The Academic Synopticon

Part Five.
Education, Historical Sciences, and History

The reason social scientists do not more often arrive at
the truth is that they frequently do not want to.
—Bertrand Russell

Education and Research

Through its own traditions, research programs, and collaborations with other human sciences, education is a discipline displaying an unbounded potency for advancing human understanding and achievement. Education is a humanistic discipline about culture rather than a scientific field about nature, so it can get classified as a non-scientific discipline because of its inherently historical and social orientation. Narratives about what children should be becoming and how they should be developing are normatively prescriptive, not just naturalistically descriptive. Why then would science serve education? Disciplines such as psychology, social theory, and anthropology are relevant to pedagogy because they bridge humanistic disciplines and naturalistic sciences: they are able to be human sciences. They themselves are hybrid blends, so their humanistic knowledge is salient to pedagogy's understanding of the child's learning and the practices of teaching.

Although education is primarily a humanistic discipline oriented more to culture rather than nature, pedagogical practice can incorporate knowledge about childhood development, interpersonal communication, intellectual growth, and social integration. Education, while far more than scientific research, thereby joins the human sciences, contributing to scientific inquiry and cultural advancement simultaneously. Due to their similar priorities, education and science make an excellent fit. What is scientific and what is educational are unified at their root by exploratory discovery. With methods exemplifying that spirit of discovery, learners and teaching practices can be studied by the human sciences. Education's humanistic ends are aided by knowledge about the nature of those to be educated.

The world is a patient teacher to a curious species seeking out knowledge. Endless answers shall be given to those asking boundless questions, and that inexhaustibility to nature leaves us both awed and humbled. What the world cannot teach is what we need most to understand: what would be the right questions to ask, to learn even more? We bear responsibility for the inquiries we undertake, so we must attend to what we are doing with our investigations, as closely as we watch nature's doings. Self-exploration accompanies world exploration.

Modern science shines its bright light upon nature, while modernity directs a spotlight of illumination onto us. "What is humanity, that we are mindful of our own education?" Education is a truly human specialty, and all of science without exception is part of humanity's education. This complementary opinion of science is hardly an unfamiliar perspective.

The corollary, that humanistic disciplines can borrow scientific methods and absorb scientific knowledge, sounds less familiar. What about that supposed divide between the sciences and the humanities, keeping both "cultures" deaf and blind to the other? Education straddles that divide, and integrates them together at their common root. Not only should science be educational and education should teach science, but their shared mission of abductive discovery connects the humanities, humans science, and sciences together in collaboration. This opening principle about discovery is sufficient, for pragmatism, to guide any elaboration of a "philosophy" of education. No theoretical philosophy of education obstructs our inquiry from the outset, and none will be defined in this chapter, although there is an educational philosophy assembled by its conclusion. To demand a "philosophy" of education up front, prior to empirical inquiry into learning, is to fixate upon an abstract obstacle obscuring the road of practical inquiry.

Education Minding Minds

Education revolves around the experiences of learning, and learning well to facilitate ever more learning. Learning that narrows, misdirects, or halts the mind does not deserve the name. Focusing on teaching and learning, we observe a special and solemn space for an important kind of human relationship. Philosophies of education differ over a great deal, but see no reason to disagree here (Carr 2005; Jackson 2011; Moore 2010; Woods and Barrow 2006). This is a normative situation replete with roles and responsibilities attending to key matters: what should be learned, how does proper learning proceed, and how learning's guidance should be conducted. Education is a human practice, and hence it can be right or wrong, and done rightly or wrongly. There is nothing neutral or value-free about education, as it performs its service advancing humanity.

Science as a human enterprise could never be neutral either. Science consists of more than theories and knowledge; it has its methods, values, and norms, too. Depicting science as value-free, alongside education as value-laden, obscures much about both disciplines. The growth of knowledge, along with the development of inquiring minds able to gain knowledge, is as normative and noble as any human endeavor. What science values, education values as well.

On that common field of shared interests, offers of constructive criticism would be expected along with congratulatory confirmations. Sometimes criticism sounds too sharp, as we hear in that head-turning question, "Why is education teaching children all wrong?" Disruptive dictums from science pundits skirt around the heart of the matter: where does science constructively connect with education? Superficial criticism only clouds the important issues. Collaborations between education and science should proceed from a shared nature and purpose, or, if no such basis exists, each one can carry on without interference from the other.

Education has long experience with social forces offering their advice or admonishment. "Why isn't education teaching children right?" is a provocative but ambiguous question, motivated by different intentions behind it. "Why isn't education teaching what is right?" expresses a moral or civic concern. "Why isn't education teaching the right subjects?" instead criticizes what is being taught. "Why isn't education teaching the right way?" challenges the teaching practices.

Science, too, is familiar with getting dragged into social controversies. Science's worldview may be judged as harmful, or helpful, for civic values. Science's knowledge could be assessed as central, or peripheral, for general competencies. Science's expertise might be incorporated as useful, or rejected as irrelevant, for pedagogical efficiencies. Modernity has brought a measure of materialism to our times, but the idea of living in a "scientific culture" remains aspirational. Voices enthusiastic about science try to be heard over those sounding apprehensive. Upon complaints to the effect that "That education is unscientific," firm priorities have to be set. Shall scientific paradigms be confrontational against, or deferential to, conservative values? Shall scientific areas be secondary to, or replacements of, other subjects? Shall scientific theories be essential to, or optional for, teaching methods?

Among all of these competing demands, education itself should remain the top priority for any society. It must not be regarded as inherently political, exclusory, or mechanical. Treating education as principally about something other than the teaching-learning relationship represents a deeper betrayal of education's mission than any sign of intrusive scientism. Nevertheless, education in general plays many social and cultural roles simultaneously, Education as a public affair does require attention, by the area of *educational policy*. Education as an academic institution calls for oversight with *educational administration*. The core mission of education universally is the responsibility of the discipline of education specifically, where *educational research* is harbored. Where educational research is distorted locally or dictated nationally by policy or administrative agendas, education becomes discordant and somewhat undisciplined.

Discipline starts from putting first things first. Education must embody what is human, to be broadly humanistic as anything else about culture, and duty-bound to advance learning for its own sake. Teaching only sacrosanct ideals deprives minds of comparing and testing values. Teaching only certain subjects to the exclusion of others prevents minds from appreciating a wide variety of endeavors. Teaching in fairly restricted ways limits minds to similarly constrained ways of thinking. Genuine education not only teaches; it teaches in ways that foster ever-more learning and the sure growth of knowledge. Learning for its own sake has but one other devoted ally among all the cultural forms and social institutions ever invented: science.

Minds should become explorative, experimental, expansive – with that mental growth in focus, the operational mission to education is coming into view. An undisciplined or debilitated education, less than fully capable of facilitating further learning, cannot do justice to that special learning-teaching bond. Mentality and its growth must possess its own inherent value and intrinsic justification. No doubt that is why all areas of human achievement, particularly science, unfailingly prize the mind – while any number of social forces try to manipulate minds.

Experiential Education and Scientific Inquiry

Science, like all exploratory discovery, built upon that foundation of education embedded at the core of human culture. It would be foolish for scientists to think that they have no need of learning, and sound insights into good learning. If knowledge does not come from learning, by what process could knowledge ever enter a mind? Mystical and mythical illumination were left to religion when science gained its independence from theology. In science, learning from exploratory experience surely counts as learning.

The purpose of thinking is inquiry, for the one who is underdoing the learning processes. This is the essence of all education, is whatever form and format. In the words of John Dewey,

> To say that thinking occurs with reference to situations which are still going on, and incomplete, is to say that thinking occurs when things are uncertain or doubtful or problematic. Only what is finished, completed, is wholly assured. Where there is reflection there is suspense. The object of thinking is to help reach a conclusion, to project a possible termination on the basis of what is already given. Certain other facts about thinking accompany this feature. Since the situation in which thinking occurs is a doubtful one, thinking is a process of inquiry, of looking into things, of investigating. Acquiring is always secondary, and instrumental to the act of inquiring. It is seeking, a quest, for something that is not at hand. We sometimes talk as if "original research" were a peculiar prerogative of scientists or at least of advanced students. But all thinking is research, and all research is native, original, with him who carries it on, even if everybody else in the world already is sure of what he is still looking for. (Dewey 1916: 173-174).

It is unnecessary to advocate Dewey's entire philosophy of education to acknowledge the sensible point about learning made here. Dewey had an enormous influence on progressive educational theory (Darling and Nordenbo 2003), and his teacher-with-learner approach serves as a counter-balance to curriculum-centered paradigms on the one side and child-centered pedagogies on the other (Noddings 2015). His broad views on education never stray far from his tight focus on thinking, problem-solving, and learning from the trials of experience.

Why would science be distanced from education? Empirical sciences could not plead ignorance of the methods behind their discoveries while taking credit for those successes. Scientific methods are fundamentally methods of experiential learning, or else they have nothing to do with knowledge. We need not rehearse outdated debates between empiricism and rationalism to understand that the sciences surmount that standoff by fruitfully combining empirical observations with reasoned inferences in their complex methodologies. Science deserves all due credit for its numerous sophisticated methodologies, carefully crafted for the many domains of diverse fields and subfields of inquiry. Reliable methodology conducive to knowledge is hardly alien to education.

Let us then seriously ponder how science is education *and* education is scientific. This thesis for deliberation is not merely that "science is educational" or that "education includes science." Announcing their rooted unity presents a truly radical thesis, exposing to our view their deep common root. Their superficial apprehensions will not delay our excavation. Education, as a humanistic discipline, often exhibits anxieties and antipathies towards what is regards as scientism. Science, for its part, would not surrender its hard-won independence just to be submissive to humanism. Both sides need to relax their defensiveness. Neither values-free scientism nor values-laden science is our objective. Worries over reductionism or relativism are premature until the territory around education and science has been adequately scouted and surveyed.

Deeper commonalities have to be investigated, to get past hasty misconceptions. A widespread notion about education thinks that it only transmits established knowledge, while science acquires new knowledge. Science

education, for instance, makes complete sense from a scientific standpoint, supplying knowledge that education conveys. This preconception treats education as just *teaching* lessons for dutiful learners while science is *testing* ideas for daring explorers. Didactic instruction fits that caricature for education, at most. Such an antiquated view of education hardly comports with science's respect for modernized empiricism. Let us all be sound empiricists at last.

Education in its refined meaning has everything to do with active learners trying out ideas new to them. Experiential learning is sounder than rote learning. Educational research accordingly explores the possibilities to dynamic learning in all its forms and formats. Experiential learning is not synonymous with solitary learning. Suitably directed, education can guide learners through processes of comparing and testing their own ideas as well as those of others, and encourage inquisitive activities calling for group participation. Science applies its methodologies within group efforts of comparatively testing ideas of explorers through guided research programs. That description makes a fine fit with the conception of empirical and experiential education. Education and science are, from their root, the same flourishing and flowering of human mentality.

From any learner's perspective, acquiring knowledge is voyage of novel exploration and discovery, just as the scientist's experience of performing scientific inquiry is exploratory discovery too. Still, voices keep insisting on science's independence from education. We will be reminded that instructional settings provide teaching guidance. Group guidance is indeed crucial, we can reply. Does the scientist confront nature alone, out beyond society and all social institutions? Just the opposite: organized scientific communities together establish confirmable knowledge. We will also be reminded that educational instruction presumes that most everything to be learned is already well-confirmed and reliably known. Again, we can reply, any scientific field relies on an ample storehouse of established knowledge from past investigations and theoretical advances.

We will next be told that educational practices, unlike scientific programs, depend on multiple disciplines. Indeed, education blends traditions of pedagogy with knowledge from allied disciplines such as developmental and abnormal psychology, sociology, and organizational studies. Yet when we turn to look at any scientific field, its supportive subfields and neighboring fields contribute knowledge and methods. The field of cellular biology would be making little progress absent the participation of biochemistry, molecular biology, and genetics, or without collaborations with physiology and evolutionary biology.

Parallels are only mounting between scientific inquiry and experiential education. Scientific independence from education is, so far, looking less and less plausible. There must be sound methodology for experiential learning and discovery, or else nothing about science or society makes sense. The sciences regard their methodologies as highly refined and specialized, and too complex for application in educational settings. That is a valid distinction, only confirming the general standpoint urged here about a shared science-education heritage.

There is much that science does that cannot appear educational, and much occurs in education that doesn't seem particularly scientific, but their common core of experiential discovery plays its essential role nonetheless. Elementary and secondary instruction introduces elements of empirical and experimental inquiry, and then scientific fields instruct their college majors and graduate students in advanced methodologies.

Culture in Nature

Admitting the core heritage behind by science and education, the path ahead may yet diverge. They are distinct fields, after all. A fact-value dichotomy might send them in divergent directions. In order for science to make theoretical discoveries, it strives to leaves the normatively human behind as it neutrally postulates natural entities, energies, and laws that exist anywhere at anytime. Education places the normatively human world out in front, proceeding for the sake of that particular world and that world's future. Education as a discipline must contain an historical and historicist component, even as it conveys its ongoing work into the future. Its pedagogical practices developed within humanity's cultures to perpetuate those heritages, and nothing about pedagogy makes sense outside of that genealogy.

Two divergent objectives now open up before us. What education, along with other humanistic disciplines, wants to comprehend is what being human can become. What science seeks to understand is what being natural must be. This is an important difference; whether there is also an ontological dichotomy is a meta-methodological matter for

philosophical reflection. Both the humanities and the sciences deserve a careful hearing. What can humanity become, in light of the way that we have gotten to where we are so far? Agency, opportunity, and liberty are presumed values with the asking of that humanistic question and can't be omitted in any sensible answer. What must nature be doing, in light of the way that we have observed events around us so far? Energy, regularity, and conditionality are presumed categories with the asking of that scientific question and won't be omitted in any reasonable answer. Philosophies do not fail to note this divergence of objectives and presuppositions, while disagreeing over their ontological and metaphysical implications. Some philosophies formulate the compatibility or even convergence of these objectives, reconciling the human with the natural. Other philosophies magnify their incompatibilities, defining the human and the natural in categorically contrary ways.

Education can be easily classified as a non-scientific discipline because of its inherently historical and social orientation. Narratives about what children should be becoming and how they should be developing are normatively prescriptive, not just naturalistically descriptive. Why then would science serve education? Disciplines such as psychology, social theory, and anthropology are truly relevant to pedagogy because they bridge humanistic disciplines and naturalistic sciences: they are able to be *human sciences*. They themselves are hybrid blends, so their humanistic knowledge is salient to pedagogy's understanding of the child's learning and the practices of teaching. Although education is primarily a humanistic discipline oriented more to culture rather than nature, pedagogical practice can incorporate knowledge about childhood development, interpersonal communication, intellectual growth, and social integration. Education, while far more than just scientific research, thereby joins the human sciences, contributing to scientific inquiry and cultural advancement simultaneously.

The internal struggle within education over the question, Shall education be a culture-oriented discipline about comprehending *what is human*, or a science-oriented field about understanding *what is natural*, can be quelled and dispelled. It is no contradiction in terms for education to focus on what should be naturally human: how each child's intellectual capacities should get developed towards bountiful results. It would be unnaturally wrong to neglect a child's thinking capacities, and normally right to administer sound teaching practices. Nurturing and naturing are united here, so long as education is well-informed about the import, efficacy, and impact of those practices.

Education can be scientific to the extent that it views its body of time-tested pedagogical practices as opportunities for further investigation, trial, and adjustment, even as education's pedagogical goals always transcend science's purview. This historical co-development, between the improvement of practices which in turn enhance cultural ends, leaves nothing unaffected or unchanged while generation and after generation receives its education. How children are taught now is a lesson telling culture how its adults will be able to think.

Philosophy of education need not follow the academic tendency to keep fields apart and erect rigid dualisms between disciplinary categories, goals, and methods. Philosophy itself can examine the historical-cultural nature of education alongside the experimental-natural purpose of science, discerning their shared commitments and methodologies.

Education, like history, social theory, psychology, and anthropology, do not number among the sciences, intrinsically or in their entirety. Their missions revolve around agency, not causality, and their methods and ethics forbid fully controlled experiments on humans. (How would experimenting with control groups who are denied such things as autonomy, nurturing, opportunity, or security, be allowed to proceed?) However, the portability and adaptability of many scientific methods allows non-science disciplines to include selected scientific phases. History can take advantage of selected criteria for factual validity and explanatory adequacy. The amenability of social theory to observational and statistical methods allows sociology to flourish. Experimental psychology can use correlative statistics and control groups. Anthropology heeds the counsels of scientific objectivity while conducting its investigative and comparative inquiries. Scientific investigations are evidently educational for humanity's ways no less than they educate humanity about nature's ways. What ontological chasm still divides the human from the natural, to keep humanistic learning far away from naturalistic knowledge?

Four proposals have been advanced so far. (1) What is scientific and what is educational are unified at their root by exploratory discovery. (2) Education is a humanistic discipline about culture rather than a scientific field about nature. (3) Learners and teaching practices can be studied by the human sciences. (4) Education's humanistic ends are aided by knowledge about the nature of those to be educated.

Proposition (1) is met with the challenge that the methods of scientific experimentation are very different in kind from the procedures of learning discovery. This challenge can be satisfactorily answered . Proposition (2) is accurate enough, although answering the first challenge, revealing the core logic of abduction shared by scientific and educational discovery, explains why humanistic disciplines cannot match the experimental powers of scientific fields. Proposition (3) is met by the criticism that the notion of a "human science" remains obscure, since science yields necessary universal laws useless for the humanistic disciplines' respect for contingency and freedom. That challenge is answered by pointing to historical sciences (such as geology, paleontology, biology, and archaeology) which appeal to neither universal nor chancy explanations. Biology is the key to defending (4) from objections. The cultured nature of the human learner has resulted from evolution, so the normativity of culture is a natural object of study by the humanistic sciences.

The *nature* of humanity is to be intelligently cultural. Culture expresses that freedom of the ongoing discovery of human potential. While more creative than controlled, humanistic discovery benefits from scientific counsels about humanity. While scientific in methods, human sciences explore how humanity has been and continues to self-created. Science is not alien to the historicity of cultural endeavor, as a component of that human project of exploration. The spirit to humanity lies in that distinctive life of the bio-culturally co-evolved human animal.

Abductive Inquiry and Knowledge Discovery

Are the methods of scientific experimentation so different in kind from the procedures of learning discovery? We have already left behind didactic repetition for rote memorization. We can also set aside inferior ways to learn from getting exposed to a heterogenous mass of supposed facts, or from getting invited to accept conclusions deduced from assumed premises. The former method is appropriate for making acquaintances with natural curiosities, and the latter is essential in geometry and mathematics. Beyond those delimited stages, acquiring useful knowledge has to be interactive rather than passive.

Learning that engages the learner's own queries and develops the learner's critical faculties must be exploratory: acquired knowledge opens up further questions for exploration by empirical eyes and rational minds. Are we only contemplating education with this conception of learning? Dewey has a basic definition for science in mind to offer us too: "science signifies, I take it, the existence of systematic methods of inquiry, which, when they are brought to bear on a range of facts, enable us to understand them better and to control them more intelligently, less haphazardly and with less routine" (Dewey 1929/1984: 3-4). Learning is learning, at any level or stage of progress.

Exploratory learning is surely enhanced by suggestive teaching. We need not exalt "self-guided" learning, the sort of inadequate psychology that pragmatism warned against, in order to keep up with the oft-heard contention that science needs no teacher other than nature itself. Depictions of the lone scientist eliciting nature's secrets is a romanticized image at best and a crude caricature at worst. Competent participants offering their knowledge, suggestions, and criticisms surround any research scientist. Research teams do have to eventually answer to nature, but so does any exploratory learner desirous to learn something directly rather than at second-hand. Motivationally, who is the cutting-edge experimenter but a proficient learner once again having a long look at nature?

Methodologically, no empirical inquiry should be solitary, since the vagaries of cognitive bias and prejudice require communal compensations. Co-informants (any information sources whether natural or human) may be in the past, the present, or mostly in the future. If informants are no longer here but only in the past, the inquirer must adopt their perspectives and viewpoints, on matters thus taken as *historical*. If co-informants are present and accessible, the inquirer can solicit their information, on matters thus taken as *expositional*. If instead co-informants will mostly exist in the future, the inquirer can conduct trials that are replicable, on matters thus taken as *experimental*.

All three methodological orientations – whether historical, expositional, or experimental – are implemented and accomplished through abductive procedures of inference (Magnani 2010; Aliseda 2017; see Shook 2021a for more references). The founder of pragmatism, Charles Peirce, places the burden upon abduction for pursuing and finding explanations.

> Abduction merely suggests that something may be. Its only justification is that from its suggestion deduction can draw a prediction which can be tested by induction, and that, if we are ever to learn anything or to understand phenomena at all, it must be by abduction that this is to be brought about. (Peirce 1934: 171-172)

Humanistic disciplines attempting to be exploratory and explanatory cannot avoid the rigors of abductive inference.

The discipline of history, as the most historical of inquiries by definition, is inquisitive, selective, and organized, but those are low standards to meet. Exemplars of far-from-scientific history are historians composing a compelling tale (the literary historian), a morality lesson (the hagiographical historian), or a vindication epic (the ideological historian). For the investigative historian, sources are indispensable but not infallible or unchallengeable. Records from sources offer viewpoints upon their topics (they are not entirely subjective), so higher objectivity lies in the collection and colligation of many source records and material traces. This historian develops a hypothesis that can be put to trial, revolving around a proposal, such as "Rome's civic instabilities were behind Caesar's dictatorship and swift assassination," that may be tested against further information and interpretations (Collingwood 1946). The scientific historian refines investigations further, heeding the naturalistic worldview and consulting allied human sciences about the past, such as antiquarian forensics, paleography, archaeology, and geography (Diamond and Robinson 2010; Roth 2012).

That abductive process also lies at the heart of the two remaining modes of investigation: expository and experimental.

While co-informants are presently accessible, exploration takes a predominantly expository form. The inquirer can solicit interviews or consultations. Broadly social influences and forces are amenable to investigative methods of the social sciences (Backhouse and Fontaine 2010). Interviewing enough people about a town's rising prices, as a sociologist, journalist, or pollster may undertake, offers some qualitative insight into local concerns. Quantitative investigations follow in their wake, scalable up to any desired scope. Calculating an entire nation's rate of monetary inflation requires the quantitative tabulation of vast amounts of data collected by fairly representative sampling across the country. The resulting expositions from extensive investigation, whether journalistic or economic, remain improvable with enough resources. As journalism's "first draft of history" is combined with related sociological information about mass behaviors, customs, institutions, and the like, to sketch a general portrait which is then available for further testing against the still-growing collection of insight and information. The efforts of economics to fine-tune its measures of fiscal and market activity can be especially relentless and ceaseless.

A paradigm form of expository investigation is the crime investigation. The accused and witnesses are questioned, crime scene clues are forensically analyzed, and contextual conditions surrounding the crime are registered. Like the historian, the detective formulates a reasoned account to explain the unfortunate event, while minding the sociological adage that human affairs are so complicated that alternative accounts have to be considered and compared. The maximally coherent account is probably closer to the truth, especially if it survives impartial scrutiny (by judges and juries, for example). Sherlock Holmes's fictionalized acuity relied on abduction more than deduction or induction, although his swift capacity for contrasting multiple guesses by their deduced consequences, and then spotting the singular clues eliminating all but one explanation, disguised his abductive powers (Carson 2009).

A detective's criminal investigation is akin to a trial, and serves as an opening phase to a potential criminal trial. "If the accused really committed the crime, then further consequences of both the criminal's behavior and the crime scene should become observable under the right conditions." Rarely do the initial facts determine responsibility. They merely set up the opportunity to explain that event as the outcome of a chronological sequencing of conditioning events that allowed that particular event to happen. More evidence must be experimentally gathered (forensics, interviews, etc.) to test various hypotheses about the responsible causes for that crime. It is true, that the "crime event" is treated as a particular event with its own contingent conditionings and causes, rather than as an "individual" event that must occur whenever necessary conditions are lawfully satisfied. That is because a "crime" is a sufficiently complex event, so inquiries into its "lawfulness" are impractical, and a "crime" is an event involving humans so it bears particular (indeed, unique) interest in its own right. For sociology, by contrast, individual deeds are only noticed and measured so that mass statistics about generic kinds of crime can be metrically accumulated. In sociology, a crime is

still an event, but it is now an "individual" event to be treated and explained as an individual case within a general pattern of mass social action (Hester and Eglin 2017).

However exploratory, a detective's investigative methods remain constrained by an inability to conduct a highly controlled experiment. It is impossible to recreate situational conditions prior to a crime, human behavior is hardly lawful even under ideal conditions, and neither the suspects nor the victim can be "reset" to initial psychological states as they were prior to the crime. It is impossible to learn if the accused "would have surely done that crime at that time in that same way". All the same, investigations can conduct partially controlled experiments. That crime was in the past, but most of its components did continue on, and many effects from those components continue to exist to the present time. That is why the investigation must happen quickly, while conditions are fresh and clues haven't dissipated (Fisher and Fisher 2012). If too much time passes, looking for additional evidence will seem more like an expedition than an experiment. "Cold cases" can still be investigated (Adcock and Stein 2014), but that sort of expeditionary quest is more akin to a animal hunt down a trail gone cold.

The third mode of discovery, the experimental, is undertaken when co-informants for the inquiry are mostly in the future. An analogy from Peirce illustrates this collective intelligence: "The scientific world is like is like a colony of insects in that the individual strives to produce that which he himself cannot hope to enjoy. One generation collects premises in order that a distant generation may discover what they mean." (Peirce 1958: 87) For Peirce, a community of scientific inquirers can be indefinitely extended into the future, no matter how many visible geniuses stand among us now (Shook 2021b). Historical and investigatory disciplines can be "scientific" in this minimal sense, seeking empirical truths through methods amenable and answerable to similarly scrupulous and honest researchers. However, with experimental inquiry, Peirce's vision from the heights of scientific inquiry looks to the far future.

Indirect communication with people that one hasn't met and won't ever meet has to take the form of exacting experimental design and precise data collection. Controlled experiments to test an abductive hypothesis have to be closely replicable so that future confirming results are repeatable and comparable. The general way that a crafted experiment is reproducible by generic experimenters, anywhere and anywhen, is essential to the postulate's credibility in the long run. The logic of abductive discovery requires this prolonged reach of experimental inquiry, so that weaknesses to poor hypotheses are eventually exposed. Peirce's understanding of science expects future inquiries, if rigorously scientific in character, to converge in the very long run (over thousands or millions of years, if necessary) towards an answer: "Inquiry properly carried on will reach some definite and fixed result or approximate indefinitely toward that limit" (Peirce 1932: 485). His definition of truth for science (not for "truth" in other contexts) is this: "The opinion which is fated to be ultimately agreed to by all who investigate, is what we mean by the truth" (Peirce 1934: 407). Whatever cannot satisfy these two conditions of character and convergence cannot count as genuine scientific inquiry, since it will lack credible objectivity and realism. The humanities are not expected to satisfy this scientific idea of truth, for their missions are focused on comprehending and explicating human practices, institutions, and areas of cultural achievement. The human sciences elevate their aims towards explanation, prediction, and direction.

Differences between investigative and experimental inquiries can be exaggerated. Physics is often held up as "genuine science" because it conducts replicable controlled experiments and validates many hypotheses to near-certain degrees. Knowledge from partially controlled experiments can be obtained, without question, and many fields offer practical advice about statistical correlations. For example, clinical trials purporting to find the efficacy of a new drug includes "control groups" cannot fully control all confounding variables. Determining true mechanisms of bio-physiological action lies beyond the capabilities of the most rigorous trials, which are at best suggestive about sure causes to guaranteed effects (Machin et al. 2021). Clinical trials are abductive experiments on human subjects, but they are more investigational than strictly experimental like chemistry or physics.

Nine Modes of Exploratory Discovery

We have distinguished three procedural types: the Empirical, Investigative, and Scientific. We then distinguished the Historical, Expository, and Experimental orientations to inquiry. A total of nine modes of exploratory inquiry, represented in table 1, are given with the nine boxes, each representing a phase of abductive inquiry as an element of discovery.

Table 1. Nine Modes of Inquiry

Type of Informants Basis of Evidence	Past Informants for **Historical Narration**	Present Informants for **Dispositive Exposition**	Future Informants for **Scientific Experimentation**
Empirical Evidence	**Mode One** Respects all available sources that are able to pass checks for credible authenticity and mutual consistency.	**Mode Four** Interrogates witnesses and collects evidence in order to discern which hypothesis can acquire the most plausibility.	**Mode Seven** Accumulates and categorizes evidence so that future inquiries can rely on its patterned and predictive organization.
Investigative Evidence	**Mode Two** One, plus: Imposes interpolations and interpretations to reach for maximal coherence and singular chronology.	**Mode Five** Four, plus: Consultations with recognized experts, but their judgments are not necessarily taken as definitive.	**Mode Eight** Two and Seven, plus: Applies controlled methodologies ready for scrutiny and replication by further investigation.
Scientific Evidence	**Mode Three** One and Two, plus: Incorporates expertise from allied scientific fields and omits non-naturalistic events.	**Mode Six** Five, plus: Relies on knowledge from allied scientific fields and ignores non-naturalistic ideas.	**Mode Nine** Six and Eight, plus: Experiments fully control conditions for repeatable consistency with future science.

Humanistic Disciplines

Humanistic disciplines are not sciences, focused instead on understanding and explaining the capacities and results of human thought, agency, and activity. Factual evidence is not dispositive here; what ought to be enjoys preeminence over what happens to be. Exploring the possibilities of human potential is the supremely important sort of exploration, devoted to creative discovery, not empirical discovery. Each discipline is highly selective about the character and salience about "evidence" relevant to its normative paradigms. Exemplars of humanistic disciplines are Philosophy (inclusive of logic and ethics), History, Social Theory, Theology, Political Theory, Economics, and Mathematics.

The Nine Discovery Modes display the predominance of abductive hypothesizing and testing over deductive and inductive methods. Deduction by itself only confirms whatever is already believed, and that is why humanistic disciplines often fail to rise above traditional customs and parochial values. More imagination is necessary. Induction yields an enlarging evidence base to improve our acquaintance with ourselves and nature, but its meanderings only hint at deeper patterns and causes. Still more imagination is needed. Fully methodological inference (abduction) is far more explanatory, by postulating underlying explanations only revealable through experimental trial.

Humanistic disciplines expanding their interests into explanation, prediction, and control, whether dealing with the natural or human realms, venture beyond the Historical and Exposition modes into scientific modes. Relationships among humanities and sciences have varied widely, from cooperation to conflict (Slingerland and Collard 2011; Bouterse and Karstens 2015). Conflict over methodological principles occurs periodically, but there is no need to regard that contest as permanent or irrevocable. So long as the Nine Discovery Modes are discriminated and applied, jointly humanistic and scientific inquiries can be charted without confusion.

Selected examples of fields for each of the nine modes are listed to illustrate distinctions found among them:

The Two Historical Modes

Mode One. Herodotus-styled History, Ecclesiastical Theology, Oral Narrative Recording, Journalistic Reporting.

Mode Two. Polybius-style History, Rankean-style History, Intellectual Biography, Political History, Systematic Theology.

Let us pause to explore modes of historical investigation. “History” comes from the Greek word for “inquiry” into actual matters leaving evidence for an inquirer to look into. An honest inquirer must be guided by sources having then-contemporary or near-contemporary perspectives, rather than blind credulity about hearsay and legend. Selectivity is necessary for the organization of empirical history, as the work of Greek historian Herodotus displays, but that is still a low standard to meet. For the investigative historian, such as the Roman historian Polybius, sources are indispensable but not infallible or unchallengeable. There is a methodological expectation of chronology and consistency among candidate facts, with a minimization of partiality and prejudice. The scientific historian (Mode Three below) refines investigations further, heeding the naturalistic worldview and consulting allied fields about past matters, such as literature, antiquarian forensics, paleography, and archaeology.

The Two Exposition Modes

Mode Four. Ecclesiastical Inquisition, Crime Investigation, Investigative Journalism, Public Polling, Ethnography.

Mode Five. Canon Jurisprudence, Civil Jurisprudence, Government Inquiry, Foreign Intelligence.

The Five Scientific Modes

Mode Three. Chronological, but hard evidence is left to more scientific fields.
Human Sciences: Scientific History, Philology, Antiquities Authentication, Art Authentication.

Mode Six. Investigatory and diagnostic, but experimentation is in the hands of other scientific fields.
Human Sciences: Digital Forensics, Forensic Criminology, Forensic Anthropology, Forensic Authentication, Abnormal Psychology, Psychiatry.

Mode Seven. Exploratory and modestly predictive, but experimentation goes little farther than events naturally or socially provided.
Natural History: Geography, Ecology, Linnean Biology, Botany, Zoology, Anatomy, Animal Behavior.
Human Sciences: Human Physiology, Clinical Psychology, Sociology, Demographics, Cliodynamics, Linguistics, Educational Research, Anthropology, Epidemiology, Political Science, Economics.

Mode Eight. Moderate control over experimental conditions, more for identifying conditions beyond human control.
Historical Sciences: Cosmology, Astronomy, Geology, Earth Sciences, Evolutionary Biology, Paleontology, Paleoarchaeology, Materials Analysis.
Human Sciences: Archaeology, Experimental Psychology, Clinical Medicine, Genetics, Neuroscience.

Mode Nine. High control over experimental conditions, more for identifying causes amenable to human control.
Physical Sciences: Mechanics and Dynamics, Classical Physics, Quantum Physics, Chemistry, Minerology, Metallurgy, Materials Science.

This organization is not about the subject-matter of a discipline, but its methodological resources.

Scientific fields among the earth and life sciences in Mode Seven have to be more exploratory and expeditionary than strictly experimental. Fields descended from traditions of natural history such as botany, zoology, geography, geology, and paleontology are obvious illustrations. To discover why a particular thing or event came to be, scientists will plan and execute investigations and explorations, but past and vast natural powers controlled what happened. Mode Eight allows for greater control over experimental design and execution. Archaeology and neuroscience, for example, share

the capacity for modest control over experimental inquiry, by meticulously conducting earthen excavations or by painstaking analyses of neural tissue. By contrast, to precisely determine how a kind of thing or event always comes to be, the physical sciences in Mode Nine are able to test hypotheses with rigorous and replicable controlled experiments.

Educational Research

Education as a discipline could be, and has often been, scaled back to history of education or to educational policy. Historical studies can summarize careers of pedagogical movements, recount teaching and learning experiences, lament inequitable access, praise respectable pioneers, point out correlations among social and civic factors, and identify enduring instructional methods. (cite standard books on education etc.). Humanistic disciplines do have normative standards and ideals to uphold. These studies in education can discern, debate, and decry the variable ways that different societies have valued learning and invested in teaching. Turning the spotlight onto national affairs, education can undertake inquisitive investigations in order to broadcast exposés, make policy indictments, and back political reforms.

As broadly as education must sojourn, it avoids becoming undisciplined by aiming higher. For a human-centered discipline beholden to best practices both today and tomorrow, it is that teaching-learning space that must remain primary, so practical problem-solving cannot be secondary, and educational research can fulfill that commitment (Baez and Boyles 2009; Biesta and Burbules 2003). Striving to be more than a collection of customary traditions, current exemplars, revered paradigms, or ideological agendas, disciplined education additionally respects inquiries assignable to scientific modes Six and Seven. Educational research cannot attain the status of Mode Eight science, unlike experimental psychology and neuroscience, although education should consult their well-established theories without imitating their techniques. Mode Nine science, by requiring fully controlled and exactly repeatable experiments, is impractical for human subjects and beyond education's reach.

Overall, it is now clear that educational research cannot be reduced without remainder to any number of physical, biological, physiological, or brain sciences. Cooperation, not reduction, opens up the path in front of education. Quality research can be accomplished, including both student-centered and teacher-led research, so long as any "laboratory" for education revolves around living educational spaces. Displays of science-aversion out of loyalty to an idolization of disciplinary independence cannot serve learners or teachers.

By joining the human sciences, disciplined education and educational research has plenty of good company for collaborations and alliances (Furlong and Lawn 2010; Bridges and Thompson 2011; Peters et al. 2014; Bridges 2017). Sociology, ethnography, psychology, organizational studies, communication studies, technology studies, and related disciplines will never be sciences either, at most attaining to human sciences. Human sciences easily lend themselves to interdisciplinary investigations and experimentation so long as they are generous with their expertise.

Scientific research in the area of educational research, like research in the human sciences generally, has been a controversial topic for decades. Key issues were present at the birth of education as an academic discipline, and they continue to carry great weight (Lagemann 2000; National Research Council 2002; National Research Council 2012). Education has plenty of company with neighboring human sciences also digesting roles for scientific inquiry. For example, James Grand and colleagues who advised the Society for Industrial and Organizational Psychology on research practices have formulated criteria for "robust science" in the human sciences: research that is relevant, rigorous, replicated, accumulative and cumulative, transparent, open, and theory oriented. In their words,

> … a robust science is one in which activities throughout the entire scientific enterprise are conducted with the intention of producing positively impactful and relevant knowledge"; "the rigor of a science is reflected in the extent to which its core concepts and their relations are operationalized with precision, and the methodologies used to collect informative observations are accurate and appropriately aligned with the analytical techniques used to infer meaning from those observations"; "the replicability of [science] findings … pursues efforts to gather repeated (i.e., replicated) observations of the mechanisms and relationships among core concepts and processes of human behavior, and that these efforts are made accessible in the corpus of scientific evidence"; "the strength of scientific understanding and inference is enhanced through

> careful vetting, deliberate calibration, and compounding multiple observations into an integrative whole. … the pursuit of cumulative knowledge is reinforced by adopting an appropriate degree of intellectual skepticism toward novel propositions and appropriately adjusting those beliefs on the basis of accumulated evidence"; "a robust science [is] one
> in which transparency and openness are embraced throughout the research process and scientific system. Activities that embrace these principles include more complete disclosure of data, materials, analyses, and hypotheses to the scientific community; promoting publication practices in which important questions answered well have a place in the literature regardless of results; and creating accessibility to the research process at all stages of production"; "a robust science is simply one in which its scientific pursuits contribute to explanation and 'refinement of everyday thinking' by replicating, bounding, revising, falsifying, and, when appropriate, advancing new claims. (Grand et al 2018: 11, 12, 13, 14)

Going further, Grand et al. emphasize that theories searching for confirming data is not explanatory science – robust science run experiments searching for data *disproving* hypotheses.

> … robust science is 'theory oriented' (not theory driven or theory dependent) and promotes this tenet by describing, evaluating, and refining explanations. Genuinely accomplishing this goal requires research that reflects quantitative and qualitative methodologies across the full range of inductive, deductive, and abductive approaches. … The rightness of a theory is not determined by the clarity of its arguments or through formal logic but by subjecting its claims to the gauntlet of empirical investigation. A science that strives for precise theories purposefully subjects its explanations to an increased "risk" of falsification to determine the level of confidence that should be placed in proposed relationships. (Grand et al 2018: 14-15)

This burden on theory comes from a scientific respect for abductive problem-solving and discovery, not the outdated "top-down" approach of earlier eras. Expecting education to become a theoretical science of its own at one leap only revisits outdated epistemological and falsificationist philosophies (Rowbottom and Aiston 2006; Rowbottom 2014).

As philosophy well knows, in the arena of empirical explanation, clever fits between a neat theory and its preferred data prove little. Education's humanistic mission is not so permissive that it deserves exemption (Carr 2006). Although positivism and foundationalism are now history, the fashionable dismissal of "pure" data is no license to deny that good data can't drive out bad theory. A theory shouldn't dictate its own observational support. That is why a mixture of methods and experiments conducted by trusted lower-level theories, including those from fields neighboring education such as psychology and sociology, supply independently-collected information (Gorard and Taylor 2004; Niaz 2008; Biesta 2010; Hall 2013). Hypotheses meriting credibility are those able to survive both serious rivals and plenty of reliably collected data from multiple sources.

For educational research, a similar statement of robust scientific criteria was provided in a major piece of American legislation about educational policy, the "No Child Left Behind Act of 2001," where scientifically based research is outlined:

> (i) employs systematic, empirical methods that draw on observation or experiment; (ii) involves rigorous data analyses that are adequate to test the stated hypotheses and justify the general conclusions drawn; (iii) relies on measurements or observational methods that provide reliable and valid data across evaluators and observers, across multiple measurements and observations, and across studies by the same or different investigators; (iv) is evaluated using experimental or quasi-experimental designs in which individuals, entities, programs, or activities are assigned to different conditions and with appropriate controls to evaluate the effects of the condition of interest, with a preference for random-assignment experiments, or other designs to the extent that those designs contain within-condition or across condition controls; (v) ensures that experimental studies are presented in sufficient detail and clarity to allow for replication or, at a minimum, offer the opportunity to build systematically on their findings; and (vi) has been accepted by a peer-reviewed journal or approved by a panel of independent experts through a comparably rigorous, objective, and scientific review. (quoted from Baez and Boyles 2009, 7)

These sorts of criteria for robust scientific research, typical across the human sciences, are entirely appropriate for Mode Seven science, and set minimum standards for Mode Eight science. Educational research benefits from its own implementation of those experimental modes (Anderson 1998; Yates 2004; Kincheloe 2004; Lodico et al. 2010; Smeyers and Smith 2014), and from its incorporation of knowledge acquired by related human sciences operating with Mode Six, Mode Seven, and Mode Eight. The human sciences, like the life sciences, are far more interdisciplinary than isolated (Lund et al 2020). Education paradigms floating free from empirical testing or scrutiny from related disciplines only amount to undisciplined speculation.

Scientific Objects, Education Objectives

Motivational and methodological commonalities are pervasive between the human sciences and most scientific fields. Their respective missions may yet be responsible for irredeemable tensions between them. Even if human sciences respect science's methods and knowledge to understand humanity, scientific theories and scientific applications may be neither humanistic nor historical. If science reduces its subjects down to objects, what happens to educational objectives?

Protests against scientific intrusions into humanistic areas try to awaken us to looming threats. Three typical contentions suffice to highlight deep tensions.

> Science has to be basically quantitative, awkward at best with the qualitative world unless registered information is rigidly categorizable.
>
> Scientific views have to conceptualize people and their activities in collective terms, reducing particular individuals and deeds to essentialized kinds.
>
> Scientific theories produce regularized formulations ready for routine application to generic objects to achieve standardized outcomes.
>
> Scientific theories postulate or presume lawful relations among natural kinds in order to explain events in deterministic and predictable ways.

On this accounting, it appears that science cannot appreciate uniqueness, difference, diversity, or self-determination. Humanistic disciplines by their nature must respect and protect those values. All the same, different disciplines have different practical means for achieving their valued ends. This is just as true for the natural sciences as the human sciences. Most scientific fields never approach the mechanistic models of Mode Nine science, while offering practical approaches to any number of human problems. As for education, it has its own practicalities as well as its principles to jointly consider. Surely there must be common practical ground, and educational research operates well there.

The practical mission of a human science, such as education in its research mode, cannot get fixated on uniqueness or diversity for its own sake, since it seeks sharable lessons and teaching practices applicable to groups of learners displaying much in common already. Finding commonalities among groupings is just as much a human affair as it is a scientific matter. The notion that science turns everything it touches into cold dead objects is entirely unfair and demonstrably untrue for most scientific fields. Let us review Dewey's insistence upon the broad meaning to "science" with his reminder in full:

> There are those who would restrict the term to mathematics or to disciplines in which exact results can be determined by rigorous methods of demonstration. Such a conception limits even the claim of physics and chemistry to be sciences, for according to it the only scientific portion of these subjects is the strictly mathematical. The position of what are ordinarily termed the biological sciences is even more dubious, while social subjects and psychology would hardly rank as sciences at all, when measured by this definition. Clearly we must take the idea of science with some latitude. We must take it with sufficient looseness to include all the subjects that are usually regarded as sciences. The important thing is to discover those traits in virtue of which various fields are called scientific. When we raise the question in this way, we are led to put emphasis upon methods of dealing with subject-matter rather than to look for uniform objective traits in subject-

> matter. From this point of view, science signifies, I take it, the existence of systematic methods of inquiry, which, when they are brought to bear on a range of facts, enable us to understand them better and to control them more intelligently, less haphazardly and with less routine. (Dewey 1929/1984: 3-4)

As Dewey knew well, there is no singular thing as "science" but only a multitude of scientific approaches to particular problems and inquiries.

Educational research would indeed be irresponsible for imposing some singular notion of scientific method that does not actually exist in the sciences, or for seeking greater uniformity or precision than its subject matter can bear. To find a good fit between teaching and learning, the ways that a group of learners are alike supplies the clues for discerning how they can learn best. Experimenting with groups to discover their shared attributes, abilities, and attainments shows no disrespect to any among them. If some individuals are too distinctive to belong to this grouping or that, then new research groupings would be the intelligent response, instead of raising old gripes against science.

Disputes between education and science can be amicably settled. Perhaps the intractable arguments over science in education erupt at the internal borders among educational policy, educational administration, and educational research. Undisciplined education permits these debates to take over the entire field's agendas. One such dispute is fueled by the view that encouraging educational research to be more scientific has the effect of endorsing the restriction of education to standardized teaching and testing. Another oft-heard view instead holds that encouraging educational research to empower teachers as co-investigators has the effect of abandoning the administration of schooling to chaotic methods and outcomes. Education must indeed deliberate about abstract educational goals, but placing the blame on empirical research is a fallacious distraction, and a disservice to those most in need of education.

Educational Research

For both education and science, mind is the mission. Through its own traditions, research programs, and collaborations with other human sciences, education is a discipline displaying an unbounded potency for advancing human understanding and achievement.

(1) What is scientific and what is educational are unified at their root by exploratory discovery.

(2) Education is a humanistic discipline about culture rather than a scientific field about nature.

(3) Learners and teaching practices can be studied by the human sciences.

(4) Education's humanistic ends are aided by knowledge about the capacities of those to be educated.

Inhuman reductionism cannot be the agenda of human sciences adapting scientific methods to their missions (Kagan 2009; Slingerland 2008). Complaints over scientism disrupting education or distorting the discipline of education can easily be overblown, and often as ideologically motivated as the alleged scientism. The label of scientism is thrown at so many different abstractions (Shook 2015) for polemical purposes that it is becoming meaningless in academic discourse. Scientific methods and modes, by contrast, are easily discriminated. Non-ideological education, as observed in previous sections, has to foster explorative, experimental, and expansive opportunities for every mind.

In conclusion, education and science are far from opposed, sharing the goal of discovery to empower humanity. Science strives for knowledge alongside education, and knowing the world is never contrary to knowing thyself. Learning prepared for ever-more learning, and applied to every art worth doing, remains free.

History and Historical Sciences

> "[B]ecause of that commemoration of goodly deeds which history accords men that some of them have been induced to become the founders of cities, that others have been led to introduce laws which encompass man's social life with security, and that many have aspired to discover new sciences and arts in order to benefit the race of men. And since complete happiness can be attained only through the combination of all these activities, the foremost meed of praise must be awarded to that which more than any other thing is the cause of them, that is, to history. For we must look upon it as constituting the guardian of the high achievements of illustrious men, the witness which testifies to the evil deeds of the wicked, and the benefactor of the entire human race."
>
> – Diodorus Siculus, *Bibliotheca Historica* Book I, 2

History emerged from twin parents that go back to origins of scribal writing: episodic *chronicles* and legend *narration*. They share a focused ontology: significant events involving human deeds. "Once upon a time, there was a bright girl who lived in a town..." Subfields such as archaeology and biography explore that ontology. Long-buried foundations of a building tell us something about the inhabitant's lives long ago, while the recounting of a subject's experiences and achievements depicts that person's life.

Before History and Social Theory were separate academic disciplines, views about society were expounded through accounts of past events that can be labeled as Social History. Straddling the boundary between oral transmission and scribal recording, earliest forms of historical composition (in order of decreasing scope) were Ethnography (reports of lands and peoples), Genealogy (of noble families), Horography (annals), Discourse (on moral/civic affairs), and Eulogy (including memorials). The genre of War Epic appears in literary civilizations as well, usually combining multiple preceding forms.

Examples of the oldest historical writings from various civilizations include:

Mesopotamia: The Laments for Sumer and Ur, dating around 2000 BCE, combined myth, annals, discourse, and war epic.

Egypt: Official stelae, such as the Merneptah Stele c.1200 BCE, recount great events, royal deeds and decrees, and memorials.

Canaan: The Nevi'im or Historical Books of the Hebrew Tanakh (Joshua to Chronicles), redacted during 700-400 BCE, recount Hebrew events and discourses back to several centuries prior.

Greece: The Iliad of Homer, a war epic composed c.700 BCE about the Trojan War several centuries earlier, entwines several forms of historical account with lore and legend.

China: The Book of Documents (Shūjīng 書經) from c.600 BC records annals and discourses recalled from centuries before that.

India: The Mahābhārata, a war epic whose oldest portions date to c.400 BCE, are about warring tribes from a thousand years before that.

These sorts of Social History reflect a high degree of scribal acumen but little scholarly expertise. Historical writing fully emerged with *chronicled narration*, the scholarly genre relaying information about significant events and lending instruction to the future about how to relate, and relate to, that past. As scholarly ability grew in some civilizations and Sage Literature began to assemble, accounts of legend and lore from the past became more sophisticated. Although historical narration displayed a concern for chronography – ordering events in a somewhat linear manner – this organization does not yet attain the level of chronology: assigning a single coherent ordering of years across

decades and centuries for all events recounted. A timeline with rational consistency may distract away from telling a compelling tale.

At the stage of Sage Literature, those age-old features of fascinating oral legend, retained by entertaining literature, never lost their vitality for historical narration:

> Good character arrives on schedule to help, benefits others, exemplifies the improvements of virtue = Mythic Legend (greatest good prevails)
>
> Good character is able to endure suffering, does good things, manages to improves matters = Heroic Epic (greater good prevails)
>
> Good character happens to do bad things, suffers accordingly, but learns how to improve from the lesson = Comedy (the good prevails)
>
> Bad character is doing bad deeds, appears to benefit for a while, but gets punished in the end = Morality Tale (some good prevails)
>
> Good and bad characters get into conflict, they endure their suffering, while nothing is improved for them = Tragedy (no greater good)
>
> Bad character gets into conflict with others, doesn't much benefit, while nothing else is improved = Anti-Hero (no good prevails)

Sage Literature, in imitation, concretely offers five models available for academic History. (Anti-Hero narration is seldom used in History, instead appearing as dystopian fictionalization.) Sage Literature in its historical genre, like philosophical Sage Literature, includes uneven mixtures of proto-social theory, proto-theology, proto-political theory, and proto-natural history. That is why initial examples of historiography produced by scholarly communities from Egypt and Greece to India and China utilize structures conducive to historical functions. If there is a story to tell, make sure to tell a truly interesting story.

Five models were hence available from the start of academic history:

narrative type:	**Mythic**	**Heroic**	**Politic**	**Ethic**	**Tragic**
The *telos* or purpose:	Universal design organizes all time so that current events are pre-figured by the past.	Individual agency decides and controls the ongoing course of events into the future.	Particular engagements among powers (nations, empires, etc.) serve as lessons.	Exemplary episodes illustrate how righteousness illuminates an era's spirit.	General cycles of climatic events arise from inevitable antagonisms that convulse each era.
Model of academic History:	"epic" history	"providential" history	"pragmatic" history	"moralistic" history	"progressive" history

With the subsequent emergence of academic History, its extraction of history as more factual (thus disciplining the mythic, epic, heroic, and hagiographic), the remaining modes for literary narrative were more dramatic: Romance, Tragedy, Comedy, Satire. That factual/dramatic distinction never vanished, explaining why history lends itself so easily to openly fictionalized history and literature leaves plenty of room for historically dramatized fiction.

The distinction between fictive narration and descriptive narration widens on the way to academic History. Narration (bearing the basic schema of "agent(s) did deed(s) to other(s) with result(s)") is the heart of historical accounts. Scholarly historical writing at minimum includes narration – scholarly history can also choose to compose new texts with *narrativization* as well: the representation of historical events and periods in terms of a structured story line.

The alternatives for academic history besides narrativization are mainly *exposition* (more descriptive than evaluative) or *explication* (for connected intelligibility over amassed details). The drawbacks to narrativization are well-known, due to permissiveness granted to the historian for reverting back to epic / providential / pragmatic / moralistic / progressive and even romantic tropes, as seen with such examples as "Manifest Destiny history," "Dialectical history," "Whiggish history," "Great Man history," "Revisionist history," "The Peoples' history," and so on. Academic history takes the risk of uncritically supporting ethical, mythical, and ideological agendas when the literary structure of narrativization dominates. All the same, academic history at its most objective also remains irreducibly orthological: history has value for humans, history is a human project as part of culture for its value, and history done rightly retains lasting value.

The 'History' of History

"The one duty we owe to history is to rewrite it."
– Oscar Wilde, The Critic as Artist (1891)

To understand the materials that a disciplined history can access and evaluate, a brief "history of history" is required.

After writing was adopted in a civilization, a society's scribes are able to record events – with reports, accounts, annals, chronicles – of what has happened and what is happening. Under the scrutiny of teachers and administrators, no scribe was personally choosing what to record or how to record it. During the Bronze Age and early Iron Age, the notion of a rogue scribe trying to record events over years and decades from an private perspective isolated from power centers was literally unthinkable as well as practically impossible. Before the invention of academic discourse and independent groups of scholars, everything of historical merit meets the needs and values of those in authority.

At the direction of the ruling administration (kingly/priestly overseers) scribes may be able to attain a scholarly level of historical narrative, attempting chronological consistency and narration coherence among many sources. That degree of accuracy could be appreciated by those in power for internal consultation, resulting in official secret archives. However, before the emergence of historiography among a culture's scholars, anything recorded by scribes that reaches public view will typically have the approval (or at least toleration) of those in power. The "historical" account presented to external view will be legendary, mythical, and ideological to some degree or another. If not quite "propaganda" in a full sense, history as represented will be favorable to those in power (and unfavorable history will get revised or erased).

Not until Herodotus's *Histories* in Greece (c.440 BC) and Sima Qian's *Records of the Grand Historian* in China (c.100 BC) could a scholar achieve academic historiography with some degree of independence from government control. Of course, independence does not imply neutrality; any historian may incorporate their own political partisanship. Even Thucydides and Polybius relied on their political connections and prejudices. However, academic historiography is far more realistic than any legendary history. Myth, miracle, and legend now plays a minimal role; leaders great and small have their faults and foibles; and investigative access to events, sources, and archives has top priority.

Legendary History does not attain the academic level of historiography. Legends, replete with mythic and miraculous events, provide idealizations and fictionalizations of whatever has been long-recalled from past eras. Authorities about the past are trusted and themselves polished up for idolization. Narration is crafted around what is now memorable and mesmerizing: what the masses *would* and *should* believe. Legendary history is not just about "deception" because the difference between historical truth and falsity had to await the academic disciplines. However, legendary history typically did have to be about "legitimization" – attestations to the justified ruling status held by current authorities over political, religious, and cultural life. For example, Bronze Age historical texts often revolve around continuous lineages: ruling leadership inherited from earlier rulers back through founding dynasties and maybe to the first gods; religious leadership passed from the earliest holy men down through succeeding generations of holy men; and cultural leadership bestowed from deified inventors bestowing the customs and crafts for society. Any disruption or break to that "official" lineage also required legitimization: usurping kings needed a manufactured genealogy or godly approval; reforming priests composed emendations and additions to scriptures; newly wealthy classes invented beneficent legends to soothe distrust towards social innovations.

Historical writings – revealing an heightened awareness of the difference between the past, present, and the future – were so mythically-oriented because they competed with the oral culture in which that literacy was immersed. Pre-literate societies surely had a robust historical sensibility, on display on the oral preservation of traditional lore, tales, and myths. The past had to be supremely important, since that was where the entire culture's knowledge-base and legacy resided. Writing profoundly altered that sensibility, since someone reading a text dated from the past may be hearing something that no one at present could or would say. After writing becomes established, reliance on oral narrative lessens; people still want spoken performances from a text, hearing something they no longer bother to recall themselves.

A literate society has a different historical sensibility than an oral culture; the past is more about what has been recorded by the few rather than what can be recalled by the many. Oral cultures have their common histories without an interest in *historicity*: preserving impersonal information for the future that may never be personally memorable. A pre-literate society cannot imagine how future members will be interested in the past, other than knowing just what is known now they way it is known now. After all, for an oral culture, the not-yet-born could only possibly know what they are directly told. The notion that future people could know the past differently from how it is known now could not enter anyone's mind. This is a matter of "first order" social intentionality: what we know now must be what anybody at any time knows. By contrast, a literate society (or at least a literate class within an ancient society) can understand – with "second order" social intentionality – how future readers could and should have somewhat different knowledge (and perhaps better knowledge) of the past than is available at present.

After a scholarly class emerges, so too does the opportunity to assist the future's understanding of the past and present, with a sense of *historicality*: the "third order" social intentionality able to promote (and manipulate) how the future comprehends its past. This opportunity for historicality could go unfulfilled. What counts as "history" could be held static, or manufactured. Static history is the result of a fairly secure ruling class. A ruling class determined to uphold its everlasting legitimacy (Egypt, Mesopotamia, India, eg.) may control history so tightly that hardly any historical accounts get produced and preserved, for century after century. The few historical texts which are permitted – approved myths, legends, genealogies, ruler lists, annals, and chronicles – hardly alter except to tack current rulers on the end. Except for origin stories about primal god-human interactions, nothing of the course of human history is remarkable except for its stability, so those societies do not seem historically minded. On the other hand, manufactured history is the result of an insecure or out-of-power ruling class offering wish-fulfillment as the true history.

Disciplined History and Objective Historiography

After academia is added to a society's institutions then "fourth order" social intentionality arrives, permitting the methodical inquiries of *historiography*. The disciplines encourage intellectuals to view current society in terms of the judgments, negative and positive, likely passed by wiser future societies.

History is never uncontentious. Harmonization is more easily attainable through imaginative mythicality rather than tedious accuracy with a rational chronology. In a scribal society, it becomes apparent how what gets *recorded* and what has been *remembered* could come into conflict more easily than coincide. The evident solution, to only permit the recording of time-honored and customary tales and accounts, characterizes the first writing civilizations. As for fresh events worth broadcasting and commemorating, such as royal achievements, they were composed to reinforce consistency with the past. Rulers knowing how they would soon join the great ancestors wanted to be remembered as worthy alongside them. Ancient kings sometimes built their own tombs complete with laudatory obituaries. Innovation and independence (much less impartial accuracy) in historical writing would have amounted to treachery.

The Egyptologist Jan Assmann has pointed out how some societies replete with scholars try to resist historicity, deliberately avoiding opportunities to revise their understandings of the past, and hence of the present. They fail to produce many historical texts beyond official inscriptions and half-fictional legends, and nothing academic is able to congeal around the missing goal of upgrading accurate knowledge of the past.

There could be no academic discipline of History without a methodology for objectivity, alongside its ontology and its orthology. The quest for methodological objectivity never rests for any of the disciplines, and especially for History. Where might reasonable objectivity be grounded, other than the nature of "the historical" itself? The discipline of History cognizes what is already *historical*, in two senses: (a) historical as something humanly artifactual dating from its own past, relative to the present historian's present time; and (b) historical as something symbolically crafted as a lasting record (e.g. a tale or a text), in resistance to memory's inherent erosion from time. History does not create or sustain the historical; the historical is the fertilized soil from which history as an intellectual enterprise can grow. Worthy history does join the ground of the historical to be absorbed in its fertility, and in that sense history assists the cumulative nature of the historical against the tides of time. Exploring how history can reasonably perform its proper work is the academic task of historiography. This explains why we can simultaneously conceived of the *past* as incremental but unchanging, *history* as accumulative and altering, and *historiography* as developmental or sometimes revolutionary.

Questions about the objectivity of history ultimately deal with matters of (a) knowledge accumulation; (b) event temporality; and (c) historian creativity.

The question of knowledgeable objectivity for history is bound up with its capacity for accumulative history, rather than just replacement history. If history amounts to a wholesale replacement of one version of a past with another version, then the question of historical priority must arise. Thus, "How can present-day historians avoid imposing their own conceptual/categorical frameworks of comprehension upon the historical understandings recorded from the past?" That question should be promptly matched by its rival: "Given the historical nature of past recordings, how could present-day historians avoid the imposition of past ideas and views upon their own contemporary comprehensions?" Both questions are premised upon a fallacious silent presumptions, that history is a "zero-sum game" of rivalry for a singular a-historical "truth". Historical literature doesn't make that assumption, nor should academic history. The admission of *fallibility* for historical knowledge is more reasonable, considering its empirical aspirations, but that is no admission of wholesale *relativity*. The reality of history is such that a later history can provide an exposition of an earlier period of time that its own inhabitants couldn't, but a contemporaneous account no matter how remote in time provides a view of matters that no later history could possibly relate or replace by itself. The inherent continuity and cumulativity of history itself reveals the mutual dependency of humanity's past and present, which of course is the entire point and telos of history to begin with.

The second concern about temporality follows upon our observations about cumulativity. History's focus on events is already embedded in the durational nature of any recording of events. To say, "Event E began in 1648..." is to already being saying that this event has been underway and a tentative ending is anticipated, or perhaps foreseen, or has already reached a culmination. To note a beginning is to already be prospective about its ending. An *historical* consciousness thinks about the past, staying embedded within that past-present-future course of continually enmeshed events, like anything organically alive. The mentality of *historicality* demands more from cognition and deep memory for the enterprise of recording events for posterity. That mentality is fully aware that any ongoing event is on its way to becoming past, that its precise duration is less important than its durable import, and that their future significance isn't quite known. This historicality is unlike the interest in the past taken by mathematized science. Natural science treats time as a mathematical variable composed of finite non-overlapping measures, down to practically instantaneous moments that remain alignable "end-to-end". That mode of temporality is unknown to the biological and phenomenological world. Life as lived only undergoes overlapping and interfusing durations where "starts" and "ends" are but relative intensities only relevant to the fluctuating densities of ongoing contexts.

The durational nature of temporality for history, and that embeddedness of the historical recorder, means that recorded events are always perdurational as well: they bear their significance due to relations with surrounding contexts that include their recorder (how else would be a recorder become aware of it?). However, those contexts are durational too, not indefinitely durable or unchanging. Heraclitus (fl.500 BCE) reported said something like, "No man ever steps in the same river twice, for it's not the same river and he's not the same man." Overlooking or omitting that perdurability, which is far from momentarity or eternality, would permit an academic to suppose that History aims towards the ideal of the perfect knower of history. R.G. Collingwood sets forward the mythic figure of Thoth, the Egyptian god of memory and knowledge. Does history legitimate its objectivity aspirations by upholding a principled idealization like Thoth to justify its methodology for attaining truth? Perhaps the "perfect" historical knower would

possess the complete book of factual events in their precise series. However, even if such knowledge could exist for divinity, that knowledge could not be history, for it is not intrinsically historical itself. No perfected series of accounts for events is possible: later accounts of an event would differ from earlier accounts, because any later context modifies the perdurability of that event's significance. In short, what an event is essentially depends on later selective contexts as well as contemporaneous contexts.

For example, what was stirring in Boston and Philadelphia during the summer of 1776: was it either the "Colonial Rebellion" or the "American Revolution"? During 1776 both "descriptions" are equally prescriptive: a British loyalist could only recognize a mere rebellion, while a colonial patriot could dimly perceive a successful revolution (only the losing side stages a "rebellion"). Only at the "end of all time" could a "final" accounting of all events be even thinkable, but that accounting would not be *historical*, for history stands amidst the course of events midstream. Were Thoth embedded in time along with us, his series of narratives would be shifting and unstable, since his earlier accounts would be inadequate or false from the perspective of later accounts. Accumulatibility is actually essential for historical objectivity, not perfectibility. Human history, and human historians, can learn nothing methodological from that idealized trans-historical standpoint: whatever a god would care to describe informationally about the world, it would be inchoate for human understanding and insensitive to human experience.

A third concern for the objectivity of history is the issue of creativity. All historical literature must be creative. The rush of ongoing events for participants and observers does not stream by in convenient blocks of tidy facts. Anyone merely recounting "the obvious facts" has already mediated events through sensibility and memory. To convey anything meaningful for future appreciation, the capacities of receptivity, selectivity, and articulation are engaged, so any "on the scene" reporter is already a creative recorder and narrator. This is even more true of anyone conveying past histories in digested and edited formats on to future readers. Yet to point out how all historical writing from the most legendary to the most academic must be inherently creative writing (that is why each historian is an *author* in a humanities field), that cannot automatically mean that all history is inventive fiction, or largely just subjective construction. Methodology matters in an academic history, and not all methods are the same.

Academic History

> Everybody knows that the first law of history is not daring to say anything false; that the second is daring to say everything that is true; that there should be no suggestion of partiality, none of animosity when you write.
> Cicero, *De Oratore*, trans. J. May and J. Wisse (Oxford 2001), p. 139-140.

Unlike historical Sage Literature, academic History is essentially *critical* history that prioritizes methodologies oriented towards cumulative truth. "History" comes from the Greek word for "inquiry" into actual matters leaving evidence for an inquirer to look into. An honest inquirer into the life and death of Julius Caesar, for example, must be guided by empirical sources having then-contemporary or near-contemporary perspectives. Unless a historian is content with just composing legendary epic or courtly annals, blind credulity towards sources cannot be appropriate.

Selectivity is necessary for the organization of *empirical* history, but that is still a low standard to meet. Exemplars of far-from-scientific history are historians composing an entertaining tale (the dramatic historian), a morality lesson (the hagiographical historian), or a vindication epic (the ideological historian).

If academic History gets somewhat undisciplined, it degenerates back towards mythic, epic, tragic (etc.) modes of narration, but those sorts of "pseudo-histories" supply a steady stream of popular historical literature. Another undisciplined fate occurs if History allows another academic discipline (e.g. philosophy, social theory, theology, political theory, science) to dictate its telos, so that History becomes constricted by mantras such as, "All history is basically the history of reason itself," or "All history is just the history of social groups," or "All history should only be providential history," or "All history is just ideological history," or "All history could only be natural history." Disciplined History accepts consultations from other disciplines without getting coopted by their quite different objectives.

Disciplined history undertakes its own methodological inquiries structured by selected context and singular chronology. For the *investigative* historian, sources are indispensable but not infallible or unchallengeable. Records from sources offer viewpoints upon their topics (they are not entirely subjective), so higher objectivity lies in the collection and colligation of many source records and available material traces. The historian develops a theory, revolving around a proposition such as "Rome's civic instabilities were behind Caesar's dictatorship and swift assassination," that may be tested against further information. Rational constraints sharply limit any inventiveness. The investigative historian expects consistency among candidate facts, interpolates the meanings of information for context and maximal coherence, and imposes a single chronological dimension for arranging sequential events. The historical researcher cannot accept another historian's account of the same period as definitive or authoritative. No research is free from a researcher's priorities and prejudices. That is why interpretations offered by rival histories merit consideration, and convergences among many histories in the long run are welcome. The *scientific* historian refines investigations further, heeding the naturalistic worldview and consulting allied fields about past matters, such as literature, antiquarian forensics, paleography, and archaeology.

"Rome's civic instabilities around 46-44 BCE" can play a theoretical role akin to the status of any unobservable entity such "the nation's inflation rate," "the nucleic proton" or "the galactic center's black hole." Only their effects could be observable, and a reasonable conception for any of them emphasizes properties/powers responsible for distinctively observable effects. The observable effects from matters of the far past, the dispersed macro-scale, the sub-microscopic scale, or the permanently obscured are themselves objects of potential examination, and hence their non-observed causes can be reasonably conjectured and possibly validated. The inferential process of abduction plays the central role here, with postulations about "not-yet observed" and "won't-be observed" matters. Explanatory abduction never functions alone. Patterns displayed by initial observed effects (the first induction phase) inspire the postulation of some hidden entity responsible for those effects (the abduction phase), and then increasing that entity's credibility requires the prediction of further specified effects due to just that entity (the deductive phase) which are hopefully observed as predicted from further trial and testing (the second inductive phase).

The historian's research into the plausibility of a postulated explanation – "Roman civic instabilities" led to "Caesar's assassination" – follows this basic abductive process if it aspires to reasonable plausibility. Continued investigations searching for additional information about that Roman era, along with enhanced consistence, coherence, and chronology, respects what is inherently human about values and judgments embodied in records, while also respecting criteria of rationality. In this manner, investigative and scientific history can be undertaken and accomplished, although each history is one historian's accomplishment. Discovering the more plausible accounts about historical events and time periods is a kind of exploratory inquiry into the unknown, not unlike the way that education in the history of one's own locale or even the whole world can be fruitfully conducted.

History, Philosophy, and Science

History and science have been set against each other, with very different goals, methods, and assumptions. Are there features of science too incongruent with the historical and the human? To segregate science apart, one may start by claiming that scientific fields are not inherently chronological in their pursuit of knowledge about matters that lack histories. This criterion demotes the life sciences from fully scientific status, since organisms are what they are due to their origins and pasts. Yet, the life sciences are not so unlike other sciences. All empirical disciplines and sciences investigate events having durations and postulate sequential connections among them. Marginalized life sciences have plenty of company. Natural sciences such as astronomy and geology, along with paleontology and archaeology, would get demoted too, due to their historical subject matters. Furthermore, because all scientific knowledge must fit within a unitary cosmos and its singular chronology, all sciences have a chronological dimension. Science is predictive, but understanding the past comes first.

The notion that natural science avoids chronology is due to physics, or rather to a philosophical stance that the mission of physics is paradigmatic for all genuine science. Only physics seeks forces and laws applying universally to all events anywhere in nature. Physics borrows the mathematical notion of a "timeless" equation, inserts metrical time as one variable, and generates the "eternal" natural law (formula with all terms already metrical too) that has in itself neither being, becoming, or ending (since time is included within that formula). However, that universality to a lawful formula for a fundamental energy (a force, a field, etc.) is an illusion. Physics (rather, philosophy of physics) simply

asserts without proof that a general law about a force or field applies everywhere cosmologically to an evolving cosmos without undergoing any temporal change itself. The applicability of a physics formula to the cosmos may itself be an event, although one of vastly prolonged duration. In any case, even if physics can regard as negligible any cosmological drift to its natural laws, such atemporality does not apply at earthly and organic scales. The rest of the sciences are inherently chronological, especially the life sciences, and so their models for human sciences such as psychology and sociology are not the less scientific for being historical.

That philosophical privileging for physics introduces a third attempt to sharply segregate science apart from the study of humanity. It is oft-said that science discovers general laws about natural kinds. Earth sciences and life sciences manage to meet this physicalist standard, such as geology's theories about feature formation or biology's theories about species evolution. These fields examine patterns of events as they regularly happened in past history, but history as a discipline studies particular non-repeating events of interest to humans. Does human history only inquire into unique events, without generalizations or regularities to structure its explanatory accounts? History does specialize in the investigation of uniquely interesting events, without question. All the same, history is a broad discipline that is more than capable of bordering on social theory and its interest in regularities displayed by mass behavior. History is hardly forbidden from examining patterns to historical events, for the purposes of generalizing and formulating regularities as explanations. Where on this continuum of questioning does history halt?

"Why did Brutus help to stab Julius Caesar to death on the Ides of March?"
"Why did some of Rome's key senators assassinate their own militaristic consul?"
"Why do political elites of a growing empire eliminate its popular commander?"
"How does an aristocratic coup against a populist dictator further destabilize a nation?"
"When do destabilized countries suffer revolutions arranged by wealthy elites?"

There are few nomological "laws" for human actions, since humans keep in view an understanding of their past partly in order to selectively choose to do things similarly or differently from that past. Human behavior is always interpretative. Animal behavior is more amenable to patterned regularities across a lifetime, individually and collectively, because memory is far more immediate, or instinctive.

Investigative history joins the Human Sciences, which remain more historical than scientific in a double sense: they focus on the study the natural history of human *existence*, as well as the cultural histories of humanity's *experience*. History's vision, like any of the human sciences, observes more than just the eventful and the epic, able to perceive the episodic too. A historical science is one in which chronology supplies a key constraint on both hypothesis plausibility and testing. Any developmental or evolutionary account of how things come to be, and have become the way they are, is historical. Chemistry is historical in this minimal sense. Understanding the course of chemical reactions is historical, such as sequencings of analysis or synthesis (bond breaking, or forming). The scientific goal is to understand the conditions under which a chemical reaction will proceed this way or that, depending on various controllable conditions.

The "Chronological Constraint" is the reason for theoretical cognizance of particularity. They are united by "the event" which by definition has a particularity and a situational placement among other events (before, during, after). Events are processes however – temporality forbids easy atomizing, unlike spatial proximity or co-extensiveness. In physics, two events that are entirely co-extensive must be the same event. In history, two events that overlap in spatiality are probably not the identical event. The same situation can be the locale for an indefinite number of events.

Scientific socio-history, by projecting regular trends in order to make testable predictions about past and future social developments, becomes cliodynamics. Cliodynamics illustrates how history and sociology can be combined for an inter-discipline on a scientific basis. The principles of cliodynamics rest on the way that any developmental patterns or regularities pertaining to historical eras are themselves eventful as well, rather than floating transcendentally above worldly events. With the advent of big data, large datasets about past facts and events can be assayed to empirically test hypothesis about socio-historical matters. Cliodynamics is also enjoying a measure of success where political economy had been trying to forecast large-scale market and financial patterns over decades or even centuries. World systems theory will benefit from cliodynamics in the search for patterns and trends on international and global scales.

Historical Sciences

Many of the Human Sciences also have to be historical sciences, because they must include origins, developments, heritages, courses, careers, and similarly temporal matters. A sampling of fields gets organized as follows:

Mode Three. Empirical but not exploratory or experimental.
Scientific History, Ethnic Studies, Global Studies, Political Science, Human Geography, Musicology, Philology, Antiquities Authentication, Art Authentication

Mode Six. Empirical and exploratory, but not strictly experimental.
Digital Forensics, Forensic Criminology, Forensic Anthropology, Forensic Authentication, Abnormal Psychology, Moral Psychology, Psychiatry.

Mode Seven. Exploratory and modestly predictive, but experimentation goes little farther than events naturally or socially provided.
Natural History: Geography, Ecology, Botany, Zoology
Human Sciences: Biology, Social Psychology, Sociology, Demographics, Cliodynamics, Linguistics, Science of Religion, Anthropology, Epidemiology, Economics.

Research methods in the social sciences, life sciences, and medicine are utilizing databases for computing analysis. These are to be classified among Mode Seven human and historical sciences, because this methodology is only exploratory, sifting data already discovered from Mode Four, Five, Eight, or Nine sciences, rather than being experimental themselves.

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