

“How do we know what we know?” is both a generic philosophical question, and an empirical question that ought to be raised every time we acquire new knowledge—especially if the knowledge is spoon-fed to us. Yet it is a question seldom asked, perhaps because answering it seems like too much trouble. I have found, though, that to habitually ask this question is both intellectually liberating, and a necessary precondition to the attainment of real knowledge and understanding.

When we do seek to validate our knowledge by basing it on evidence and rational argumentation, we have two, or perhaps three ready made epistemological modes to turn to: the scientific, the legal, and the historical. All of these modes of knowing, or of persuading, are like all human endeavors subject both to self-delusion and institutional corruption, but because they are public methodologies they also incorporate self-corrective mechanisms that usually keep them from straying too far off course.

The Epistemology of Science

I follow a number of specific sciences, and scientific theories, in a casual way (I’ve been a subscriber to the reliable and concise periodical, *Science News*, for over 40 years), occasionally dipping down into the specifics of published books and studies in various fields: for example, in recent years I’ve gotten heavily involved with the application of genetics (via DNA testing) to the working out of family and human population history.

One of the principal takeaways from my reading in science is that most of the studies and findings that are breathlessly reported in the latest journals and magazines are strictly provisional, and only a small percentage are ever replicated, yet the ability to replicate at will is the principal touchstone of scientific truth. Some recent scientific studies of studies, have quantified this observation, and suggested many of the reasons why.^[1] Evidently, modern science has become deeply corrupted by the big money that flows into it through government grants, and the prestige that money and expertise confer in American society.

Still, the very provisionality of science is also one of its great strengths. As Karl Popper, the premier modern philosopher of science, argued in *The Logic of Scientific Discovery* (1934), and it’s sequel, *Conjectures and Refutations: The Growth of Scientific Knowledge* (1963), nothing is ever proved in science: all hypotheses remain perpetually open to revision. Indeed, it is the chief task of the scientist to devise tests, not to validate, but to falsify his hypotheses, because only through falsification (or more usually partial falsification), is progress made— by revising the faulty hypothesis then testing again. Only facts, says Popper, are known for sure. And Harold I. Brown in *Perception, Theory, and Commitment: The New Philosophy of Science* (1977) argues, convincingly I think, that even facts are hypotheses.

But what about scientific laws? Aren’t they necessarily true? Without delving into the deep philosophical controversies in this area, I will simply provide my own one-word answer: no. Scientific laws are merely such well-established hypotheses that we may reasonably predicate even our most important choices in life on their truth, but they still fall short of the necessary truths of mathematics and pure logic. Scientific deductions from laws and apparent facts may seem analogous to mathematical reasoning based on certain accepted postulates and proven theorems, and mathematics itself may be applied to science, but there is always some question as to whether these formal systems capture the whole of reality, and in fact modern physics has given us plenty of reason to suppose that they don’t—even that they can’t—that there is some indeterminacy lurking even in the apparently hardest factual data.

¹ See, Michael Hiltzik, [“Science has lost its way, at a big cost to humanity”](#), *L.A. Times*, 27Oct2013.

Most modern scientific findings since the 19th century, in fact, have been framed and qualified in terms of probabilities and statistics to account for the imperfect fit between our partial theories of what's happening and the complex and imperfectly understood real world data that we seek to apply them to. And if scientific theories and mathematical models in physics often fail to account for or predict the phenomena they are concerned with, how much less valid and applicable is the mode of scientific epistemology to propositions regarding human behavior and history? However, even though such propositions cannot be properly framed as falsifiable scientific hypotheses, certain aspects and techniques of the scientific method can usefully be adapted to the methodology of seeking legal or historical truths as well.

The Sociology of Science

Thomas Kuhn, in *The Structure of Scientific Revolutions, 2nd edition* (1962) brings into consideration the social factors affecting scientific opinion: Kuhn argues that institutionalized science at any given period in history depends on consensus around a more or less universally accepted paradigm, and that scientific knowledge grows slowly within this paradigm through the classic Popperian cycle of hypothesize-experiment—revise—experiment—revise... In time, though, given the ever-growing institutional investment in the established paradigm, alternative hypotheses are ruled out of court, and inconvenient facts are branded anomalies and swept under the rug. As these anomalies accumulate, the established paradigm becomes increasingly fragile and riddled with cracks, setting the stage for a “black swan” event—a revolution that overthrows the existing paradigm, and provides a whole new foundation that accounts for all the data, not just the data that fits.

Kuhn's work has been deservedly influential, and has been rightly applied to many other kinds of intellectual communities. Indeed, it has perhaps inspired Randall Collins, in *The Sociology of Philosophies: A Global Theory of Intellectual Change* (1998) to extend it to all intellectual (including religious and artistic) communities.

But Kuhn's and Collins's theories are sociological, not epistemological in character. Scientific epistemology stands on its own two feet, and is thoroughly captured by the more modest formulations of Karl Popper and his successors. All thought is in the end individual, and truth is not a matter of consensus. The sociology of science aside, the work of just one scientist, essaying the first correct interpretation of a hitherto dismissed anomalous fact, is in principle enough to confute and overturn an established paradigm accepted by all other scientists over many decades, or even centuries.

Nonetheless, sociologized science can work in favor of the truth too, up to a point. It contributes to the truth by providing stern tests for any new theory to surmount; but eventually the established paradigm becomes a hindrance to progress when all too human resistance to change doesn't end once the hurdles have been surmounted, and a credible alternative hypothesis is able to explain the anomalies as well as the inherited body of recognized facts.

A very different problem arises in the many new hybrid fields and scientific pretenders that are abroad in the modern world. For these, there typically is no single set of consensus paradigms, and the would be scientists in these often ill-defined fields end up talking past each other. Practically all of the social sciences fit this frame, as do, of course, all the humanities, but then even such knowledge and truth seeking humanities as history don't pretend to be sciences.

Metaphysical vs. Scientific Hypotheses

Popper distinguishes between *scientific hypotheses* that are designed to be subject to falsification, and *metaphysical hypotheses* that are not even in principle subject to falsification.

Hypotheses about God are of this latter character, even the argument from design, which, as Hume pointed out, is essentially an empirical argument derived from our illusory psychological predilection to view the world in terms of cause and effect; but how can one infer a necessary metaphysical being from a chain of contingent material causes that reaches back far beyond the scope of our possible knowledge, if not to infinity? The argument from design is thus not only incoherent philosophically, it's also not subject to falsification, and is thus merely a metaphysical hypothesis—or just a compelling and seductive metaphor—and must be accepted or rejected on other than scientific grounds.

More on Metaphysical Hypotheses: Evolutionary Theory vs. Creationism

Both Creationism and Evolutionism come in different flavors and forms. Evolutionary theory, in particular, has a rich and deep intellectual tradition,^[2] and it has been the subject of bitter polemics since Darwin's publication of *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* in 1859. The controversies became lethal as Darwin's strictly biological theory was misappropriated metaphorically for sociological and political purposes by the "social Darwinists". And these extravagant and illicit extrapolations from scientific Darwinism not unreasonably generated most of the violent opposition, then and now, from critics who had never bothered to read his books. Such critics need to beware of wasting their energies attacking dead horses, or worse, straw men of their own devising.

In the broad Creationist vs. Evolutionist debates the Creationists are quite right in pointing out that to the extent that evolutionary theory goes beyond its methodological analyses and seeks to be a comprehensive history of the species, it forfeits its claim to be scientific. History is different from science, and calls for its own epistemology. For one thing, as Heraclitus said, "One cannot step twice into the same stream"—there is no question of replication, or even in the scientific sense, falsification, because history follows the unidirectional arrow of time, and never repeats itself. Besides this, the course of history is holistic, and it would be futile to apply the key methodology of scientific experimentation to it even if history could be rerun, namely to isolate a particular part of it for scientific study. History is a confluence of causal factors beyond all human imagining, and the best we can do by way of explanation of its vicissitudes is to identify a few prominent historical themes.

When Darwin identified natural selection as the key driver of historical biological evolution, he was doing no more than any other historian might do, and the complex and sophisticated history of evolutionary theory since its classical Darwinist beginnings, more resemble an historiography than a scientific progress, for all the light they have indeed shed on certain aspects of the ongoing history of the species in their terrestrial contexts.

Of course, Creationism can hardly claim to be a worthwhile alternative to the evolutionary theory of one's choice. Most Creationist theories not only don't contribute to our understanding of the nature of evolution, or the history of the species; they aren't even compatible with science.

There are a couple of versions of Creationism that have been and are widely espoused that *are* compatible with known science, though they must still be classified as metaphysical hypotheses.

One of these would allege that God created the universe as a sort of clockwork mechanism, building in to it certain fixed laws and necessary relationships, and then set it in motion, but stood aside thereafter.

A variant on this would be that God was likewise the creator of an orderly universe and that, rather than stepping aside and leaving it entirely to its own devices, his continued will remains

² For an account of the rich history of the theories of evolution, I recommend *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection* (1997), by David J. Depew, and Bruce H. Weber.

necessary to sustain it; this hypothesis was espoused by the 18th century revivalist minister Jonathan Edwards, and was widely believed by Calvinists not only of that period, but before and since, but most of these same people believed also in an intervening Providence, capable of performing “miracles”, and that promptly made hash out of the divine order of creation.

From the scientific point of view, of course, preemptory *ad hoc* intervention by God would itself be a miracle, but if a lightning strike happened to occur that was in accord with the laws of science, the attribution of it to God would still be compatible with science, and would constitute a miracle only in the mind of the believer. Of course, those who believe that God actively intervenes in our lives in a manner that isn't predetermined by antecedent causes would probably object to such a reductionist characterization of Divine Providence. While for non-believers in these scientifically acceptable versions of Creationism, the metaphysical hypothesis of God the creator, would seem at best an irrelevancy.

In essence, metaphysical hypotheses require subjective faith to support them, although the psychological starting points for both scientific and metaphysical hypotheses are probably the same: intuition guided by what one takes to be knowledge. To satisfy the demands of science, however, and to render one's hypothesis credible to those who lack one's particular faith—who require a more objective, evidence-based standard of proof—one must limit one's claims to hypotheses that are capable of falsification.

Although the most sweeping historical claims of evolutionary theory may fail this test, many aspects of historical evolutionary theory *are* subject to falsification in the logical (rather than empirical) sense that they are incompatible with other accepted theories, whether scientific or metaphysical.

For example, the general order in which the species must have evolved has been inferred from universal findings of the same characteristic sets of fossils in the same sedimentary layers all over the world, and the sedimentary layers have been reliably dated through a number of different, overlapping atomic clocks based on known rates of radioactive decay of certain isotopes of igneous rocks.^[3] In principle, the discovery of even a single fossil of a certain era in the wrong sediment would constitute falsifying evidence against a part of this inferred historical chronology. Of course, a chronological relationship between fossils does not by itself establish that one is the ancestor of the other. However, now that it has become economic to sequence and compare whole genomes of various species, ancestral relationships can now also be inferred logico-mathematically to a high degree of probability just from a comparative analysis of the DNA of different fossils, although examples of high quality fossil DNA are still proving hard to come by.

The main general tenet of evolutionary theory, that the species have evolved in a particular, intrinsically logical order, can be established beyond reasonable doubt. What cannot, probably, ever be known in any detail are the specific histories and causal factors, such as the extent to which any particular historical step in the evolutionary narrative occurred through classic Darwinian natural selection, as opposed to other factors. The history of evolution is, after all, a history like any others, and the fossil record, even when supplemented by clever analysis of progressive mutations to the DNA can only rarely and speculatively bring the story down to the level of specific narrative.

³ As a check on this, fossils typically provide their own intrinsic dating through the radioactive decay of their Carbon-14 isotopes to Carbon-12, and though the rate of this particular decay has varied somewhat over the centuries, because it is dependent on variable atmospheric effects, this variable has been compensated for by calibration with dendrochronology, or the analysis of tree rings—a dating system that is accurate to the year going back continuously at least 10,000 years, and with gaps for up to 700,000 years.

Another Metaphysical Hypothesis: Anthropogenic Global Warming

Another example of a metaphysical hypothesis, or more properly set of hypotheses, are the ones concatenated under the rubric of Anthropogenic Global Warming. Given our grossly inadequate theoretical understanding and inability to quantify or even identify all the many factors that affect weather and climate, AGW is necessarily predicated on inferences from historical data. But the historical data lacks both the duration and the precision to support the sweeping AGW thesis, with its claims of regular fraction of a degree of warming per year (necessitated by the need to correlate the supposed warming with human activities and thus identify it as man-made), and in fact the data over the last 60 years or so when we do have a smattering of fairly precise measurements, contradicts the whole warming thesis; there has been no global warming for the last 15 years, according to our best modern satellite measurements, and in the decades before 1980 scientists were worried about global cooling.

Moreover, the best mathematical models of the AGW proponents can't even account for the recent historical data we have, in part no doubt because they ignore poorly understood factors known to be crucially important to global warming/cooling such as widely varying and unpredictable sunspot activity, volcanism, and geothermal emissions. And the models don't even attempt to explain how and why the pre-industrial 11th century Vikings were able to grow grapes in Greenland, while during the Revolutionary War in America, the winters were so cold that the Hudson River froze solidly enough that George Washington's heavy artillery could be dragged across the river to keep them out of the hands of the British. Needless to say, any global warming that has occurred since then is all to the good.

Anthropogenic Global Warming, Creationism, certain versions of Evolutionism, and many other popular modern doctrines are examples of metaphysical, not scientific hypotheses, and they must be accepted on faith or not at all. Science doesn't have the answers to everything, in fact it is constitutionally incapable of addressing "the big questions", such as: "Who and what are we as human beings?", "Why are we here?", and "How should we behave?" We must all seek our own answers to these questions as best we can, although scientific and other kinds of evidence-based knowledge can provide a guide. Metaphysical beliefs only become dangerous and socially undesirable when they contradict evidence-based knowledge, and when their proponents seek to foist them on others by force, as through the agency of government.

The Epistemology of the Law

Unlike science, in which all truths are provisional and subject to falsification by testing, in the courtroom truth is determined by a consensus of human judgements, and it is determined once and for all (allowing for the appeal process to run its course).

Truth in the courtroom is arrived at by an adversarial process in which competing theories, or narratives, that account for all the facts of the case, are retailed to the jury (or in administrative cases just to the judge) by the two adversarial parties. In principle, either judge or jury could reject both stories in favor of a third story of their own devising, but I think that this must rarely happen, because it's hard enough to come up with any narrative that explains all the facts, and chances are that the two attorneys, if they are competent, will already have latched onto the most plausible ones.

The adversarial aspect of the proceedings pretty much guarantees that each story will be subject to severe criticism, and in principle this will stimulate the judge and jury to think actively and critically about the facts and thereby arrive at some reasonable approximation to the truth. This is in principle a workable system, but like any other human institution, the court system is subject to deep corruption, and ours has long since arrived at that state.

In America, most important verdicts, criminal and civil, are rendered by juries—supposedly a jury of peers of the parties at trial—but by the time the jury selection process has run its course, the outcome of the trial has largely been determined (although it may still be unknown) even before the facts and theories of the case have been presented. Knowledgeable and independent-thinking jurors aren't wanted, and will seldom survive *voir dire*.

Meanwhile, witness manipulation begins during the investigative stages of each case. Most witnesses are co-opted by one or the other of the adversarial parties and are coached to support their particular narrative. The testimony of important witnesses is sometimes suppressed or ruled out of court by discriminatory judges, and—the most important distortion of all—since the jury has usually been deliberately dumbed down, the testimony of the most credible witnesses is undermined by attacking them *ad hominem*—confusing them or riling them with rhetorical tricks, preventing them from qualifying their answers (which both distorts evidence and undermines their credibility), etc.—to produce an unfavorable impression of them in the minds of jurors and to distract the latter from the content of their testimony.

There are occasions where scientific evidence, and the scientific method are allowed into the courtroom, but unfortunately few jurors or jurists understand science or the scientific method sufficiently to take proper account of the meaning and weight of such evidence. In fact, jurors who might have this ability tend to be systematically excluded from the judicial process. Thus, the testimony of scientists and other experts is generally reduced to bogus argumentation from credentials and authority, and when an attorney has managed to secure a credible expert, their credibility and authority is often then exploited by drawing out their opinions on matters where they have no special expertise, with the jury hardly noticing the difference.

Altogether, the typical modern courtroom proceeding has become more an exercise in jury manipulation, than in trial by presentation of competing narratives.

Nonetheless, the epistemology of the law provides us with a far more appropriate model for the epistemology of history than does that of science, and scrupulous historians have a much better chance of arriving at the truth by applying this model, than the participants in courtroom circuses.

The Epistemology of History, with a focus on family history

History, like the law, is an inquiry into past events, whose reconstruction isn't subject to the scientific method, because the events are not repeatable.

One of the great strengths of the courtroom paradigm is its constant focus on epistemology in the rules of evidence. Hearsay testimony is generally excluded, and even the most credible witnesses may be discredited by showing that their testimony wasn't, or couldn't have been, based on personal knowledge. With respect to documentary or physical evidence, only the original, or, under certain circumstances, the best extant substitute, will do.

Ostensibly, historians are at a disadvantage with respect to these stringent rules of evidence. Most witnesses are dead and not subject to cross-examination; they can be brought into the courtroom only by documentary means, like deponents. And even so, the contents of most historical documents would still have been hearsay even if their recorder were present to testify in court. For example, even such a prime piece of genealogical evidence as a birth record entered contemporaneously by a town clerk, is only a transcription (and possibly an erroneous one) of what the clerk was told. The one rule of evidence historians can, and should, insist on is recourse to the original documentary source. Otherwise these inherent evidential deficiencies must be overcome to the extent they can by constant application of the epistemological question "How did this person know that what he said was true?", and by careful weighing of the evidence in its broad circumstantial context.

And here we arrive at the essential epistemological methodology of history. Where courtroom attorneys elicit, and/or construct, the most plausible narratives to account for all the demonstrable facts of the case, historians to be credible must recreate the circumstantial historical contexts within which the events they're reconstructing took place. Most genealogists (family historians) fall short in this regard, because they have insufficient understanding of the laws and customs of the time and place, and/or of the broader historical contexts, but most of all they tend to focus too narrowly on individuals or individual families, instead of thinking in terms of neighborhoods, of extended families (who may live in other areas), or of "allied families" (including in-laws) within the local neighborhoods in which most of our ancestors lived.

The libraries are full of local histories with embedded biographical or genealogically relevant evidence, and these have deservedly been criticized by academically credentialed historians for their lack of scholarly rigor. But these kinds of books can be invaluable not only to the family historian, but also to the academic historian, by providing only slightly retrospective windows into vanished times. The largest number of books of this sort were published in the mid to late 19th century, and they look back several generations from there from the point of view of the old-timers recollecting the days of their youth and what they remember of passed down family traditions. Hearsay, in such cases, must simply be ruled admissible, though we should do our best to validate the claims independently from public records, and we may reasonably draw the line at double or triple hearsay, since each retelling of a story introduces opportunities for corruption and error.

The most valuable evidence for the historian are the records and documents contemporary to the events. Few contemporary private records survive for ordinary folk, but their lives and circumstances can often be recreated suggestively by means of the public documents preserved at the courthouse, properly interpreted in the context of the law and customs of the time and place—and when I say place, I mean the local place—the county, town or rural neighborhood, and the land one's subjects lived on. One needs to build up an in-depth understanding of the typical inhabitants of a local place, and of what sorts of information the records preserve about them, in order to be alert for the often subtle differences that individuate them and differentiate them from the norm.

The goal in family history, as in history in general, is comparable to that of the law: to be able to construct a plausible chronological narrative of the doings of recognizable individual characters compatible with all the known facts, and the more circumstantial evidence one can pile up—even of trivial circumstances—the more constrained to the truth the possible narratives will be.

Making a Strong Historical Case

In the immediately preceding critique of historical evidence as compared with courtroom or legal evidence (at least in the ideal), it would seem that the former is at a disadvantage to the latter. However, in the real world, historical research that adheres to the highest scholarly standards trumps the productions of the law every time.

Most of the evidence available to the historian is circumstantial, and many people imagine that since circumstantial evidence is deprecated in court, that it is somehow of lesser weight than the direct evidence that so often seems to be lacking. But both the premise and the conclusion of this argument are wrong. Not only is circumstantial evidence admissible in court, it can be argued that all evidence is circumstantial, because even direct evidence that supports an unequivocal inference depends on an implicit mesh of circumstantial patterns for its interpretation. Thus, even supposed "gold standard" evidence, for example, the testimony of two eyewitnesses, may be discredited in court by showing that certain circumstances render their testimony suspect, or that other circumstances cast doubt on whether the testimony of one wasn't influence by the other.

As a matter of fact, there is good reason to be highly wary of all witness testimony. Recent advances in the psychology and neurophysiology of memory have shown that every time we recall a memory, we aren't just xeroxing a copy of an indelible original, we are re-interpreting that memory in the light of our current beliefs and overwriting the old version with the new edited version.^[4]

Thus, except for the knowledge that we draw on constantly and repeatedly over a lifetime, our own memories typically evolve in exactly the same way that gossip, rumors, and stories pass from person to person, acquiring “enhancements” (i.e. distortions) in the process. And one of the principal kinds of narrative or memory distortions that takes place is the incorporation of the views or perspectives of others into our own. That's why attorneys take pains (and often insufficient pains) to show that their several witnesses came by their views independently, even though this can seldom be known for sure.

The real gold standard for historical evidence, as it turns out, is the original testimony of knowledgeable witnesses *written down or recorded at the time of the event*. Thus, the best evidence turns out to be *the contemporary documentary evidence of dead witnesses*—not the testimony of living witnesses on the stand, even though subject to cross-examination; in fact it can be argued that the principal effect of cross-examination is to confuse the witness, discredit his probably valid testimony, and to generally muddy the waters. Likewise, personal recollections and narratives written down by a person long after the events, and perhaps mainly on the basis of hearsay, are inherently unreliable, though they may provide invaluable leads to better, more contemporary documentary evidence.

The strongest case, in law or history, is the one that is replete with circumstantial detail, because any narrative constructed in the light of a complex mesh of circumstantial detail must be severely constrained in its possibilities, or at least its plausibilities. Where the historical contexts are fully developed and instantiated by abundant detail, any particular narrative reconstruction of events may be wrong in certain minor details, but is almost guaranteed to be right in the main, because no other substantially variant account can conceivably explain all the known circumstances.

Historical Proof Standards

The chief professional accrediting body for genealogists, the Board for Certification of Genealogists, has adopted a “[Genealogical Proof Standard](#)”, which should be of interest to all historians. I subscribe to the evidential principles itemized in connection with this standard, with minor reservations, but I do not like the term “proof”, which is appropriate only to the field of mathematics, or in a more specialized and limited sense in the courtroom setting.

As philosopher of science, Karl Popper has argued, even scientific propositions aren't subject to proof—only to falsification, and if decisions at law are final, and thus a case may be said to have been “proved” in a sense, that is an epistemological weakness, not a strength, of the legal paradigm.

In science, and in history, the case always remains open to the emergence of new evidence, or to a more judicious interpretation of old evidence, perhaps with the aid of newly discovered techniques like DNA testing, or simply new analytical methodologies.

That noted, it is worth considering in some detail the three proof standards that have evolved in the law. The most relaxed is the *preponderance of evidence* standard applicable in most civil cases,

⁴ See “[The Forgetting Pill Erases Painful Memories Forever](#)”, in *Wired* (2012); Karim Nader, “[Memory Traces Unbound](#)”, *Trends in Neurosciences* 26(2003):65–72; Suzuki, et al., “[Memory Reconsolidation and Extinction Have Distinct Temporal and Biochemical Signatures](#)”, *The Journal of Neuroscience*, 24(19May2004):4787–4795; and the work of psychologist Elizabeth Loftus.

which decrees that if the weight of the evidence tips ever so slightly on one side of a proposition, then it shall be considered either proved or disproved. BCG used to wrongheadedly promulgate the preponderance of evidence principle as their proof standard, thus implicitly endorsing a bare minimum criteria that any serious genealogist ought to find inadequate.

A much more rigorous, but at the same time vague and unquantifiable, legal proof standard is the requirement that evidence for a proposition be “clear and convincing”. This has a nice common sense ring to it, but it begs the question: convincing to whom? Convincing to the average judge? The average (dumbed down) juror? The average man in the street? Since this formula antedates the blatant jury manipulation practiced today, let us presume that what is meant is that the evidence, or the case, must be “clear and convincing” to the average juror, who is a true peer of the parties at law. It still leaves us with questions about just how convincing the evidence must be—marginally convincing, as in preponderance of evidence cases—or enough to convict someone of a crime, perhaps with a heavy penalty. It is time now to consider the third and most rigorous legal proof standard: “proof beyond reasonable doubt”.

At first sight, this standard seems subject to the same criticisms as the “clear and convincing” standard, but I think most people would agree that it raises the bar much higher—as it should if it is to be adequate to convict someone of a crime carrying a heavy punishment. But we would still like some quantification to guide us in the interpretation of the term “reasonable” in this formula.

As it happens, there have been some studies that quantify what typical jurors consider to be beyond reasonable doubt. In one study^[5] the subject participants were first trained to make subjective probability assessments, expressed in confidence percentage, and then asked at what percentage probability they would vote to convict “beyond reasonable doubt”. The results were reported in the form of a frequency distribution, although no mean value is provided. The largest cluster, the modal value, was at the 90th %ile, and the other principal clusters were, as one might expect, at the 95th and 99th %iles, in decreasing order of frequency, with the mean lying somewhere around 92%.

I note that the quantified results of modern scientific experiments are mostly subject to a strikingly similar probability quantification. To be considered of “statistical significance”, and therefore worthy of note in a peer-reviewed scientific journal, a result must show at least a 95th %ile (20-1 odds) of not being due to chance, or, to adopt a more stringent criteria, a 98th %ile (50-1 odds) level.

⁵ Harry D. Saunders, "[Quantifying Reasonable Doubt: A Proposed Solution to an Equal Protection Problem](#)", in *Beppress Legal Series*, 7Dec2005, Working Paper 881. This study also argues convincingly that the standard should be explicitly quantified by the several state legislatures to reduce the many egregious miscarriages of justice. The results obtained in the study support the author's argument on this point, as the stated thresholds for conviction ranged from 30-100%, which is to say that one of these prospective jurors would have convicted even though the evidence was heavily on the side of the accused (meaning that the case would have presumably been dismissed summarily by the judge), and in the 100% case the party would have always voted to acquit, no matter what. Since even remonstrance failed to budge either of these parties, these extremes might be written off as anomalies, but it's bad enough that an appreciable proportion of responses clustered in the 80% range, and quite a number insisted on at least 99.9% probability to convict.

It has been pointed out by critics of quantification that a juror's interpretation of reasonable doubt should ideally be predicated on the balanced utilities of tolerating wrongful convictions, versus letting criminals go free, and that these are, and should be, affected by the degree of the punishment—which jurors are at the present time instructed to disregard. Despite this prohibition, it is argued, jurors nonetheless do take the possible punishments into account, and typically raise the epistemological threshold for capital crimes. It is therefore argued that specifying a particular less stringent quantified proof standard for all cases would tend to overbalance the scales in favor of wrongful convictions in capital crimes, but in my opinion, this is a criticism, and a valid one, of the jury selection system system, and not of the quantification proposal. Instructing juries that they must disregard the punishment when deciding on guilt or innocence is just another of the many judicial usurpations that have corrupted our original common law jury system.

Historians, including family historians and genealogists, must make the best of their evidence, and if they think that the evidence is preponderant on one side of a proposition, they have an obligation to provide their readers with some idea of just how preponderant the evidence is. This need not be done in a strictly quantitatively way, by affixing numerical percentages, but there should at least be a judicious and consistent use of qualifiers attached to any important historical proposition. All too often the historian's conclusions are presented *ex cathedra*, without any qualification at all, and served up, to boot, with a godlike pretense of objectivity.

If there are to be “proof standards” for historical or genealogical propositions (but please, let us use a less absolute word than “proof”), let them aim high, and, for clarity, imply a quantified standard. Speaking from experience, I think that a 95% probability is well within reach for many of the kinds of propositions family historians put forward, and I think they are therefore entitled to consider such propositions as established beyond reasonable doubt. As long as the historical case always remains open, as it will and must, I see no reason why historians may not strike a note of confidence with respect to their better grounded propositions, but the work of many (typically the very ones who skimp on the presentation of supporting evidence) would be improved if they served up their less well founded claims with appropriate qualifiers. And a word to editors: editing out qualifiers in historical writing may improve the style, but it weakens the credibility of the matter

There are situations where quantified probabilities can be legitimately adduced in support of historical propositions. Certain conclusions derived from yDNA testing, for example—mostly negative conclusions—are a case in point.

Probabilistic inferences may also be made in populations for which it can be shown statistically that most individuals or families adhered to a certain pattern. For example, as I've argued [elsewhere](#), in the Scotch-Irish settlements on the American frontier, and in Scottish families in general, a particular onomastic pattern was generally followed in the naming of children, at least for the first three of each sex, and where the names of all the children and the birth order can be ascertained, this may be clear and convincing evidence that the pattern was followed in a particular family. And in families where the pattern is thereby shown to obtain, rather strong inferences can be made about the names of otherwise unknown parental ancestors, or children.

Finally, having considered the application of both scientific and legal epistemological standards to the propositions of history, I would like to return to the principles of the “proof” standard proposed by the BCG:

- (1) Reasonably exhaustive search;
- (2) Complete and accurate citation of sources;
- (3) Analysis and correlation of the collected information;
- (4) Resolution of conflicting evidence;
- (5) Soundly reasoned, coherently written conclusion.

We can pass over (2) and (5) as they go to the form of presentation, not to the evidence itself, and (3) and (4) may be bundled into “Construct the most plausible narrative that explains all of the accumulated facts”, which is what any competent courtroom attorney (or for that matter investigating officer) does.

The most important of these principles, and the one most often neglected, is the first: *reasonably exhaustive search*. Decision theorist and Nobel Laureate, Daniel Kahneman, in his book, *Thinking Fast and Slow* (2011), has cataloged most of the systematic kinds of mental errors the human mind is prey to, but none is as important as our propensity to make judgements on the basis of WYSIATI

(What You See Is All There Is)—to contentedly predicate our opinions on our partial and inadequate knowledge. It explains why the most arrogant and opinionated people are typically the most ignorant, and the most impervious to additional knowledge or facts that contradict their cherished beliefs.

Unfortunately, this is a failure of straight thinking that we are all prone to, if only for practical reasons: there just isn't time to dig into the grounds for most of our opinions adequately. However, that is no excuse for failing to research and think out the implications of our most important opinions or chief interests—the things we live, and die, for.

Conclusions

In sum, I believe that the epistemology of the law, including the standards of proof and evidence that obtain in the courtroom, can serve as a model, with certain modifications, for validating the propositions of history. The scientific method, *per se*, is rarely applicable to such propositions because history cannot be rerun like a lab experiment. Still, aspects of the scientific methodology may occasionally prove useful, and the Popperian philosophy, that the propositions of science must always remain open, and can never be proved, only falsified, or falsified in part, applies equally to the propositions of history, though in a weaker sense of the word “falsified”.

A corollary of Popper's characterization of the scientific method not heretofore discussed, is that since hypotheses should be designed to be falsified, the ones that are most easily falsified—namely the boldest ones—are the best, since they speed up the revise-test-revise cycle. This dictum may be also be applied to historical hypotheses (even though they may not be, in the strictest scientific sense, falsifiable)—namely, by substituting “gather more facts” for “test” in the cycle of scientific methodology—and this is one of the reasons why genealogists are well advised by such accomplished practitioners of the craft as Robert Charles Anderson to make complete family reconstructions, including at least estimated birth dates for all the children, even where the evidence is skimpy to non-existent. Such bold hypothetical frameworks are almost guaranteed to conflict with circumstantial data not otherwise suspected of being relevant, and to thereby provide feedback to guide more plausible and accurate family reconstructions.

In other words, we shouldn't be afraid of theorizing—only of becoming wedded to our hypotheses. The Popperian version of the scientific method, works psychologically something like the Socratic Method, which encourages bold assertion to stimulate argument and creative thought. And as further justification for this top-down theoretical approach to the pursuit of truth, Popper obliges us, in *The Logic of Scientific Discovery*, with an apposite advisory from the German philosopher Novalis, who died in 1801 at the age of twenty-eight:

Theories are nets; only he who casts will catch.