linguistics, limited empiricism, and behavioral science can find some ethical solace in that the systems they elucidate, while unsatisfactory knowledge in Serres’ understanding, do provide us with examples of how we learn about ourselves, if they do not fully achieve the understanding they seek to impart. It might be argued that Serres’ view is biased towards the historical form of understanding as knowledge ideally being a progress towards the specificity of real historical events rather than the scientific progression towards the generality of ideal systems.13 If so, this does not preclude understanding of knowledge as a phenomenon of human life.

We may take it that the human holon described earlier is just such a black box, and provides an exemplar concept of simplicity and generalization that, like the general concepts in general, allows or encourages the intellectual overreaction to formulate etiologies of events not necessarily caused by, but linked to, such structures or phenomena—this is an attempt to

13 For a brief discussion of this exact point read Michael Stanford, *An Introduction to the Philosophy of History* (Malden: Blackwell, 1998), 147; Stanford might liken the ongoing discussion in his analogy of progressing upwards in a Z, where linguistics and the meaning-network or fabric of Saussre or Quine are at the foundation level while genuine communication of novel and unique ideas proceed on the upper level, 210-212; cf. reference 1 above. With an example of the danger in characterizing ‘progress toward specificity’ as the past recedes, cf. note 15 below.
reconstruct here the success of specialized ‘microhistories,’ which discuss isolated events, or also extended history in terms of isolated social concerns.

The danger in the result is not an implausible description, but rather the increasing complexity of categorization of causes and effects. The first version of an event that fits an identified, general pattern is seen as an archetype while the latest becomes a current upgrade to the general program of defining knowledge about the category of events. Such structuring of events all too easily pigeonholes antecedents for events and effects that are not wholly determinable in analyses that avoid such categorizations. Furthermore, precedents are defined where political or judicial interests are concerned with history. One result is that there is an endemic loss of freshness in the packages of all other events in the emergent historical category, i.e., the microhistory. Are there holons in the realistic structure of history? If so, classification of events and etiologies ideally needs to remain balanced with all directly linked events not a part of the taxonomy of understanding.

As an example, take your pick between the events leading up to the 1803 trial of Marbury vs. Madison or alternately, Clinton’s midnight pardons of militant Puerto Rican separatists, among others, on December 31, 2000. Both are unique events in the history of American presidents, but the first is a precedent which has been revisited in terms of constitutional law, media reports, and historiography in multiple iterations before the most recent instance. Considering the recent event, it might still be understood as a partially recorded data set that reflects diachronic progression of the actions and their agents, but increasingly, understanding

---

14 Ironically, a strong argument for a recognition of the underdetermination of historical evidence is put forward with an analogy to the legal ideal of impartial trial in Avizier Tucker, “The Future of the Philosophy of Historiography” History and Theory 40, no. 1 (2001): 37-56.
and the historical event itself would seem to arise from structural knowledge independent of this condition of historical progression.

The general point may be déjà vu for specialized historians: links between events falling within a general category are inevitable because thorough or general understanding both may encourage a relation of the event with metaphors or mnemonics that rely on disparate events linked by arbitrary structures. This point says nothing of the apparent usefulness of immediately arriving at some predetermined deeper causes for the event, if not in a popular or professional interpretation, then in the actual rationalization of the agent(s) for their taking the choices that precede their actions in the event being studied. One interpretation is that everyone making history or writing a history of events in this context is at least an amateur historian, and an historical agent.

Revisiting established tentative links to biology, the meaning and misunderstanding of past events could be the tendency which is inherited with our understanding of history. Microhistories, while focused and informative, may be arbitrary. More evocatively, the inheritance of our history through learning and experience is a deep structure that does more than underdetermine events, even if the craft of the historian is underdetermined by the best evidence or methodology. And so, a growth of knowledge, epistemology, should become a necessary concern in historiography at large.

The amount and extent of data regarding any particular historical event accessible to journalists, members of other professions, and the general public, as opposed to professional historians, should be expected to affect and disaffect categorizations into which the event falls, while defining initial poles that emerge from early interpretation, generating in the process more data for positive feedback into the loop of popular cultural interest for emerging history. The
professional historian approaches the task of writing history secure in an established methodology to work around this noise, but nonetheless never starts with a clean slate. Would it be more certain to recall the black box concept and make note that we find reinforcement as a structural relation of journalist media to historiography, which may rely on a cybernetic presupposition (positive feedback, reinforcement), while the behaviorist basis for cybernetics has been superceded? The historian has her work cut out in this practical problem of epistemology.

We have arrived at the point that the paradigm “those who do not learn history are doomed to repeat it” is more than an ethical appeal to establish a direct link with the past. It is clearer that the underlying determination of events is learned, what we understand to be learning is a process inherent in human biology, and so both the cultural and individual levels of interpretation of historical events may benefit by marrying historical and biological perspectives, even though this is not easy, at least for the novice philosopher. As far fetched as the initial proposition may still seem, the current mode of positing to find the cogency and usefulness of the endeavor would be to continue to avoid appeals to literary device in developing the idea

---

15 Of course, the media in general as a secondary source can be read between the lines where experience and ability of the historian allows it, but as sources recede into the more distant past, filtering out the noise being defined here can certainly approach protean levels of involvement with the texts and a potentially diaphanous internal representation. If one considers an incompleteness inherent in the dialectics of historical interpretation, it is possible that even the interpretations of expert historians can become riddled with static in the accepted methodology, particularly in light of more circumspect modern media, the writings all of which are granted greater shelf life and organizzability with search technology and digital storage going forward. Consider the humorous parody of a future where the methodology of human memory is so burdened that, “First-hand ideas do not really exist… Do not learn anything about this subject of mine – the French Revolution. Learn instead what I think that Enicharmon thought Urizen thought Gutch thought Chi-Bo-Sing thought Lafacadio Hearn thought Carlyle thought Mirabeau said about the French Revolution. Through the medium of these ten great minds, the blood that was shed at Paris and the windows that were broken at Versailles will be clarified to an ideal which you may employ most profitably in your daily lives. But be sure that the intermediaries are many and varied, for in history one authority exists to counteract another” Beatrice Battaglia, “Losing the Sense of Space: Forster’s “The Machine Stops” and Jameson’s «Third Machine Age»” Histories of the Future (Houndmills: Palgrave Publishers, 2000), 61, quoting E. M. Forster, “The Machine Stops” Collected Short Stories (Harmondsworth: Penguin Books, 1982), 135-136.

16 Serres, 36, calls cybernetics “a crossed association of the material and the logical.”

17 Nonetheless, insofar as narrative forms pervade the writing of traditional history, examining literature and fictional narratives in light of the understanding and meaning of history we are working towards here, it should
that our biology—the fact that humans are living, finite beings—and in general, the philosophy of science developed that attests to this fact and a correspondent will to transcend such boundaries, is a useful intuition for the historiographer, present and future alike. In this task, we appeal to mathematical understanding that, as intrinsic to experimental methods and goals, co-habits the scientific understanding co-opted for the historian’s use.

Chaos and a Scientific-Technological Definition of Determinism as A Worthwhile Exception to the Ideal Historical Process of Understanding

Is historiography a machine? Donald E. Knuth states in the opening of his classic handbook of computer science that there are five requirements for solving problems in an algorithm, the theoretical construct of a computer program; these are (1) finiteness, (2) definiteness, (3) input, (4) output, and (5) effectiveness. The last point is undeniably linked to the first in that there is only so much time a computer is given to solve a problem with the methodology to which it may be have been disposed to processes the given data into output that might be useful to the user. For some programs, input is not required. This would be a concept parallel with evidence in historiography, which historians, of course, cannot do without.

---


19 See Kellert, 55-62. Kellert posits four emergent levels of strength for determinism, from differential dynamics, unique evolution, value determinateness, and total predictability.

Otherwise, at this point, the resemblance might be uncanny. At least, our imaginary historical machine is continually accessing new input, i.e., the output of new events, evidence.

But the nature of evidence brings us to the conclusion that the process of history cannot hope to be mechanical because the second fundamental criterion, *definiteness*, is not met—we have seen that history, perhaps especially professional history, is often *if not always* underdetermined by the evidence and language. This is less so for evidence in science, but the boundaries or limits of the effectiveness of language and communication in general remain mostly unchanged, unless we foresee a transcendence of relative individual experience as Richard Rorty has tried to build into his sense of possibility about language, while apparently ignoring the context of human biology considered above. Jürgen Habermas in critical theory, with his use of the phrase “lifeworld” also undermines an essential difference between individual experiences of society; because we humans share the same biology, with the same limits and structures of understanding, this is at least one reason that universality of understanding may not be achievable, even if historical interpretation ideally might fulfill the role. Nonetheless, events that play out on the historical stage would seem to be evidence for the supposition of impossibility. Once again, we have gone from the hope of a mechanical methodology to the organic one which historiography remains.

But organic life, and presumably historiography as we know it, has properties which cannot be hoped for in a machine. One of the most fundamental of these is the phenomenon of

---

21 See references 2 and 14 above. Interestingly, there are linguistic algorithms that combined with databases of sentence fragments do output readable synthetic critiques of modern literary works in postmodern style, generated on demand for users of the world wide web.

22 Rorty’s idea of correspondence is briefly integrated into, or rather out of, an interpretation of the fundamental problem of historical epistemology in John R. Hall, “Epistemology and Sociohistorical Inquiry” *Annual Review of Sociology*, no. 16 (1990), 332, 347.
emergence. Consciousness emerges from the independent structures of the brain. A functional organism emerges from its organs, which in turn emerge from tissues, then cells, then molecules of life. The idea of emergence is another black box, but as a phenomenon is unpredictable and only understood in hindsight. Fundamentally, in the framework laid out, history would be the emergent property of knowledge, and knowledge, likewise is emergent from consciousness.

With this confirmation of a general lifelike quality to the structures of learning, and the meaning of learning intrinsic to historical understanding, whatever it may be, it is worthwhile to finally look at what history can learn from the ideal it cannot hope to achieve. In clarifying this crucial argument, it is hoped that the method and motive of historical writing might be insured compatible with the human mode of individual learning and meaning, and the same at the breadth and depth where humanity is concerned as well.

Where biomolecules are concerned, the mechanisms which permit life emerge from physics, physical structures of matter, whereas a discipline or knowledge of physics emerged from mathematics with Leibnitz and Newton. Arguably, in their applicability to improving the future of humanity, the individuation, emergence, of knowledge and of life both have been powerful transformations. The border between the two disciplines can be shared with historiography with further transformative effects on our learning, understanding, as well.

Computer models of life began in tandem with modern computation itself—John von Neumann, builder of ENIAC founded the programming philosophy behind such models and the theoretical ideas of Alan Turing predating this have been put to use in attempts to describe

---

23 For analysis of the limits of this understanding with respect to consciousness, see the works of the philosopher, Daniel C. Dennett, with extensive grounding in biology. Not discussed nor necessary here was his concept of “memes,” as socially learned genetic algorithms; however, comparison with the biological social-historical mimesis described above may be evocative.

physical structures of consciousness. At this point, one would hope for the indeterminacy, if not underdeterminacy of history to be imported to these studies—and it has—but from chaos theory, and this when physics itself has not stepped in.

A theoretician and collaborator of Stephen Hawking, Roger Penrose clarified the direction of physics:

Apart from celestial mechanics and the behavior of projectiles…, and the study of simple systems where small numbers of particles are involved, the main ways that Newtonian mechanics is used appear not to be in this detailed ‘deterministically predictive’ way at all. Rather, one uses the general Newtonian scheme to make models from which overall properties of behaviour can be inferred. Certain precise consequences of the laws, such as conservation of energy…, indeed, have relevance at all scales. Moreover, there are statistical properties that can be combined with the dynamical laws governing the individual particles and which can be used to make overall predictions concerning behavior. …Newton’s own remarkable calculations of the speed of sound in air (subtly corrected over a century later by Laplace) was a good example of this. However, it is very rare indeed that the determinism inherent in Newtonian (or, more generally, Hamiltonian) dynamics is actually used.

The complexity of computer models of life is matched and superceded by the physics that underlies life itself. The understanding of emergence, in its biological sense, allows us to correct or at least refine our understanding of human life itself.

The nature of the beast now being tackled by physics, and inherent in the ‘anti-generalization’ of historiography, is complexity – and complexity is unavoidably linked in our modern language to determinism. The modern leviathan of technology and scientific understanding works because it has historically strengthened the meaning of determinism. Since the enlightenment, the effects of scientific induction which presupposes at some level the determination of events, their sequence, or their motivation has arose from the work of Newton (and the philosophical boldness of Laplace to consider a master equation of existence), but as a rush to understand what has been left out is now being mathematically investigated, it is more than interesting to note that, with the exception of the overarching concepts of substantive

26 Ibid, 183.
27 Levy, 263.
history and some of the specific points made by microhistorians, historiography by the nature of its methods has done this all along.28

Oddly, contrary to the apparent natures and resistance of disciplines involved, we see physics become constructive in attempting to contend with artificial intelligence, and we see chaos theory from nonlinear mathematics act deconstructively on the fields of chemistry, biology, and economics but as an outgrowth of a study of linear, deterministic, or differential equations.29

Returning for a moment to historiographical method, we can recall from the introduction that qualification and sometimes quantification are expected of historical accounts, but not prediction. Nonetheless, chaos theory has enabled understanding of physical systems without prediction, at the expense of linear (in the mathematical sense—of sets of equations with independent variables that are additive and homogeneous) understanding. History has often found understanding through nonlinear (in the narrative, chronological sense) accounts; where chronology is not available, induction plays a central role. We find a commonality of scientific, if not purely logical, induction. Knowledge as Serres has said above, may be fractal. In terms of our understanding he says, “we know of no system that functions perfectly…, without losses, 

28 Stanford, 217-218; Kellert, 93-96. Stanford characterizes the diachronic nature of history; Kellert, the synchronic concern of physics with simultaneous events, and progress in mathematics to overcome this perspectival limitation.

29 See Grégoire Nicolis and Ilya Prigogine, Exploring Complexity (New York: W.H. Freeman and Company, 1989). On p. 57, e.g., the conclusion is reached “that the analysis of physical systems cannot be reduced to a mathematical game.” Hamiltonian energy models, potentially fractal diagrams of equal energy levels are invoked as a quintessential example here, as in Penrose in making the shift from discussing classical physics to his primary interest in quantum paradoxes, 174-184. The relatable, simpler Hopf bifurcation is described in more mathematical detail found in Grégoire Nicolis and Ilya Prigogine, 102-103. For a highly technical discussion of the Hamiltonian-Hopf bifurcation, see for example, Jan-Cees van der Meer, The Hamiltonian Hopf Bifurcation, eds. A. Dold and B. Eckmann (Berlin: Springer-Verlag, 1980). A historical chronology of “Poincaré [1879], …Liapunov [1892]” and others furthering linear dynamics (instead of their now oft-cited contributions to studies of nonlinearity) is given on p. 43.
…accidents, opacity… Even the world itself does not work quite perfectly. The distance from… perfect agreement, is history.”

As seen in the analyses of Prigogine, Penrose, and Kellert, in a realistic modern view, uncertainty coexists with a classical form of understanding. And prediction becomes less a concern. The knowledge that is found through the act of trying to predict becomes part of the world, realized through technology. As an example, consider the kinetic theory of gasses—diffusion is controlled by the Maxwell-Boltzman distribution, a determinate but statistical differential equation. The understanding of atomic forces which really determine the curve shape was not understood, so a probabilistic approach was derived and applied in new probabilistic physics, which the theory, in terms of quantum mechanics, still is trying to catch, even in this year’s Nobel Prize-winning physics experiment proving quantum diffusion predicted by Bose and Einstein in 1922.

Kinetic theory has found application in the principles of economics, and in this way influenced history, an extension of the earlier point that we are all historians, even physicists, in the sense of epistemology. The second law of thermodynamics, that states energy dissipates (while remaining conserved), is at the heart of the discussion of Hamiltonians, Einstein’s relativity (mass and energy are in some way interchangeable; this simple perspective becomes

---

30 Serres, 12-13.
31 For a theoretical examination of time and energy dependence of this probability function, and the limitations on the idea of probability valid to scientific understanding, see Ilya Prigogine, The End of Certainty (New York: Free Press, 1996), 74-81.
32 The idea behind the Bose-Einstein condensate discovered is that atoms induced at low temperature to take on an identical quantum state (consistently in their lowest possible energy state approaching the theoretical temperature limit of absolute zero) will initially collapse without the effects described in the Maxwell distribution, but diffuse even as temperature drops because movement slowing to a speed of 0 would make this variable determinable, when in fact it is by quantum mechanical definition, not. This is a confirmation of the Heisenberg uncertainty principle, but does not provide an understanding of the underlying logic, which remains elusive. It is possible to find footage of the phenomenon online, courtesy of the University of Colorado’s Physics 2000 website.
33 Brief reference to this interest of the computer geometer Benoit Mandelbrot is found in an excellent compilation of discussions given by chaos researchers, Chaos: The New Science, ed. John Holte (Saint Peter, MN: Gustavus Adolphus College, 1993), 31.
essential at both very high and very low physical energies), and also the certainty assumed in the extended systems of classical physics. The benefits of understanding quantum uncertainty must be withheld in light of scientific observation of macroscopic complexity, including the big historical picture. The second law is also the bridge back to a fundamental philosophy of biology and learning linked to in the historian’s concern with uncertain and underdetermined history.

Erwin Schrödinger, the positor of quantum mechanical stability in terms of differential probability equations (his psi equations), had said that life feeds on “negative entropy.”34 This is interpreted as chemical energy at one level, but at the level which we are concerned here, this is information and its organization. In the biggest sense for humanity, this is historical epistemology, which therefore most effectively, completely, or determinately may explain human imperatives to reorganize or rethink—thus, substantive history. But in the pursuit of scientific understanding of what can physically be achieved by humanity, historical perspective is here justified as the best conveyor, our best chance to be certain of the determinism, sometimes false, encountered in the intersubjective35 motives or effects of technological advance. Otherwise, “the history of science obeys the law of diminishing returns. Newton gives the law of the world, leaving only a few marginal scraps for his offspring.”36 Maybe so, but:

History is the locus of full causes without effects, immense effects with futile reasons, strong consequences from insignificant causes, rigorous effects from chance occurrences. [This] logic is at work in the physical world and the living one too; we have to know that it is at work in history.

History is the river of circumstances and no longer the old orbit of the mechanists, bearing its conflicts and its relations of forces.37

---

34 “Schrödinger (1944), p. 72”, quoted in Koestler, 199. The term “negative entropy” is also pervasive in the translation of Serres’ *The Parasite.*
35 Serres, 61-2.
36 Serres, 17.
37 Serres, 20.
If a change in the structure of information can lead us to these profound realizations, the above synthesis towards that realization should be a clear example that the potential of a given set of information, knowledge, is indeterminate and unbounded. This justifies intersubjectivity of history with the sciences, in that order, in the context that the power of technology and organized structures, understanding, of information comes not from a fixed instinct for invention or rationalization to which empiricist philosophical explanations had resorted, but instead something that so far is outlined as the transparence of human biology and our modern mode of living in a necessarily darkening physical cloud of entropy, the classical kinetics-linked variety of theoretical disorder.

**Bifurcation**

In one word and not only in one prefix, the whole text and the whole story. In the diagram, the line no longer goes to the end of the second line, but to another spot along the way. Then and only then can it be understood that it is an origin for the art of memory.\(^{38}\)

We have reached a point at which something must give, either the vitality of our living biology, or scientific progress. In practical terms, we see the effects clearly laid out in the work of documentaries of the modern condition or its possibilities,\(^{39}\) and in the emerging historiography of the twentieth century. Observation of new works about the twentieth century in all social contexts indicates a loss of historical accuracy, or a loss of historical significance resulting from the identity of individuals depicted in diametric opposition or in set hierarchies as historical agents. One result has been that clear definitions of leaders and those they lead are

---

\(^{38}\) Serres, 33.

\(^{39}\) For example, in socioeconomics, see the work of David C. Korten, *When Corporations Rule the World* (West Hartford: Kumarian Press, 1996).
more easily obscuring identifiable relationships of power and complacency where intersubjective bureaucratic delegation is increasingly closer to the true structure of power in place.40

At the peril of avoiding political implications, an underlying perspective in historiography that science has the upper hand in determining the future is at best misguided, and at worst, complacency in the face of shrinking borders of historical agency for the historical enterprise itself. In constructing history that delineates the interests of science from itself while becoming more acutely aware of scientific progress, we might more accurately develop and test our human identity and purpose than we have done during the course of the twentieth century.

40 Inspired by Serres’ discussion of the energy/information dilemma, and found symbolically structured like the above logic on 58-9. Perhaps the extent of use of the passive voice in any given work is a linguistic example.
WORKS CITED

General Philosophical and Historiographical Works


Works Concerned with Fiction


**Fictional Works**
