

Commentary Traditions and the Evolution of Premodern Religious and Philosophical Systems: A Cross-Cultural Model

Steve Farmer,^{*} John B. Henderson,[†] and Peter Robinson

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^{*} Steve Farmer, Ph.D., Portola Valley/Palo Alto, California; saf@safarmer.com.

[†] John B. Henderson, Ph.D., East Asian Studies, Department of History, Louisiana State University, Baton Rouge, LA 70803; jbhende@lsu.edu.

Peter Robinson, Recom Technologies, NASA-Ames Research Center; robinson@ptolemy.arc.nasa.gov.

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Abstract

Parallels in the rise and fall of religious and philosophical traditions are highlighted when those traditions are studied cross-culturally. In literate old-world societies, those parallels included near simultaneities in the initial emergence of abstract theology and philosophy in the mid-first millennium BCE and striking similarities in the patterns of growth and decline in cosmological traditions from late-classical to early-modern times. This paper introduces a general model to explain these parallels, integrating cross-cultural data with abstract representations of nonlinear dissipative systems. One novel feature of our model is its ability to be implemented in a series of simple computer simulations. In brief, we argue that parallels in the growth of premodern religious and philosophical systems were byproducts of cultural invariances in commentary traditions. The most important of these invariances involved the methods used by premodern commentators to reconcile highly stratified textual canons. In our model, biologically innate modes of analogical thought, embodied in the earliest canonical texts, are transformed by the repeated application to later traditions of a small set of exegetical techniques. The iterative application of the same techniques in successive layers of tradition, combined with a variety of dissipative forces involved in textual transmission, resulted in the growth of religious and philosophical systems exhibiting emergent self-similar properties. Classical examples show up in the complex mirroring systems of so-called Neo-Confucian and Neo-Platonic traditions and in closely related Daoist, Buddhist, Hindu, Islamic, Jewish, and Christian scholastic thought. The fact that similar emergent structures can be identified in the literate remains of pre-Columbian Mesoamerican traditions suggests the universal applicability of our model. Rates and reliability of textual information flows serve as tuning parameters in our model; changes in such variables are used to model the impact of changing technological and historical conditions on the growth of correlative religious and philosophical systems. We argue that the rapid development of abstract thought that occurred in the Mediterranean, India, and China in the mid-first millennium BCE was linked to expanded use in that period of lightweight writing materials (supplemented, in the case of India, by the development of elaborate oral mnemonics that emerged in part in reaction to that growth). We argue that the rapid decline of high-correlative systems in later stages of the Eastern and Western printing revolutions can be modeled using the theory of self-organized criticality (SOC), which envisions the collapse of self-similar systems as they approach maximal levels of complexity and systematic integrity. We conclude by discussing protocols for our computer simulations and our model's teaching and research applications.

^{*} Steve Farmer, Ph.D., Portola Valley/Palo Alto, California; saf@safarmer.com.

[†] John B. Henderson, Ph.D., East Asian Studies, Department of History, Louisiana State University, Baton Rouge, LA 70803; jbhende@lsu.edu.

Peter Robinson, Recom Technologies, NASA-Ames Research Center; robinson@ptolemy.arc.nasa.gov.

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This working paper was originally given at the **Kolloquium zu historischen und methodologischen Aspekten der Kommentierung von Text**, held at the University of Heidelberg on 4-6 July 1997. Minor revisions were added in 2000 and 2001. The suggestion that computer models can simulate the growth and decline of premodern religious and philosophical systems may be the ultimate heresy in an historical field in which theory of any sort is viewed with distrust. We want to emphasize that the model developed in this paper is heuristic in nature; its object is to encourage new approaches to premodern thought, not to replace traditional textual research. Whatever the value of our initial simulations, we are confident that models of the general class discussed below will become standard tools in premodern studies in the coming decades. Please address comments on this paper to saf@safarmer.com.

0.1 Theoretical Framework

This paper describes a general model of the rise and fall of premodern religious and philosophical systems—or, more precisely, those parts of a general model pertinent to literate traditions.¹ One of its novel features is its ability to be implemented in a series of simple but potentially powerful computer simulations. The model originally arose out of textual studies of European and Chinese cosmological traditions, but its ideas are supported as well by data from premodern India, Southeast Asia, the Middle East, and pre- and early-colonial Mesoamerica.² The Mesoamerican evidence is especially critical, since it suggests that the parallels treated in the model are not artifacts of direct cross-influences in Eurasian thought.

The model depends on a critical feature of manuscript traditions: processes of transmitting and commenting on those traditions, repeated over long periods, tended to transform their structures in predictable ways. The parallels discussed in this paper can be pictured as byproducts of two such mechanisms: dissipative or entropic processes (the result of linguistic drift, textual losses, scribal errors, and similar forces) that drained unique information *out* of those traditions, and repetitive commentarial or scholasticizing processes that simultaneously pumped stereotypical information *into* them. These two processes, modified by periodic classical revivals or textual “purist” movements, which tended to oppose both of them, provide the abstract engine that drives our model.

¹ Neurobiological and preliterate grounds of the model are discussed in a book in progress. For preliminary discussion, see S. A. Farmer, *Syncretism in the West: Pico's 900 Theses (1486): The Evolution of Traditional Religious and Philosophical Systems* (Tempe, Arizona, 1998 [1999]), esp. pp. 91–96. See <http://www.safarmer.com/pico/>. See also now Steve Farmer, John Henderson, and Michael Witzel, “Neurobiology, Layered Texts, and Correlative Cosmologies: A Cross-Cultural Framework for Premodern history,” *Bulletin of the Museum of Far Eastern Antiquities* (2002). A reprint can be downloaded from <http://www.safarmer.com/neuro-correlative.pdf>.

² For some of the textual evidence on which the model is based, see Farmer, *Syncretism in the West*; John B. Henderson, *The Development and Decline of Chinese Cosmology* (New York, 1984); Henderson, *Scripture, Canon, and Commentary: A Comparison of Confucian and Western Exegesis* (Princeton, 1991); Henderson, *The Construction of Orthodoxy and Heresy: Neo-Confucian, Islamic, Jewish, and Early Christian Patterns* (Albany, 1998).

Despite its simple dynamics, the model is capable of simulating the growth and collapse of a number of key features of mature premodern traditions—including the emergent growth of nested hierarchies, complex systems of correspondence, and the general property that all parts of reality mirror all others (for one graphic example, see **Figure 1** on page 15). Adopting terms first used in Chinese studies, we refer to these mirroring structures as “correlative systems” or “correlative cosmologies.” The development of these systems can be traced through hundreds of years of so-called Neo-Platonic and Neo-Confucian traditions and in a broad range of Jewish, Buddhist, Christian, Islamic, and Hindu scholastic sources. Elaborate correlative systems can also be identified in the literate remains of pre-Columbian Mesoamerica, in which hints survive of the long-range operation of commentarial processes.

Interest in parallel growths in Eurasian thought has increased in recent decades, but to date most studies have stopped at the descriptive level.³ Our original studies of commentarial processes arose from attempts to understand the dynamic processes driving those parallels. Much of our research has focused on the methods commentators used to reconcile or “syncretize” traditions, since the most elaborate correlative systems arose in epochs in which information flows were accelerating and pressures to harmonize traditions were intense.

Our earliest cross-cultural model was exclusively verbal in nature. The model focused on how the syncretic methods of premodern commentators promoted the growth of correlative systems throughout Eurasia. (A table of such methods and their systematic effects is found in **Appendix A**, on pages 30-31.) Our attempts to translate our model into computational terms began recently, after we discovered similarities in the dynamics of our model and those involved in evolutionary processes in other fields. (For one algorithm used in our simulations, accompanied by a flow chart, see **Appendices B** and **C**, on pages, on page 32-3).

Mirroring or reflecting properties of the sort found in correlative systems are known to mathematicians as self-similar structures, or “fractals.” The emergence of self-similarities in any evolving system often suggests that the growth of that system can be modeled using the tools of nonlinear dynamics—a collection of closely related fields including fractal geometry, chaos theory, and the theory of complex or self-organizing systems. The use of these tools is most clearly indicated when fractal or self-similar growths arise from the joint action of dissipative and recursive processes—precisely the conditions that we discovered on the historical plane.

In the last twenty years, the models of nonlinear dynamics have allowed researchers to simulate a wide range of phenomena that were previously impervious to mathematical analysis, including developments in the social and cultural sciences. For reasons discussed at the end of our paper, one class of nonlinear models, involving

³ Early interest in these parallels showed up in George Sarton’s seminal studies in the 1920s of premodern scientific traditions in Eurasia. For more recent examples, see, e.g., Hajime Nakamura, *A Comparative History of Ideas* (London and New York, 1986), and the papers collected in José Ignacio Cabezón, ed., *Scholasticism: Cross-Cultural and Comparative Perspectives* (Albany, 1998).

self-organized criticality or SOC, allows the simulation of not only the growth but the collapse as well of correlative systems—a key feature in the shift from premodern to modern thought.⁴

The claim that computer models can simulate *anything* of interest in religious and philosophical traditions breaks with conventional views of the history of ideas. Nevertheless, the grounds of that claim are remarkably intuitive. Manuscript traditions were not handed on passively, as traditional textual scholars often imply, but were steadily transformed by commentarial processes. The most important of these processes aimed to free authoritative traditions from internal contradictions or to harmonize them with foreign traditions. Because the reconciliative methods of religious and philosophical commentators were similar worldwide (conditioned by neurobiological constraints), whenever rates of textual information flow were roughly comparable, structural growth in those traditions tended to evolve in similar ways as well. The result is that when two manuscript traditions of similar exegetical “depth” are set side by side, the systematic byproducts seen in each layer of those traditions show strong family resemblances. The longer those traditions develop, the more similar (and *self-similar*) their abstract byproducts tend to be, no matter how different their specific contents.

The most elaborate parallels of this sort show up in late-medieval thought, which in a sense summed up two thousand years of exegetical transformations. No Western medievalist would be likely to mistake a fourteenth-century scholastic text from Thailand or Tibet for an ancient treatise, no matter how unfamiliar that scholar was with the technical jargon of Thai or Tibetan scholasticism. The long chains of verbal distinctions, nested hierarchies, multilayered analogical structures, and elaborate systems of correspondences in the treatise would quickly give it away as a product of extended commentarial processes. Most Western scholars could guess the date of the text within a century or two, based on a knowledge of similar structures in a Scotus, or Dante, or similar figure.

What experienced scholars achieve “intuitively,” computer programs can achieve using formal means. A number of simple ways can be devised to compare the complexities of scholastic texts; relatively straightforward measures—counts of “scholastic distinctions” or levels in heaven and hell, or estimates of the degrees of contradiction and/or self-similarities in those texts—serve as markers of the exegetical efforts exerted in compiling the texts. When information flows remain constant, these complexities often correlate closely with the historical age of those traditions.⁵

⁴ For recent overviews of nonlinear dynamics, see, e.g., Garnett P. Williams, *Chaos Theory Tamed* (Washington, D.C., 1997) and Yaneer Bar-Yam, *The Dynamics of Complex Systems* (Reading, Massachusetts, 1997). Further on complex systems and self-organized criticality, see the papers collected in George A. Cowan, David Pines, and David Meltzer, eds., *Complexity: Metaphors, Models, and Reality* (Santa Fe, New Mexico, 1994). For other sources on SOC, see note 48.

⁵ On some general means of estimating complexity in evolving systems, see, e.g., Bar-Yam, *Dynamics of Complex Systems*, pp. 759-81.

Generalizing these views, our paper argues that a long series of parallel developments, beginning in the middle of the first millennium BCE, arose from the stereotypical ways in which manuscript traditions were compiled, transmitted, synthesized, and retransmitted by successive waves of theological and philosophical exegetes. Applying the concepts of nonlinear dynamics, it is possible to simulate transformational processes of this nature using relatively simple computer programs. The key to understanding how those simulations work lies in grasping the stratified ways in which canonical traditions tended to evolve.

Computer simulations of this sort have limitations as well as uses. Like models in the physical and biological sciences, they achieve their goals by emphasizing certain data at the expense of others. Our model suggests that whenever information flows in manuscript traditions rose and fell in similar ways, self-similar features in those traditions tended to develop in predictable patterns. But the model doesn't claim to capture all salient features in those traditions, nor can it predict the appearance of unique elements in them due to the influence of single writers. The model provides a useful cross-cultural framework for studying manuscript traditions, but it cannot replace traditional textual research.

Writing on the limitations as well as uses of nonlinear models, Bar-Yam comments: "A study of universal principles does not replace detailed description of particular complex systems. However, universal principles and tools guide and simplify our inquiries into the study of specifics."⁶ Nonlinear models can help us picture the self-similar properties in waterfalls, in the rise and fall of stock prices, in the distribution of galaxies, or in the growth of premodern correlative or scholastic systems. But they tell us little about detailed elements in those phenomena—about the behavior of individual drops in the waterfall, the movements of single stocks, the positions of single galaxies in larger clusters, or the contents of individual scholastic systems. Conversely, the fact that our model "*only*" predicts the growth of typical features in premodern systems does not diminish its usefulness in providing a cross-cultural framework for studying traditional thought—which cannot emerge from the study of single systems. Whatever its limitations, the model can successfully predict the conditions under which systems *like* those of a Sankara, Thomas Aquinas, Zhu Xi, or similar writers can be expected to appear.

At a fundamental level, the relationship between models and empirical data is no different in the history of thought than in the physical and biological sciences. The common argument, going back to Dilthey, that history is unique in treating "particulars" and not "universals" is groundless, since even biographies and narrative history involve high-level modeling.

Bar-Yam's remark that studies of universal principles guide and simplify inquiries into the specifics of complex systems also applies to our work. Our model throws light on minute acts of textual exegesis whose historical significance is clearest when

⁶ *Dynamics of Complex Systems*, p. 2. For what follows, cf. pp. 788-89.

those acts are viewed cumulatively, through a wide-angle historical lens; investigated at close range, the exegetical (or “scholastic”) distinctions of premodern commentators may seem too trivial to demand serious attention. An analogy can be drawn to evolutionary biology, in which the accumulation of small mutations over long periods may lead almost imperceptibly to divergent life forms. Our model pictures similar small mutations arising in religious and philosophical traditions through the force of minute acts of textual exegesis; in this case, however, the general direction of change was not divergent but convergent; the piling up of those acts over long periods resulted in the growth of elaborate correlative systems whose self-similarities became increasingly evident by late traditional times in China, Southeast Asia, India, the Middle East, Europe, and elsewhere.

This paper argues that these parallels were not products of cross-cultural influences or imagined suprahistorical forces (Jungian archetypes and the like), but of mundane processes of transmission operative in all extended manuscript traditions. On this view, exegetical transformations that may seem trivial when viewed in single texts in the aggregate played a dominant role in the evolution of all the world’s “higher” traditions.

0.2 Overview of Detailed Argument

Our argument is divided into four parts:

1. *Parallel developments in premodern thought.* In our first section (1.1), we argue that a long chain of parallels, stretching from the mid-first millennium BCE to the seventeenth century CE, were byproducts of the inbred and stratified ways in which sacred or semi-sacred traditions evolved. On this view, each new layer of tradition, whether embodied in canonical texts or later commentaries, tended to transform the products of earlier strata in predictable ways.⁷ Our model links the speed of those transformations to rates of premodern information flows (section 1.2). While many factors affected those rates, the most lasting were tied to developments in literate technologies. Correlation between different stages of culture and the evolution of literate technologies—the emergence of writing, simplified scripts, scrolls and codices, paper, printing, and so on—have been intensely discussed in recent decades, prompted by the long series of revolutions in information technologies in our own era. Adding a new element to these discussions, we argue that near simultaneities in the first emergence of abstract philosophy and theology in the Mediterranean, India, and

⁷ The model of textual stratification sketched in our paper is related to, but broader in scope than, the “accretion theory” recently proposed by E. Bruce Brooks and A. Taeko Brooks, *The Original Analects: Sayings of Confucius and His Successors* (New York, 1997). The Brooks model focuses on accretional processes in early canonical sources like the Analects, but it does not focus on the systematic transformations that arose as byproducts of those processes—emerging, for example, from systematic attempts by later redactors to reconcile early strata of those canons with later ones. The analyses of Brooks and Brooks and a number of similar efforts—attempts to “destratify” the Daodejing, the Vedas, the so-called *Q* document (in New Testament studies), or various Platonic, Aristotelian, or Buddhist texts—ultimately evolved out of nineteenth-century attempts to distinguish textual strata in the Torah or Pentateuch.

China around 500 BCE were tied to a broad diffusion in that era of the use of lightweight writing materials.⁸ These materials provided the material preconditions for the growth of manuscript traditions and for the two thousand years of later systematic developments sketched in our paper.

2. *The commentarial engine.* Our second section (2.1) looks at the mechanisms driving those developments. In brief, we argue that these parallels arose from the repetitive application to sacred and semisacred traditions of a relatively small, and largely culturally invariant, series of commentarial techniques.⁹ From a systematic standpoint, the most important of those techniques were reconciliative in nature. These techniques were used by generation after generation of commentators to syncretize opposing or foreign traditions or to harmonize conflicting layers of canonical texts. This section of our paper illustrates how the same reconciliative methods generated different systematic structures when applied to different types of texts. Thus, when used to harmonize early canonical sources, the same reconciliative strategies could generate abstract pantheons of gods, monotheistic deities, or abstract ethical or cosmological principles, depending on the exact genres of texts being harmonized. In later traditions, typical products included dualistic or trinitarian concepts of deity, broad systems of correspondences, multileveled pictures of heaven or hell, elaborate emanational systems, and other diagnostic features of scholastic traditions. Over many centuries, higher-level integrations of structures like these gave birth to elaborate multilayered correlative systems—Neo-Platonic, Neo-Confucian, Buddhist, Hindu, Islamic, or Christian cosmologies, etc.—whose levels of self-similarity tended to increase whenever those traditions inbred and grew in complexity.

3. *Computer simulations of the growth and collapse of premodern systems.* Our third section (3.1) describes designs for our computer simulations, which draw on nonlinear models used in a variety of nonhistorical fields. Rates of information flow act as tuning parameters in our simulations; adjusting those rates allows us to test parts of our models that link those rates with the growth of correlative systems in the historical sphere. This section also discusses extensions of our model, applying the concepts of self-organized criticality (SOC), that simulate the *collapse* of correlative systems in late stages of the Chinese and European printing revolutions, when rates of information flow increased by several orders of magnitude above those seen in earlier centuries. This section thus suggests ways to link the emergence of more “open” thought systems typical of the modern period with the decline of the “bookish,” and relatively closed systems treated in our model.

4. *Summary and conclusions.* We add brief comments in our final section (4.1) on some implications of our work. So far as we know, ours is the first model of the evolution of religious or philosophical ideas capable of being implemented in

⁸ This argument was first developed in Farmer, *Syncretism in the West*, pp. 78-79, esp. note 52. On claims concerning developments in supposedly purely oral traditions in India, see note 12, below.

⁹ The cultural invariances of these techniques are traced in our broader model to neurobiological data; for preliminary discussion, see *Syncretism in the West*, pp. 91-96.

computer simulations. The principles behind those simulations are simple, and we anticipate that increasingly powerful models of their general class will be constructed in coming decades. The simplicity of those simulations does not prevent them from modeling the growth of complex historical phenomena. In general, the possibility of building such models confirms the view put forward twenty-five years ago in a famous paper by the mathematical biologist Robert May—that nonlinear models driven by simple iterative processes can simulate the behavior of very complex systems.¹⁰ Our paper ends by pointing to some practical uses of such simulations for research and teaching purposes.

1.1 Parallel Developments in Premodern Thought

Historians have paid increasing attention in the last decade to structural parallels in Eastern and Western intellectual traditions, building on a heritage in comparative studies reaching back to Leibniz.¹¹ These parallels show up in all literate religious and philosophical traditions, including those developing in Europe, the Middle East, India, Southeast Asia, China, and Mesoamerica. Paradoxically, near simultaneities in these developments are clearest in the two major old-world regions that had the least contact in premodern times—Europe and China. Since these parallels cannot be explained credibly by direct contacts (e.g., between near contemporaries like Confucius and the early pre-Socratics, or between Zhu Xi and Thomas Aquinas), we will place most of our stress in reviewing those developments on China and Europe. Adopting this approach, we minimize the chances that those parallels can be dismissed as artifacts of direct cross-cultural influences.

Those parallels stretched from the first canonization of sacred texts in the first millennium BCE to the decline of traditional thought starting two thousand years later. In this section we review five of these parallels, pointing to *prima facie* evidence that exegetical processes drove each of them. Discussion of specific commentarial methods is reserved for section 2.1; on this issue, see also **Appendix A**, on pp. 30-31.

1. *The emergence of the first textual canons.* The first parallel concerns the emergence of the earliest sacred canons in the Middle East, Greece, India, and China. This development can be dated from roughly 700-500 BCE (exact dating here is controversial, but is not critical for our purposes). These ancient canons provided the earliest, and often most sustained, objects of commentary throughout Eurasia, often extending into the modern era.

In Greece, the earliest religious canon consisted of the Homeric corpus and, to a lesser degree, writings ascribed to Hesiod or legendary poet-priests including Orpheus and Musaeus. In China, a similar role was played by early strata of the Analects and

¹⁰ Robert May, “Simple Mathematical Models with Very Complicated Dynamics,” *Nature* 261 (1976): 459-67.

¹¹ For Leibniz’s excursions in comparative history, see Gottfried Wilhelm Leibniz, *Writings on China*, trans. Daniel J. Cook and Henry Rosemont, Jr. (Chicago, 1994).

pre-Confucian layers of the Five Classics, most notably the Changes, Documents, and Songs. In India, analogous roles were served by the Vedas, whose dates are even more disputed than those of Homer or the Chinese classics (some Indologists push the composition of the Vedas back to an improbably early period). The end of the Vedic Age, however, is normally fixed around 600 or 500 BCE. Early Middle-Eastern canons or protocanons included parts of the Psalms and early strata of the Torah and Zoroastrian Avestas. Although dating here too is in dispute, widespread agreement exists that these sources reached early canonical forms, after long periods of preliterate gestation, in these same centuries. The Egyptian Book of the Coming Forth of Day, or so-called Book of the Dead, while not comprising a canon in the same sense as these other works, also found its first fixed form, including set chapter numbers, in these centuries.

The earliest canons in the Middle East, Greece, India, Southeast Asia, and China differed widely in their genres and specific contents. These differences have discouraged comparative analyses of these texts or have led to attempts to force-fit them into unitary molds, as exemplified by recent searches for “lost” Chinese epics. Despite their differences, all these canonical texts were characterized by later commentators in remarkably similar ways—most typically as being encyclopedic in nature and as somehow encompassing all knowledge and truth. These views led later commentators to tie their systems closely to these texts and to spend much energy trying to reconcile their contradictions.

Our model pictures the near simultaneity in the emergence of these canons as a byproduct of a rapid expansion in the mid-first millennium of the use of lightweight writing materials—papyrus or parchment in the Mediterranean, palm leaves and birch bark in India, and bamboo strips and silk in China. Lightweight writing materials provided the necessary foundations for manuscript traditions and for the systematic structures that were later built on those foundations. While direct intellectual contacts were rare in distant Eurasian civilizations and cannot explain most parallel developments, innovations in literate technology moved swiftly and could rapidly transform geographically isolated regions in similar ways. The fact that stratified manuscript traditions had their origins in roughly the same period everywhere in Eurasia helps explain why developments in these traditions kept more or less in sync over the next two thousand years.¹²

¹² Cf. Farmer, *Syncretism in the West*, pp. 78-79, esp. note 52. We cannot discuss in detail the hotly debated question of when Vedic sources first appeared in literate form; we plan to deal with this question in a future study. In brief, evidence supports the traditional view that oral transmission of canonical texts, backed by powerful mnemonic techniques, played a larger role in India than in most other ancient civilizations; nevertheless, extensive quotations from opposing textual schools in later layers of Vedic traditions (e.g., in the Vedic sutras, dating from the last half of the first millennium BCE), show that the frequent claim that the Vedas were not written down until well into the common era are exaggerated. While material evidence of writing in post-Harappan India does not begin until the mid-third century BCE, strong indirect evidence indicates that literacy began before the time of Panini, who can be dated between 500 BCE and 350 BCE. Evidence also suggests that the extreme mnemonic techniques used to fix texts in later Vedic times (use of Padapatha texts, etc.) may have first developed in reaction to expanding Persian literate influences during the early Achaemenid era in Northwest India

2. *Near simultaneities in the development of “abstract” thought.* The second parallel involves the simultaneous emergence of classical philosophy and theology in Greece, India, and China from around 550-300 BCE. Abstract theological developments in Hebrew thought also date from this era. In Greece, this period opens with the early pre-Socratics and closes with the emergence of the Platonic, Aristotelian, Epicurean, and Stoic schools. In China, the period starts with the oldest strata of the Analects and extends through the “hundred schools” to the time of Xunzi, who was born just after our terminal dates. In India—following for the moment traditional dating—the period begins with the “historical” Buddha and the Mahavira (reputed founder of Jainism) and closes with the redactors of the philosophical layers of the Upanishads and Vedic sutras. While Hebrew traditions did not generate abstract philosophical constructs of the sort found in Greece, India, or China, the first development of abstract monotheism appeared in this period in later strata of the Torah and related texts. As we point out shortly, this development can be traced to exegetical forces similar to those responsible for the initial growth of abstract philosophy in Greece, India, and China.

The temporal coincidences in this period are often quite remarkable, at least if we accept the traditional dates suggested in ancient sources. According to the most common variation of those dates, to cite one example, we find Confucius, Buddha, and Xenophanes (the first pre-Socratic for whom we have extended fragments) all dying in the same five-year period, 483-479 BCE! The fact that those dates, and even the historicity of these figures, often rests on shaky grounds¹³ does not diminish the

(late sixth century BCE). In China, limited use of bamboo strips for writing can be traced to the early Zhou dynasty, but evidence of extensive use of the material doesn't begin until the fourth century BCE—exactly the same period as the explosive growth of manuscript traditions in Greece and the Middle East. In Egypt, papyrus was available as far back as the third millennium BCE, but its export was restricted until the mid-first millennium—the first period in which extensive evidence exists of the use of lightweight writing materials elsewhere in the Middle East. For discussion of the latter evidence, including references to limited earlier uses of such materials, see Raymond P. Dougherty, “Writing Upon Parchment and Papyrus among the Babylonians and the Assyrians,” *Journal of the American Oriental Society* 48 (1928): 109–135. Internal commentaries in Egyptian sources can be identified as early as the mid-third millennium in the so-called pyramid texts, which apparently once existed in perishable as well as durable form; these internal commentaries continued in the coffin texts and Book of the Dead, allowing us to trace conceptual developments in Egyptian funereal texts for over two millennia. Systematic developments in these texts, which we plan to discuss elsewhere, provide strong confirmation of the general model discussed in this paper. The pan-Eurasian diffusion of lightweight writing materials in the mid-first millennium was closely related to pan-Eurasian political consolidations in this period—a topic that we also plan to discuss in a later place.

¹³ The recent tendency, in both Indian and Chinese scholarship, has been to push these dates significantly forward. Thus recently proposed dates for the “historical” Buddha (if such a figure ever existed), based in part on archaeological evidence, place him as late as the mid-fourth century. See Heinz Bechert, “The Date of the Buddha Reconsidered,” *Indologica Taurinensia* 10 (1981): 29-36, and the remarks in Patrick Olivelle, trans. and ed., *Upanisads* (New York, 1996), xxvi, note 23. Tendencies to push these dates *backwards* in ancient times were frequently the result of fierce competition between warring schools. Thus if Confucians claimed that their half-legendary founder died in 479 BCE, Chinese Buddhists were naturally inclined to put Buddha's death a few years earlier (e.g., 483 BCE) and the Daoists their mythical founder, Laozi, earlier still (e.g., 602 BCE). Leaving aside this traditional game of one-upmanship, there is no doubt that the temporal window within which classical philosophy began in Greece, India, and China was remarkably narrow—differing by less than a century in the two most distant Eurasian societies, Greece and China.

impression that powerful forces in this era were transforming thought in widely separated cultures in similar ways. Major differences in the *varieties* of “abstract thought” that emerged in this period suggest that these parallels could not have resulted from direct intellectual contacts, but must have arisen indirect mechanisms of some kind.

Classicists often treat premodern philosophers as “speculative” thinkers, encouraging purely phenomenological accounts of their thought—or what commonly passes for their thought.¹⁴ In contrast to these views, much evidence suggests that most of these thinkers were commentators of one sort or another on earlier canonical texts. The famous remark in *Analects* 7.1 that Confucius was a transmitter, not an innovator, and sections of the *Analects* commenting on the *Songs* and *Documents*, have recently been assigned to layers of the *Analects* postdating the “historical” Confucius by a half century; the terse sayings ascribed to Confucius in the text’s earliest strata appear to originate in a period of restricted literacy and not in the literate courtly traditions of later periods of the Warring States era.¹⁵ No matter whether or not we accept the literal existence of an “historical” Confucius, however, it is clear that by the last half of the fifth century the early compilers of the *Analects* were deeply involved in commentary on the text’s early strata and on pre-Confucian layers of the *Songs* and *Documents*. These exegetical concerns were to dominate intellectual developments in China for well over two thousand years.

The exegetical concerns of early Greek philosophers are less widely recognized than those of early Chinese thinkers; however, as Havelock argued back in the early 1960s, evidence shows that early Greek philosophy largely arose out of commentarial “integrations” of earlier Homeric myth.¹⁶ Occasionally, as in the case of the four-element theory, we can watch abstract thought arising directly from earlier mythic layers of thought.¹⁷ By the first half of the fifth century, much of pre-Socratic commentary had turned hostile towards older mythic canons—as illustrated in the sharp criticism hurled at Homer and Hesiod in fragments ascribed to Xenophanes or Heraclitus—but commentary it was nevertheless. Claims that the Homeric corpus was the repository of “everything knowable” remained strong, in fact, long after

¹⁴ These accounts are often accompanied by naïve views of the authorship of early philosophical texts, which commonly (as in the case of the *Analects*) turn out to be highly stratified works. As Karlgren argued about early Chinese texts, and Havelock about pre-Socratic documents, surviving fragments from this period were typically “worked up” abstractly in the much later documents in which these fragments survive—and hence do not faithfully represent the thought of the figures to whom they are attributed.

¹⁵ See Brooks and Brooks, *The Original Analects*.

¹⁶ E. Havelock, *Preface to Plato* (1963). On Havelock’s views of the links between Homeric exegesis and the evolution of the Platonic theory of Ideas, see pp. 21-2 below.

¹⁷ Thus the abstract four elements commonly ascribed to Empedocles show up in Empedocles frag. 6 as Hera, Zeus, Aidoneus, and Nestis—i.e., as *gods* of earth, air, fire, and water. Similar shifts from mythic to abstract forms show up in India in China—in the latter case, e.g., in the evolution of the abstract cosmological principle of *Tian* or “Heaven,” whose earliest pictograms were unambiguously anthropomorphic in form.

newer philosophical canons were challenging Homer's religious authority; thus well into the fourth century BCE, the author (or authors) of the Platonic *Ion* felt the need to attack the reciters and exegetes of Homer, who continued to portray the *Iliad* and *Odyssey* as the source of all human wisdom; ironically, the late-ancient commentators who allegorically "read back" philosophical ideas into Homer were helped by the fact that many of those ideas originally developed in earlier Homeric exegeses.

Similar developments were simultaneously taking place outside China and Greece. Indologists commonly affirm that exegetical transformations of early Vedic hymns lay at the roots of abstract philosophy in India. This view can be supported by much textual evidence in later strata of the *Brahmanas* (the earliest Vedic commentaries) and the philosophical layers of the *Aranyakas*, *Upanishads*, and Vedic sutras. In Hebrew culture, similar evidence suggests that the transcendent creator god of later strata of the *Torah* arose from exegetical integrations by the so-called Priestly redactors of primitive anthropomorphic concepts in earlier levels of the text; syncretic fusions with foreign concepts, drawing on the same strategies, also played a role in this development.¹⁸ The dates of these abstract developments closely parallel those we have noted in China and Greece.

Exegetical integrations of early textual canons, promoted by a rapid pan-Eurasian diffusion of lightweight writing materials (presumably promoted by deeper political and demographic trends) efficiently explain near simultaneities in the first development of "abstract" thought in the mid-first millennium BCE. Religious reformers and early philosophers of the period generated primitive element theories, transcendent and partly deanthropomorphized deities, and abstract ethical or cosmological concepts (*ren*, *dharma*, "the Way," *brahman/atman* dualities, the *Logos*, "the idea of the Good," and so on) by exegetically "working up" conflicting mythic concepts embodied in older levels of tradition. The hermeneutical problems faced by these commentators, and the methods used to solve them, were similar throughout Eurasia; common variations in the systems they created can be explained by differences in the specific canonical texts to which those methods were applied.

3. *Parallels in syncretic system-building in the imperial age.* A third extended series of parallels took place from approximately 300 BCE to 550 CE, the first great syncretic age in Eurasian history. The era was marked by the domination of giant empires in China (collapsing in 220 CE), Rome (in decline from the fourth century CE), and India (falling around 550 CE). On the intellectual plane, the period witnessed a long series of attempts to "work up" classical sources into broad encyclopedic syntheses and higher-level systems. Some of these syntheses included high-syncretic religions (most prominently, state Confucianism, Mahayana Buddhism, and Christianity, all arising in the same period) and first-level correlative cosmologies like those associated with so-called Neo-Platonism, later Daoism, or the late-ancient predecessors of Neo-

¹⁸ Cf. Farmer, *Syncretism in the West*, pp. 89–91.

Confucianism. In many ways, the great syncretic systems that evolved in this period unified the intellectual world just as the great empires unified the political realm.

In China, the first important work of encyclopedic scope was the *Spring and Autumn Annals of Lu Buwei* (c. 240 BCE), which according to tradition was commissioned by the prime minister of the Qin state that later unified China. In the West, a rough equivalent is found in the Aristotelian corpus, which (according again to tradition) was composed by Plato's student and the tutor of the unifier of the West, Alexander the Great. The products of these highly stratified compilations were not philosophical abstractions like the early element theories, "the Way," *dharma*, or "idea of the Good," etc., generated in earlier traditions, but high-level syntheses, elaborate systems of correspondence, and (increasingly as the period evolved) complex hierarchies of beings that developed remarkably in sync in Greco-Roman, Indian, and Chinese civilizations.¹⁹

Systematizing tendencies in China declined after the fall of the Latter Han Dynasty at the beginning of the third century CE, but those tendencies continued unabated in the remaining two-and-a-half centuries of the Western Roman Empire. Pagan scholastic systems reached their most elaborate states at the end of this period in monumental exegetical projects like Proclus's massive Platonic commentaries and *Platonic Theology*—which were aimed at reconciling discordant passages of Platonic scriptures line-by-line, and often word-by-word. The byproduct of Proclus's efforts was an elaborate correlative system that was not matched in complexity in any Eurasian society before the later middle ages.²⁰

4. *Syncretic-scholastic systems of the later middle ages and early modern era.* A slowdown in systematic developments occurred in China and the West in late antiquity due to the destruction of imperial libraries and other intellectual centers. But large-scale system building resumed with a vengeance throughout Eurasia in the great

¹⁹ The exegetical origins of these hierarchical systems (manifested in the West in the so-called great chain of being, and in the East in systematic orders of Buddhas, avatars, saints, etc.) is most dramatically demonstrated in the high-syncretic systems that developed in late antiquity along the central Asian borders of Eastern and Western societies—where Buddha, Jesus, and various Zoroastrian and gnostic divinities were organized in complex correlative arrays. See, on this point, the fascinating texts translated in Hans-Joachim Klimkeit, *Gnosis on the Silk Road* (San Francisco, 1993). Just as in similar systems in nonhistorical fields, elaborate fractal growths in history are most common along borders or elsewhere (e.g., at the intersection of trade routes) where opposing forces collide.

²⁰ Given the fact that Socrates and Plato were literally worshipped in the late Academy, the phrase "Platonic scriptures" is no exaggeration. For suggestions of this, see Marinus's *Life of Proclus*, translated, e.g., in J. L. Rosán, *The Philosophy of Proclus* (New York, 1949). Parallels can be drawn to the worship of Confucius, Laozi, and Buddha in late classical times in China or India. Proclus's pagan scholasticism was an extreme one that had a deep impact on later Islamic, Jewish, and Christian scholastic traditions. In Proclus's system, multiple mirror images of pagan gods were assigned to different hierarchical levels as abstract "henads." The multiplication of these deanthropomorphized gods, who eventually metamorphized into the Christian hierarchies of angels, developed out of exegetical attempts to reconcile discordant references to classical deities in different parts of the Platonic corpus or its early commentaries. Similar bifurcations and abstract hypostatizations transformed Eastern gods and cosmological principles in Asian scholastic systems. For some evidence here see, for example, the Thai Buddhist source referenced in note 23.

age of scholasticism, which for our purposes can be dated roughly from 1000-1600 CE.²¹ These second-level scholastic systems arose in response to a massive increase in the number of sources that were then available throughout the old world; a series of information explosions occurred in this era that deeply affected every civilization from Europe to Japan, related to increases in travel, a long series of classical revivals, and to technological innovations including the development of printing in the Far East and its eventual transmission to the West. As increasing numbers of sources became available for synthesis, scholastic-correlative systems arose of unprecedented levels of complexity; in response to increased information flows throughout Eurasia, reconciliative impulses overrode all other exegetical concerns.

The cross-cultural similarities in scholastic traditions have often been obscured by parochial attitudes in traditions or by the propaganda of warring schools. Western scholars still often characterize scholasticism as the result of attempts “to reconcile reason with Christian revelation,” obscuring the methodological affinities between Latin scholasticism and movements elsewhere aimed at harmonizing religious and philosophical authorities. In China, early Neo-Confucians are sometimes denied the “scholastic” or “syncretist” labels on the grounds that they claimed to reject Buddhism and Daoism (no less than rival schools of Confucianism) in order to revive the “pure” sources of Confucian thought; despite these claims, these writers drew heavily on Buddhist and Daoist views in constructing their systems, which from a structural point of view are remarkably similar to scholastic systems in the West. Similar remarks can be made about Vedantic scholastics like Sankara, who attacked the Buddhists while quietly incorporating Buddhist principles in their systems; or about Renaissance classicists (the so-called humanists), whose syncretic excesses were often just as extreme as those of the medieval scholastics they publicly scorned.²²

In scholastic writers like Shao Yong, Ibn Rushd (Averroës), Albert the Great, and Nichiren in the high middle ages, or extreme syncretists near the end of premodern times like Lama Tsongkhapa in Tibet, Giovanni Pico della Mirandola in Europe, or their syncretic counterparts in Mughal Dynasty India or Ming Dynasty China, correlative systems reached their most extreme expression. The problems faced by commentators in late-traditional societies were no longer restricted to harmonizing conflicts in a single tradition or handful of traditions; these exegetes were, instead, often forced to reconcile whole traditions en masse. The syncretic pressures on their thought led them to construct cosmologies in which every part of reality was said to reflect every other; these systems allowed them to assign conflicting statements in authorities to different levels of reality, where each statement could be affirmed as being true “in some mode.” Multileveled correlative and allegorical systems, in a limited number of types, show up in Latin scholastics, in literary monuments like

²¹ High-scholastic phases of medieval Indian and Islamic traditions would require slightly earlier starting dates. In general, we would argue for greater continuity than is usually acknowledged between late-ancient and medieval scholastic traditions throughout Eurasia.

²² Cf. Farmer, *Syncretism in the West*, pp. 135-37.

Dante's *Commedia*, and in tens of thousands of Neo-Confucian, Buddhist, Hebrew, and Arabic scholastics who flourished in this era.²³

The links between exegetical processes and the birth of high-correlative systems are demonstrated by the fact that the most elaborate of these systems first appeared in writers who faced the most difficult reconciliative tasks. Those links have been studied most fully in perhaps the most extreme syncretist of all times, the Renaissance philosopher and theologian Giovanni Pico della Mirandola (1463-1494). Pico lived in an era in which four centuries of textual revivals combined with the printing revolution to raise rates of information flow far above those seen in preceding centuries. In late 1486 Pico drew up 900 theses representing the views of the “wise Chaldeans, Arabs, Hebrew, Greeks, Egyptians, and Latins,” subdivided into 28 subtraditions, that he proposed to debate and harmonize at Rome before the pope, cardinals, and leaders of all the “warring schools.” One of Pico's 900 theses (which he claimed could be broken into 600 separate headings) promised to reconcile Plato and Aristotle in their entirety; others proposed to resolve the most ambiguous questions fought over in all the major schools. In achieving these goals, Pico promised to reveal in his debate three or four methods leading to an understanding “of everything knowable” (*de omni re scibili*).

In planning his project (which he immodestly hinted might trigger the end of the world), Pico was forced to draw on virtually every major reconciliative device found in the previous 2000 years of Eurasian thought. One byproduct of his use of these methods was an abstract picture of the cosmos that was nearly perfectly fractal in structure (see **Figure 1** on the next page). Pico's system was closely related to Leibniz's monadology, developed two centuries later; but in Pico we can see (as we cannot in Leibniz) the exegetical roots of that system exposed. Pico was just one of thousands of writers in fifteenth- and sixteenth-century Europe, India, Southeast Asia, and the Far East who developed high-correlative systems to harmonize the flood of presyncretized sources that had piled up over the previous 2000 years—completing developments that began with the origins of manuscript traditions in the mid-first millennium BCE. In Pico's 900 theses, the correlative ideas of medieval Latin, Arabic, and Hebrew scholasticism; of Greek Platonism, Aristotelianism, and Neo-Platonism; and of a wide range of esoteric and magical traditions—each based on syncretic syntheses of even greater antiquity—merged to form a generalized notion of cosmic correspondence. The pressures of thousands of years of reconciling books and traditions resulted in a final metamorphosis of exegesis into cosmology; the idea of

²³ For a striking fourteenth-century parallel in Southeast Asia to Dante's high-correlative system, see Frank E. Reynolds and Mani B. Reynolds, trans., *Three Worlds According to King Ruang: A Thai Buddhist Cosmology* (Berkeley, 1982). For an overview of other scholastic traditions, see Cabezon, *Scholasticism: Cross-Cultural and Comparative Perspectives*.

QUANT A CE QUE CHACUN DES TROIS

mondes est pourueu de sa racine, quarré & Cube, tout ainsi que l'Vniuers, comme il apparoist par les nombres qui sont hors les rondeaux, par la peux-tu entendre l'Armonie & conuenance de tout, & comme peut estre vray le dire d'Anaxagore, qui mettoit omnia in omnibus & singula in singulis.

Ceste suite de nombres procedant de 1. a. 28. second nombre parfait & Cube du 3. declare le secret & mystere de l'ame & du mode descript & demostre par Platon au Timée.

Note le mystere des lettres Hebraïques, chacune desquelles vaut autans que le nombre qu'elle a pres de soy enclos dans un petit rond.

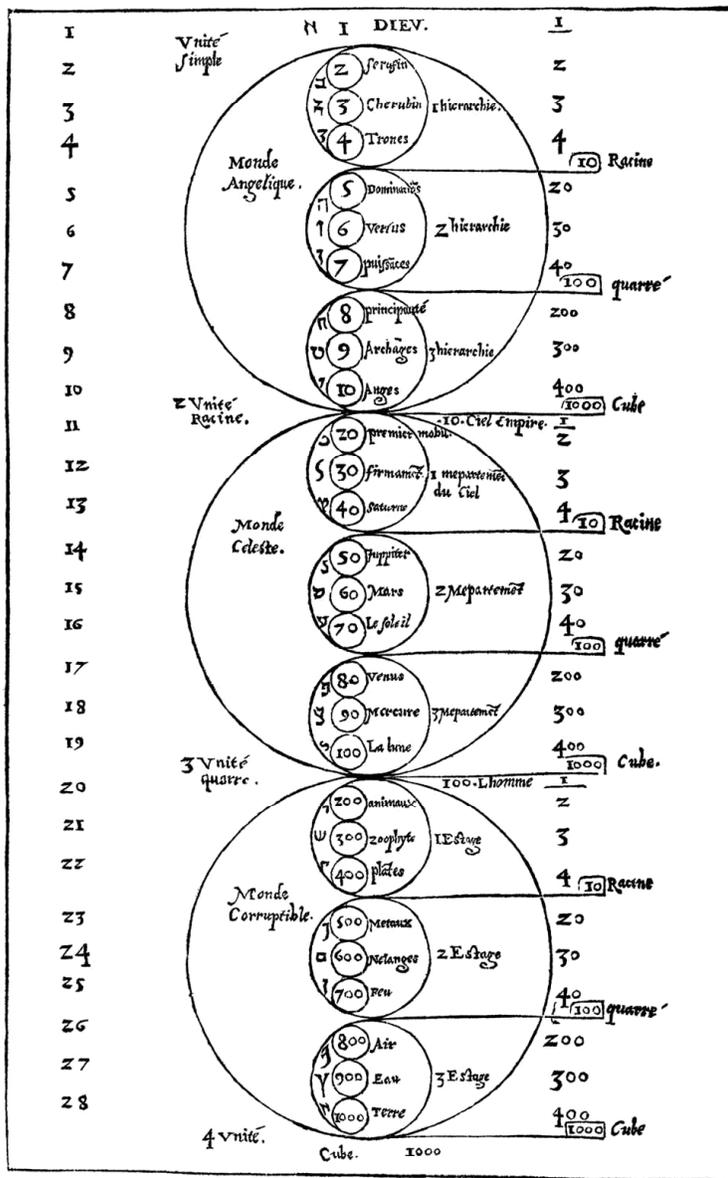


Figure 1. An abstract diagram meant to illustrate an extreme mirroring cosmology, developed by a sixteenth-century commentator on the works of Giovanni Pico della Mirandola (1463-1494). The diagram appears in Nicolas LeFèvre's 1579 French translation of Pico's *Heptaplus* (1489).

The correlative structure of Pico's system—known today as a self-similar or fractal system—is evident in the scaled circles-within-circles representing different metaphysical "levels" in the cosmos. LeFèvre sums up the correlative principles of Pico's cosmology with words traditionally (if anachronistically) ascribed to the pre-Socratic philosopher Anaxagoras: *Omnia in omnibus & singula in singulis*. [All things exist in all things, and all individuals in all individuals.]

The saying, which finds counterparts in correlative traditions in the Middle East, India, and China, could pass as a concise modern definition of a self-similar or fractal system.

cosmic correspondence, embedded in a thoroughly magical world, now lay at the center of reality; in Pico's words: "Whatever is in all worlds is contained in each one"!

When Pico's commentators reduced his complex verbal symmetries (see 2.1 below) into diagrammatic form, the result was a neat fractal portrait of his worlds-within-worlds. Systems with similar structures can be "grown" in computers by repeatedly applying to primitive texts methods similar to those of premodern exegetes—a fact critical to the simulations described at the end of this paper.²⁴

5. *The collapse of high-correlative systems.* One final parallel involves what Stephen Jay Gould has called "the greatest intellectual transformation in modern Western thinking"²⁵—the precipitous decline of correlative systems that occurred between 1550 and 1750. Some of the reasons for their demise in this period (which has, in fact, been documented in Chinese as well as Western traditions) can be traced to internal developments in manuscript traditions. In the works of late-traditional syncretists, correlative systems became so elaborate that they threatened to collapse under their own weight. With each leap in complexity, those systems became increasingly distant from the original sources involved in their synthesis and from any concepts of nature remotely suggested by empirical observation. Due to the complex correspondences resonating in those systems, moreover, any assault on any side of them—whether of a philological, scientific, religious, or political nature—potentially became an attack on them as a whole.²⁶

This collapse was obviously also tied to the development of competing mechanistic models that began to develop in the mid sixteenth century; by the middle of the seventeenth century, those models had already had a deep impact on traditions in both Europe and China. Those systems were attacked from another side by classical "purists" and religious reformers; the goal of these writers was to return thought to what they viewed as the ancient foundations of thought, which they identified with an increasingly narrow body of texts. These attacks were also aided by developments in philology and linguistics; by later stages of the Eastern and Western printing revolutions, all the philological tools were available to begin the tedious job of

²⁴ It noteworthy that Benoit Mandelbrot, who first coined the term "fractals," recognized self-similar or fractal structures in Leibniz and in the so-called great chain of being—although not apparently in premodern systems outside the West. See the historical notes in *The Fractal Geometry of Nature*, rev. ed. (1983). Mandelbrot was the first to strongly emphasize the general relationship between iteration and the growth of self-similar systems, but given the state of historical studies when he wrote his book, he could not have guessed that similar processes were also responsible for the development of fractal growths in the historical realm. Further on fractals in premodern cultures, see the essay by the mathematical biologist A. L. Goldberger, "Fractals and the Birth of the Gothic: Reflections on the Biologic Basis of Creativity," *Molecular Psychiatry* 1, 2 (1996): 99-104, which stresses neurobiological elements in such developments. Cf. Farmer, *Syncretism in the West*, pp. 93-96.

²⁵ Stephen Jay Gould, *New York Review of Books* 38, 11 (13 June 1991): 11.

²⁶ As James I put it to the Puritans: "No Bishop, no King." The sensitivity of high-correlative systems to slight perturbations corresponds in the mathematical sphere to the phenomenon of self-organized criticality (SOC). This fact can be exploited in simulations of the collapse of such systems in the early-modern era; see pp. 27-28 below.

destratifying traditions, cutting through the exegetical accretions that had gathered in them in the previous two millennia. The most extreme “purists” and philologists (the groups often overlapped) in China and Europe from the sixteenth through eighteenth centuries busied themselves with peeling off successive layers of traditions to get at what they viewed as the authentic cores lying underneath.²⁷ While they left the job unfinished, by the mid-eighteenth century they had achieved enough to discredit high-correlative systems in progressive intellectual circles throughout Eurasia.²⁸

Attacked from many sides, correlative cosmologies began a rapid decline from 1550 to the mid eighteenth century. The collapse occurred more abruptly in Europe than in China, but it occurred in both societies nonetheless. An epitaph of sorts for the two thousand years of exegetes who created these systems was provided by Voltaire in his famous portrait of the “Theologian,” a bitter-end scholastic whose syncretic excesses ultimately led him in skeptical directions:

He had mastered the oriental languages, and was as well informed as possible about the rites of the ancient nations. He knew the Brahmans, the Chaldeans, the fire-worshippers, the Sabeans, the Syrians, the Egyptians as well as the Jews. He was familiar with the variant texts of the Bible. For thirty years he had tried to reconcile the gospels, and bring the fathers into union. . . .The difficulty of organizing in his head so many things whose nature is to be confused, and to throw a little light on so many dark clouds, often disheartened him, but as these researches were his professional duties, he devoted himself to them in spite of his disgust. He finally attained to knowledge unknown to most of his colleagues. The more truly learned he became, the more he doubted all he knew. So long as he lived he was tolerant, and as he died he confessed that he had uselessly worn out his life.²⁹

²⁷On parallels between Ming and Qing Dynasty *literati* and their Renaissance “humanist” counterparts, see Henderson, *Chinese Cosmology*, and Benjamin A. Elman, *From Philosophy to Philology* (Cambridge, Mass., 1984).

²⁸Even today, the job of destratifying early textual canons is by no means complete. Studies in the past decade have gone a long way towards destratifying classical Daoist, Confucian, and Indian sources, and fresh research on the New Testament (especially in regard to the so-called *Q* document) has continued that process in biblical studies. However, in the case of the two major philosophical canons in Western thought, ascribed to Plato and Aristotle, the job of destratification has hardly begun. Evidence that research is moving in the right direction can be found in the studies of European classicists like H. Thesleff and a handful of other scholars. When the stratified nature of these canons is widely acknowledged, the impact on historical studies as a whole can be expected to be profound.

²⁹ Voltaire, *Philosophical Dictionary*, trans. Theodore Besterman (London, 1972), p. 387.

1.2 Cultural Evolution and Rates of Information Flow

In concluding this section, we would like to make one theoretical observation, fairly obvious but rarely emphasized, that is critical to the simulations described later. Much evidence exists that the rise and fall of premodern systems can be closely linked to fluctuations in rates of information flows. In periods of heightened textual flows—in eleventh-century China, for example, accompanying the first widespread use of printing, or in the textual revivals in Europe extending from the twelfth through sixteenth centuries CE—accelerated developments occurred in systematic thought. Returning to a point discussed earlier, we find a related phenomenon in the middle of the first millennium BCE, tied to the expanded use of lightweight writing materials. Similar increases in information flows also occurred in the period of vast political consolidation in the Han Dynasty and Greco-Roman period.

Looking at converse patterns, we find *declines* in the growth of systematic thought in periods of cultural collapse like those found at the end of classical antiquity, when rates of information flows dropped far below those in earlier or later periods. Dampened rates of development also existed in a handful of premodern societies that possessed lightweight writing materials—including premodern Mesoamerica and ancient Egypt—when the use of the technology was offset by sharply restricted literacy or institutional constraints on the use of texts. Numerous exegetical artifacts can be identified in the literate traditions of Mesoamerica or Egypt—multilayered conceptions of heaven and hell, protomontheistic gods, paradoxical dualistic or trinitarian deities, formal systems of correspondences, inbred cyclical models of time, and so on—whose growth can be tied to internal commentaries operating in stratified religious texts like the Popul Vuh or Book of the Dead.³⁰ But nowhere in these civilizations do we find the same degree of abstract developments generated in major Eurasian civilizations in the mid-first millennium BCE, which our model links to the expanded use of lightweight writing materials and associated increases in the number and complexity of traditions. The suggestion again is that rates of information flow and the growth of systematic thought were closely coupled.

In at least one special case, involving the collapse of high-correlative systems in the early-modern era, a sustained *increase* in rates of information flow, and not a decrease,

³⁰ The problem of textual stratification has not been widely discussed in relation to either the Popul Vuh or Egyptian funereal texts, despite much recent philological work on those sources. The existence of both textual strata and internal commentaries in the Popul Vuh shows up clearly in Dennis Tedlock's standard scholarly translation of that work (New York, 1985), although these phenomena are not noted by Tedlock himself; similar strata also appear in many similar Maya documents, including the so-called books of Chilam Balam. R. Faulkner's standard translations of Egyptian funereal texts are created from hypothetical "ideal" manuscripts, with the result that the heavily stratified internal commentaries in parts of those texts (e.g., in chapter 17 of the Book of the Dead) are badly obscured. For a partial correction of this problem, see the works of Thomas George Allen, *Occurrences of Pyramid Texts With Cross Indexes of These and Other Egyptian Mortuary Texts* (Chicago, 1950); Allen, *The Egyptian Book of the Dead* (Chicago, 1960); and Allen, *The Book of the Dead or Going Forth By Day: Ideas of the Ancient Egyptians Concerning the Hereafter as Expressed in Their Own Terms* (Chicago, 1974).

was implicated. In our computational models, the collapse of extreme correlative cosmologies can be simulated by applying the ideas of self-organized criticality (SOC), which posit nonlinear thresholds in the evolution of complex systems; once the complexity of those systems reaches certain levels, those systems begin to collapse.³¹ It is possible by adjusting rates of information flows to simulate other nonlinearities in the evolution of correlative systems, including the sudden appearance of anti-correlative movements that developed in many periods of antiquity (seen, for example, in the traditions of early Theravada Buddhism, and in similar mystical movements elsewhere).

2.1 The Commentarial Engine

The links between exegetical processes and the evolution of religious and philosophical systems have been noted occasionally in studies of specific traditions, if not in studies of premodern thought in general. One specialist in Vedantic scholasticism, Patricia Y. Mumme, comments:

It is remarkable how metaphysics in Indian thought are so tightly bound to interpretive strategies. The views of reality seen in the various schools are driven by specific strategies of scriptural interpretation. In fact, metaphysical categories are often mirror images of interpretive strategies. . . . It may be a Western bias to assume that a metaphysical system is the goal of philosophy, and that scriptural interpretation is secondary or merely instrumental. From an Indian perspective, an orthodox metaphysical system may be only a by-product of a proper hermeneutical approach to scripture. . . . Western Indologists need to divert some attention from the metaphysical carts in Indian thought in order to give closer scrutiny to the hermeneutical horses that may be driving them.

As her central example, Mumme points to the way that the use by Sankara (c. 788-820 CE) and his commentators of the “double-truth” supported the Vedantic view of “two [analogical] levels of reality, the ultimately real *brahman* and the provisionally real realm of *maya* or *avidya*.”³² It can be shown that use of the double-truth as an exegetical device led to precisely the same results in medieval Japanese, Chinese, Islamic, and Christian scholastic traditions.

The most general conclusion of our studies has been that much of systematic thought in premodern literate civilizations—and not just in India—arose from the repetitive use of just such devices. Commentarial engines left a long series of exegetical artifacts in their wake, ranging from isolated metaphysical principles to multilayered correlative systems; the specific structures generated by those engines depended in

³¹ For references, see note 48, below.

³² Patricia Y. Mumme, “Haunted by Sankara’s Ghost: The Srivaisnava Interpretation of *Bhagavad Gita* 18:66,” in Jeffrey R. Timm, ed., *Texts in Context: Traditional Hermeneutics in South Asia* (Albany, N.Y., 1992), pp. 69-84.

part on which layers of traditions they operated upon. Those structures also varied slightly from culture to culture, reflecting in part the specific genres of canonical sources lying at their base; thus, similar exegetical devices might produce monotheistic deities or linear models of time when operating on one series of texts, and abstract metaphysical principles or cyclical models of time when working on others.

While the full range of exegetical techniques was culturally invariant, moreover, the frequency with which individual techniques were used differed from tradition to tradition—leading to further variations in thought. Key selection principles included how easily a technique could resolve textual conflicts in a given tradition and how often authorities in earlier levels of that tradition used the same technique. These differences, repeated over many centuries, helped generate “path dependencies” in history, helping explain the predominance in one society, tradition, or subtradition of specific variations of correlative systems.

Admittedly, much or even most commentarial discussion was systematically neutral; parts of it, moreover, exhibited strongly anti-systematic tendencies.³³ Moreover, systematic developments in commentarial traditions were often painfully slow, which helps explain why the links between formal exegesis and cosmological developments are often overlooked. Over the long run, however, a dozen or so exegetical devices with strong systematizing features were used so frequently by religious and philosophical exegetes that steady systematic growths were assured. The long-range pattern, holding true in a wide range of traditions, was a gradual increase in the complexity, formality, and systematic integrity of correlative thinking.³⁴

Our earlier studies have analyzed the systematic effects of dozens of commentarial methods. (A summary of a number of these methods and effects is found in **Appendix A**, on pages 30-31.) For the purposes of this essay, these methods can be reduced to two major classes:

1. *Integrative methods*, which tended to transform concrete or mythopoeic images into abstract religious and philosophical concepts.
2. *Correlative methods*, which tended to bifurcate or multiply preexisting religious or philosophical concepts and, when used repeatedly, to foster the growth of formal systems of correspondence.

Some striking examples of integrative methods show up in the earliest strata of traditions, reflecting the efforts of early religious and philosophical exegetes to

³³ On anti-systematic tendencies in traditional thought, see Henderson, *The Construction of Orthodoxy and Heresy*; cf. Farmer, *Syncretism in the West*, chapt. 4.

³⁴ For discussion of exegetical strategies and their systematic effects, see Farmer, *Syncretism in the West*, pp. 59-96 and passim. Cf. Henderson, *Scripture, Canon, and Commentary*; Judith Berling, *The Syncretic Religion of Lin Chao-en* (New York, 1980).

harmonize heavily layered canonical texts. In China, supposedly the first commentator to use those methods was Confucius himself (c. 551-479 BCE)—referring, as Brooks and Brooks suggest, to the fictional “Confucius” of later strata of the *Analects*.³⁵ According to tradition, it was Confucius’s goal to restore the great society of the early Zhou era; to accomplish this required that all extant records of the sagely rulers be examined to uncover those qualities that made an ideal society possible. Exegetically reworking materials from earlier canonical sources, in particular passages from pre-Confucian levels of the *Songs* and *Documents*, early Confucians abstracted general virtues such as *li* (ritual propriety) and *xiao* (filial piety).³⁶ This process of abstraction was carried to even a higher level in respect to another virtue, that of “humanity” (*ren*), which in early texts often carries the concrete sense of that which is “manly” or “virile.”³⁷

In the reworking of *ren* ascribed to Confucius, the term was elevated to an abstract plane as a kind of “Virtue of virtues”—defined, like the Platonic “idea of the Good,” or Vedic *dharma*, by still *other* abstractions. Thus, according to later layers of the *Analects*, *ren* can be viewed as the ability to practice the five virtues of respectfulness, tolerance, trustworthiness, diligence, and kindness (*Analects* 17.6). While *ren* in one sense subsumed these virtues, however, hints are given that something remained in it beyond all understanding—even for a sage like Confucius.³⁸ Like the *Dao* of classical Daoism, *brahman* of the Upanishads and Vedic sutras, “idea of the Good” of the Platonists, and the transcendent god of late strata of the Torah, *ren* remained ineffable and mysterious—not fully accessible even to sages and prophets.

Nearly four decades ago, Havelock pointed to similar exegetical mechanisms as the driving force in the development of abstract philosophy in Greece—arising from attempts by the early pre-Socratics to integrate conflicting ideas in the Homeric corpus. The most famous product was the abstract dualism of the theory of Ideas:

You can take a word, justice, city, courage, bed, ship, and treat it as a common name and demand a general definition of it which will cover all the possible poetic instances. But this procedure is sophisticated. It becomes possible only when the spell of the poetic tradition has already been broken. . . . But how, while still working within that tradition, can one start to extrapolate such topics and principles out of the narrative flux? The answer is that you can take similar instances and situations which are severed and scattered through different

³⁵ Brooks and Brooks, *The Original Analects*.

³⁶ See, for example, *Analects* 2.21, 3.8, and 14.43. Brooks and Brooks argue that much of the *Songs* and *Documents* were forgeries written *after* the earliest strata of the *Analects*, complicating discussion of the exegeses of those texts found in its later strata. Discussion of this issue, which does not affect our main thesis, must be reserved for another place.

³⁷ Benjamin I. Schwartz, *The World of Thought in Ancient China* (Cambridge, Mass, 1985), p. 75.

³⁸ *Analects* 7.33; Schwartz, p. 91.

narrative contexts but which use many of the same words and you can proceed to correlate them and group them and seek for common factors shared by them all. . . . So another way of putting the mental act of isolation and abstraction is to say it is an act of integration. The saga [here, the *Iliad*] will contain a thousand aphorisms and instances which describe what a proper and moral person is doing. But they have to be torn out of context, correlated, systematized, unified and harmonized to provide a formula for righteousness. The many acts and events must somehow give way and dissolve into a single unity.³⁹

Integrative processes like these appear in the earliest levels of commentary traditions throughout Eurasia, giving birth to monotheistic gods, abstract cosmological principles, systematic orders of virtues or elements, and dualistic views of reality that provided the bare abstract frameworks for later cosmological developments.

Our second class of exegetical techniques—correlative methods—helped generate many of the entities that filled out those frameworks, eventually giving birth to full-blown correlative systems. These techniques came in many subtypes: allegorical methods, the “double truth,” scholastic distinctions, and others summarized in **Appendix A**. Despite their differences, all these techniques were based on the same general principle: conflicts in authorities can be resolved if we take their conflicting words to refer not to the same but to analogous concepts standing on different “levels” of reality.⁴⁰ When traditions were “worked up” over many centuries using such techniques, the eventual result was the construction of high-correlative systems in which every part of reality was said to reflect every other.

Perhaps the most common of these correlative techniques was what is widely referred to as “standard” scholastic distinctions, which attempted to reconcile conflicts in authoritative sources by claiming that the same terms appeared in those sources in two or more analogical senses. Neo-Confucian commentators, for example, reconciled a major conflict between Confucius and Mencius over human nature by claiming that in the conflicting passages Confucius was referring to the *temperamental* side of human nature, but Mencius to the *foundations* of human nature.⁴¹ Southeast Asian scholastics used identical means to reconcile internal conflicts in the Vedic and Buddhist canons, and Western commentators from Cicero to the Renaissance Platonists to harmonize apparent discord in Plato and Aristotle. In the visual arts, one famous expression of the technique shows up in Raphael’s famous depiction of the “School of Athens,” where we find Plato holding the *Timaeus* and pointing upwards, while Aristotle holds the *Ethics* and spreads his hand over the world. The point was

³⁹ Havelock, *Preface to Plato*, p. 218.

⁴⁰ In part of our model that we do not discuss in this paper, the origins of these correlative techniques are traced to fundamental neurobiological processes. For references, see Farmer, *Syncretism in the West*, pp. 91–96.

⁴¹ Cheng I, quoted in Zhu Xi, *Sishu jizhu, Xia lun* (The Four Books with Collected Commentaries; Latter Part of Analects) (Taipei: Xuehai Chubanshe, 1974), p. 119.

to emphasize that apparent conflicts in those authorities arose from their primary interests in “higher” and “lower” realities; their outwardly conflicting ideas were complementary, not contradictory.

The more complex the exegetical tasks, the more complicated these correlative methods became. To illustrate this principle, we will limit ourselves to citing two passages from the Renaissance syncretist Giovanni Pico della Mirandola and a third from the Neo-Confucian scholastic, Shao Yong. In both of these writers, the repeated use of this and similar methods led to the construction of unusually elaborate correlative systems.

Our first example, from Pico’s 900 theses, introduces a long chain of correlative distinctions to harmonize conflicting claims in Plato, Plotinus, Proclus, and other authorities as to the cosmic location of “beauty.” Conflicts here, as in the simpler cases discussed above, could be reconciled by invoking a series of verbal modifiers to suggest that different “modes” of beauty existed on different planes of reality. Reflecting the outrageous scale of Pico’s syncretic system, the result—which is suggestive of computer-generated prose—was arguably the most extreme example of scholastic writing known:

Beauty exists in God as its cause, in the total intellect truly essentially totally, in the particular intellect truly partially essentially, in the rational soul truly participationally, in the visibile accidents of the heavens imagerially essentially totally, in subcelestial visible qualities imagerially partially essentially, in quantities imagerially participationally. [!]

The exegetical origins of constructs like these are underlined in another one of Pico’s 900 theses, aimed this time at reconciling apparent conflicts in Pre-Socratic sages over the metaphysical concept of the “one”:

Although there were three [writers] who said that all things are one—Xenophanes, Parmenides, and Melissus—whoever carefully scrutinizes their words will see that the one of Xenophanes is that which is one simply. Parmenides’ one is not the absolute one, as is believed, but is the oneness of being. The one of Melissus is the one that possesses extreme correspondence to Xenophanes’ one.⁴²

The point of this thesis is that secret harmonies lie beneath the outer conflicts in the ancient wisemen—with Xenophanes first revealing God’s oneness, then Parmenides the reflected oneness in creatures, and Melissus finally the negative oneness of non-being or prime matter. One obvious byproduct of Pico’s method was a highly articulated correlative view of reality.

⁴² Theses 5>26 and 3>70 in Farmer, *Syncretism in the West*. The original Latin texts are also provided in that work.

Similar extreme structures show up in the works of the medieval Chinese syncretist Shao Yong. The structural similarities between Shao's and Pico's systems, which were both heavy with numerological symbolism, can be illustrated by quoting a few sentences from one of Shao's larger numerological constructs. In the following passage, Shao correlates a long series of concepts, including the titles of four of the Chinese classics—the *Changes*, the *Documents*, the *Songs*, and the *Spring and Autumn Annals*—by arranging all of them in every possible logical sequence. Shao's motive here was similar to Pico's when he linked the ideas of Xenophanes and the Eleatics: to suggest that a uniform view of reality was shared by the ancient sages. When linked correlatively, the Chinese classics reveal to us all the principles that govern the world:

The *Changes* of the *Changes* means to produce life; the *Documents* of the *Changes* means to produce growth; the *Songs* of the *Changes* means to produce harvest; the *Spring and Autumn Annals* of the *Changes* means to produce storage. The *Changes* of the *Documents* means to increase life; the *Documents* of the *Documents* means to increase growth; the *Songs* of the *Documents* means to increase harvest; the *Spring and Autumn Annals* of the *Documents* means to increase storage. . . .⁴³

These examples of premodern exegesis are extreme ones, but the strategies that generated them were commonplace. Many of the most important features of premodern religious, philosophical, and cosmological systems arose from the repeated use of such strategies over millennia. A short list of such developments includes the original birth of monotheistic and transcendental deities; the development of abstract philosophical language and dualistic visions of reality; the growth of Buddhist, Christian, and Hindu trinities (and paradoxical concepts of deity in Mesoamerican thought); the emergence of abstract orders of demons, aeons, henads, angels, saints, and similar divine beings; the development of multilevel mirroring pictures of heaven and hell; the evolution of theories of multiple world creations and destructions; the origins of elaborate typological (linear) and cyclical models of time; and the growth of fully articulated models of man-the-microcosm, which show up in every mature premodern civilization.

Higher-level integrations of ideas like these, arising from the efforts of commentators working over thousands of years, were the primary force behind the growth of multilayered correlative cosmologies that dominated systematic thought in all major world societies until early modern times.⁴⁴

⁴³Shao Yung, *Huangji jingshi shu* (Book of the Supreme Rules Governing the World) SBBY ed. 5.9a. Not surprisingly, constructs like this in Shao and Pico were also tied to complex numerological structures—which can, in a sense, be abstracted directly from their verbal constructs.

⁴⁴ Cf. Farmer, *Syncretism in the West*, chap. 2.

3.1 Computer Simulations of the Growth and Collapse of Premodern Systems⁴⁵

In the last several years, we have designed a number of computer simulations capable of implementing and partially testing the ideas described above. Our work here has arisen from combining what we have learned from our textual research with general studies of complex or self-organizing systems. Such studies have made major strides in the past decade, providing a number of algorithms that can be readily adapted by historical modelers.⁴⁶ Below, we provide a non-technical overview of how those simulations function.

We first realized that simulations of this sort might be constructed in the late 1980s, when we discovered that the evolution of self-similar structures like those we discovered in premodern cosmologies were being intensely studied by mathematicians. Self-similar or fractal structures can be viewed as the signatures or “footprints” of iterative processes. The discovery of self-similar growths in any evolving system typically suggests that nonlinear dynamics can be applied to modeling the development of that system. As Mandelbrot and others have shown, self-similar structures tend to emerge in systems that are repeatedly transformed by recursive operations—by feedback mechanisms in which the output of each prior transformation becomes the input of each new one.⁴⁷ What we found remarkable this finding was the similarities between the dynamics of such systems and those we found in the historical sphere. Our textual studies suggested that increasing levels of self-similarity in correlative systems were byproducts of the repetitive application to those systems of a small set of exegetical techniques, especially those of a reconciliative or syncretic nature. This discovery suggested that it might be possible to develop simulations of the growth of correlative systems by adapting nonlinear models already widely used in the biological and physical sciences—fields in which the emergence of similar fractal patterns are well known.

Consider the following sketch of a simple simulation. The simulation can be run in either automatic or interactive modes. In the latter case, a human assistant assuming the role of “apprentice commentator” intervenes at key choice points in the simulation. Using a human assistant enhances the simulation’s value as a teaching device and greatly simplifies computational operations. (In the classroom, we have even used simplified versions of the simulations using nothing but paper, pencils, and a few specially prepared “canonical texts.”) Certain parts of the simulation (e.g., the “contradiction detectors” mentioned in **Step 3**) are borrowed from computer models

⁴⁵ An updated version of the following material can be downloaded as a PDF file from <http://www.safarmer.com/simulations.pdf>.

⁴⁶ For an overview of modeling techniques involving complex or self-organizing systems, see the references in note 4. For further models related to evolutionary models like ours (in this case, from the biological sciences), see Stuart A. Kauffman, *The Origins of Order: Self-Organization and Selection in Evolution* (New York and Oxford, 1993).

⁴⁷ Mandelbrot, *The Fractal Geometry of Nature*; cf. H.-O. Peitgen and P.H. Richter, *The Beauty of Fractals: Images of Complex Dynamical Systems* (Berlin and New York, 1986), p. 5.

designed to handle complex scheduling tasks for the U.S. space program.⁴⁸ A high-level description of the simulation follows (see **Appendix B** on page 32 for a formal expression of the algorithm underlying the simulation):

1. Select **primitive sets of texts** representing ancient textual genres—short prayers, ritual or magical texts, court poems, epic or lyric poetry, dynastic histories, oracles, etc. Key sentences in the texts (statements about divine forces, human virtues, ritual objects, etc.) are “tagged” as potential objects of exegesis.
2. Sort and randomly combine subsets of these texts to create **stratified textual canons**. These canons will typically include numerous textual inconsistencies; for example, the tagged statement “god X is Y” may appear in one place in the canon, while “god X is not Y” or “god X is Z,” etc., may appear elsewhere.
3. Apply contradiction detectors, or alternately use a human assistant, to define a prioritized list of **exegetical tasks** for each textual canon.
4. Select a subset of **exegetical strategies** out of a larger set using best-fit rules for canons and/or types of exegetical tasks (a human assistant can also be asked to make the selection). Different sets of strategies can be selected to generate competing subtraditions.

(Reconciliative strategies are of the general type illustrated in **Appendix A**, the majority of which have obvious correlative features; exegetical strategies of different sorts can be added to model anti-syncretic forces in traditions, which tend to develop in tandem with extreme reconciliative tendencies.)

5. Apply exegetical strategies to a limited subset of exegetical conflicts in the canon. The application of these strategies to a canon generates **exegetical artifacts**, which normally amplify any existing correlative structure in the texts.
6. Collect exegetical artifacts in **commentarial systems**, whose basic forms are defined by simple templates.
7. Combine textual canons and commentarial systems to **create stratified traditions**.
8. Apply **textual degradation rules** to selected levels of tradition (shuffle or discard parts of texts, etc.) to mimic entropic or dissipative processes in manuscript traditions; different degradation rules can be assigned to canons and commentarial systems.
9. **Iterate starting at step 3**. Run the simulation until all inconsistencies in the traditions, or in any partitioned sets of those traditions, are eliminated.

While this simulation is admittedly crude, it will generate systematic byproducts that are remarkably similar to those generated by exegetical processes in stratified textual traditions. Those byproducts tend to grow in complexity with each iteration;

⁴⁸ See, e.g., the papers in *Technical Report FIA-92-17*, NASA Ames Research Center, Artificial Intelligence Research Branch (May, 1992).

simultaneously, their self-similarities and internal consistencies tend to increase. The fact that (1) the textual quality of traditions is degraded after each iteration (**Step 8**) while (2) correlative structure is repeatedly fed into those traditions (**Step 5**) ensures that the system will evolve in self-similar way in an emergent fashion. It is, in fact, possible to observe the self-similarities in the system growing in each successive layer of tradition; this mimics the ways in which such structures evolved in premodern traditions.

Due to the use of best-fit rules that link exegetical strategies to exegetical tasks (**Step 4**), among the first systemic byproducts that arise in the simulation are abstract objects—primitive dualities, monotheistic deities, abstract cosmological principles, primitive sets of elements and virtues, etc. (Depending on the exegetical strategies used, elaborate pantheons of gods may also emerge.) Abstract dualistic frameworks then evolve; these are followed by broader cosmological systems, as exegetical artifacts generated in later iterations “fill out” those frameworks. After a large number of iterations, expanded syncretic-correlative systems (of the sort found in Neo-Confucianism or Neo-Platonism, or similar scholastic traditions) develop that have increasingly complex mirroring structures. Whether those systems are laid out in hierarchical or temporal frameworks (in either cyclical or linear subtypes) depends on which exegetical strategies are driving the system. When best-fit rules are applied, selected exegetical strategies tend to amplify the most common types of correlative structures found in the earliest levels of a tradition.

The speed with which systematic artifacts arise out of the textual flux is associated with the rate with which inconsistencies are eliminated from the textual canons; this rate can in turn be linked to the degrees of initial contradiction in the texts (determined in **Step 3**), which vary from canon to canon. Rates of information flows in the system are further associated with the number of exegetical acts performed in each iteration in **Step 5** and with the depth of information loss that takes place in each loop in **Step 8**. Adjustments to these tuning parameters can be introduced to simulate special historical conditions—developments in literate technologies, increases or decreases in literacy rates, shifts in levels of travel and cultural contact, textual losses and revivals, political expansions and contractions, institutional constraints on information flows, and so on.

So long as the “traditions” being simulated contain high enough levels of contradictions, linguistic output in the simulations (in the form of simple verbal statements) will eventually develop the kinds of proportionalities found in the hyperscholastic verbal constructions of late-traditional syncretists like Shao Yong or Pico (see the examples on pp. 23-24, above)—whose systems, in a sense, “summed up” the results of two millennia of previous commentarial processes.

It is possible to add functions to the simulation to allow the abstraction of numerological features out of those systems as self-similarities grow or to translate the output of those systems into graphic form (of the sort seen in **Figure 1**, on page 15). Political, social, and religious “selection algorithms” can be added to the textual

degradation rules in **Step 8** to simulate some of the historical conditions favoring the survival of one type of tradition over another—including some of the more unsavory institutional controls on thought found pervasively in premodern societies.

More complex versions of the simulation allow modeling not only of the growth of correlative systems but of their collapse as well. When the complexity of certain classes of self-similar systems approach critical thresholds, their sensitivity to even slight perturbations increases, resulting in states in which minor events can trigger the collapse of large parts of their structures; this is the phenomenon known as self-organized criticality, or SOC.⁴⁹ These thresholds are related to the relative ease with which information flows through distant parts of the system, which is linked in turn to the global levels of self-similarity in those systems. At such thresholds, individual elements in the system become sensitive not only to influences from nearby elements but from those in all regions of the system; a classical example in physics involves long-range spin alignments in ferromagnetic systems just below Curie's point.

The rates with which the rise and fall of such systems occur are controlled by tuning parameters that can be pictured as representing the energy pumped into those systems. The nature of this "energy" will vary depending on the system being modeled. This energy might be food in biology, labor and raw materials in economics, or information flows in historical models like ours. When those rates increase, they can push the complexity of such systems to critical thresholds, causing those systems to begin to collapse in dramatic fashions.

The classical example of this is the collapse of a sandhill, which has been extensively studied experimentally and in computer simulations. As sand is piled higher in the hill, the slope of the hill eventually reaches a critical level; after a certain point, any additional sand added to the pile will cause avalanches of increasingly large magnitude that will eventually push the slope back below the critical level. To put this another way: as the complexity of the sandhill approaches a critical threshold, "communication" between distant regions of the hill increases until the whole system begins to collapse in response to even small perturbations.

Analogies exist here again with the historical behavior of correlative cosmologies, which became increasingly vulnerable to attack the more complex and self-similar those systems became. As Galileo discovered to his cost, as critical thresholds are approached correlative systems become so cohesive that any attack on any one part of the system threatens the whole. In computer simulations of correlative systems, rates of information flows can be adjusted to ensure that the systems generated in the simulations eventually reach states of self-organized criticality. Simulated scientific, philological, or religious attacks on those systems might be imagined whenever the "conceptual distance" between those systems and earlier levels of tradition, or

⁴⁹ For details, see P. Bak, C. Tang, and K. Wiesenfeld, "Self-Organized Criticality," *Physical Review A* 38 (1988): 364-74; P. Bak and K. Chen, "Self-Organized Criticality," *Scientific American* 246 (1) (1991): 46-53; P. Bak, "Self-Organized Criticality: A Holistic View of Nature," in Cowan, *Complexity*, pp. 477-496.

between those systems and models of empirical reality, reach critical levels. At that point, special rules can be applied (e.g., to **Step 8**) to allow those traditions to decompose in a realistic fashion.

It is amusing to imagine simulations in which best-fit rules at critical points cause “flips” in exegetical methods (in **Step 4**) from syncretic to antisyncretic modes—simulating, in a sense, the historical shift of Voltaire’s bitter-end scholastic from reconciliative to skeptical ways of thinking. Once again, the rates of information flow at such points are key.

4.1 Summary and Conclusions

In this paper we have sketched a model of the structural growth of premodern religious and philosophical systems. In that model, parallel intellectual developments in premodern China, Europe, and other literate civilizations are pictured as byproducts of exegetical processes operating in manuscript traditions over long periods of time. At the end of the paper, we briefly described abstract representations of our model that can be implemented in simple computer simulations.

In the last decade, we have fine-tuned our model in the classroom to produce a powerful framework for teaching comparative history. We have also considered ways in which future simulations can be used to guide research and to help in historical reconstructions. We anticipate in particular the use of simulations in helping date chronologically vague or textually depleted areas of premodern history, like those typical of ancient India or Mesoamerica. Even in the absence of other textual evidence, study of the systematic byproducts of commentarial processes can help us date those products and can tell us something about any lost traditions underlying them. In general, from a consideration of how rates of information flow affect traditions, it is possible to fill in holes in the evolutionary record of one tradition by extrapolating from data available in others. The parallels here with procedures used in evolutionary theory in geology and biology are obvious.

In closing, we want to point out that we recognize that our model may prove troublesome to those who view traditional religious and philosophical systems not as exegetical artifacts but as monuments to unconditioned human “genius.” We hope that this deficiency, if it is one, is offset by a number of historical puzzles that the model efficiently solves.

Appendix A: A Few Systematic Effects of Exegetical Strategies

The following is a short list, intended to be illustrative and not exhaustive, of a few exegetical strategies that had major systematic effects. The majority of these strategies had a reconciliative purpose: to harmonize traditions, to unveil the hidden unity in canonical sources, to reconcile new traditions with old ones, or to co-opt the ideas of warring traditions or subtraditions. Which strategies were preferred in different traditions — and hence which types of cosmologies tended to evolve within those traditions — depended in part on (1) the ease with which those methods solved given exegetical tasks and (2) the frequency with which those methods showed up in earlier layers of tradition. The inbreeding of traditions over long periods resulted in the cross-cultural growth of multilayered correlative systems that by late traditional times exhibited high levels of structural complexity, formal consistency, and self-similarity. Partially counterbalancing this development were anti-scholastic (or classicist) movements that tended to grow in strength the further traditions drifted from the sense of their base texts; the seesaw battle of syncretic and anti-syncretic forces was a major theme in the history of thought until the final collapse of high-correlative systems in early modern times.

EXEGETICAL STRATEGY	DESCRIPTION	TYPICAL BYPRODUCTS
Correlation of gods from different polytheistic traditions.	Gods of different traditions are pictured as bodily parts or inferior reflections of superior deities for reconciliative ends.	Generation of early pantheons of gods in ancient Egypt, Mesoamerica, India, Greece, etc. Similar tendencies in Chinese folk religion.
Syncretic fusion of different animistic deities from one or more tradition.	Conflicting concepts of animistic deities are harmonized to create more transcendent gods.	The initial appearance of proto-monotheistic or monotheistic deities.
Processes of abstraction applied to harmonize diverse references to moral or intellectual concepts in mythic traditions.	Abstract cosmological principles are generated through integrations of conflicting uses of terms in earlier layers of texts.	‘Heaven,’ the ‘Way,’ <i>dharma</i> , <i>Logos</i> , the ‘One,’ Platonic theory of ideas, etc. Abstract dualistic frameworks are created for later cosmic developments.
Paradoxical concepts applied to conflicting references to divine beings or abstract cosmological principles.	Conflicting references to divine beings or cosmic principles are identified in paradoxical ways to harmonize texts.	Simultaneously transcendent and immanent gods; paradoxical Confucian-Daoist ‘Way’; Buddhist, Christian, and Hindu trinities; dualistic deities in Tibetan or Mesoamerican traditions, etc.
Order sages, divine beings, or inferior creatures from different traditions in hierarchical, emanational, or temporal series.	Figures from one or more tradition are fit in a single framework by assigning them to different levels of reality.	Grades of Confucian sages, Buddhist arhats, Hindu avatars, etc.; gnostic aeons and Neo-Platonic henads; orders of demons and angels.
Syncretic fusion of multiple or conflicting stories concerning ancient sages, philosophers, and tradition founders in a growing canon.	Multiple stories of sages, philosophers, and tradition founders are harmonized by transforming these figures into semi-divine or divine beings.	Eventual transformation of Confucius, Laozi, Socrates, Buddha, Jesus, etc., into semi-divine or cosmic beings.

EXEGETICAL STRATEGY	DESCRIPTION	TYPICAL BYPRODUCTS
Systematic correlations of conflicting references to single deities.	Conflicting references to deities are identified as inferior manifestations of that god.	Abstract schemas of the names and powers of god in Islamic and Christian scholasticism; the kabbalistic <i>sefirot</i> , etc.
Allegory methods applied in hierarchical frameworks.	Abstract philosophical or religious ideas read out of (or into) non-philosophical works.	Intensified hierarchical visions of reality. Transformations of poetic and other non-philosophical works into cosmological treatises (Homer, the Odes, Spring and Autumn Annals, etc.)
Allegorical methods applied in a temporal framework (typology).	Concepts or persons in earlier traditions are pictured as imperfect anticipations of concepts or persons in later ones.	Growth of analogical views of time in progressive (linear) frameworks. .
Compilational or allegorical strategies applied in cyclical temporal frameworks.	Conflicting stories, concepts, divine beings, or temporal events in different layers of texts are reconciled by assigning them to different eras in a cyclical temporal framework.	Multiple creations and destructions of the world in Greek or Mesoamerican traditions; concept of divine <i>avatars</i> and multiple Buddhas, etc.; reconciliative use of the “five phases” (<i>wuxing</i>) in Chinese dynastic histories.
Compilational strategies in hierarchical frameworks.	Conflicting stories, concepts, or cosmological schemes are rejoined in a hierarchical manner.	Multileveled mirroring visions of heaven and hell in Christian, Buddhist, Hindu, and Mesoamerican traditions; complex faculty psychologies; etc.
Syncretic syllogisms.	Disjoined snippets of texts are conjoined to unveil their hidden unities. Heavy use in Vedic, Neo-Confucian, Midrashic, and other commentarial traditions.	Increased reverence towards holy books; intensified word magic, bibliomancy, etc.
Standard scholastic distinction.	Apparent conflicts in texts are reconciled by adding verbal modifiers as needed to those concepts.	Increasingly complex, correlative, and hierarchical visions of reality in Neo-Confucian, Buddhist, Hindu, Islamic, Jewish, and Christian scholasticism.
‘Double-truth’ models.	Religious or philosophical authorities are reconciled by distinguishing complementary realms of truth.	Bifurcations of reality in the three-treatise school of Buddhism; similar developments in Neo-Confucian, Vedantic, Averroistic scholasticism, and Latin scholastic traditions.
Mystical letter/glyph interpretations and anagrammatic manipulations of canonical writings.	Mystical letter/glyph interpretations and anagrammatic readings introduced to demonstrate the hidden unity of canonical texts.	Glyphomancy in China, anagrammatic manipulations of texts in India, the Middle East, and the West. Intensified linguistic realism, fusion of mysticism and calligraphy, etc.
Higher-level fusions of systems of correspondences.	Presyncretized (correlative) concepts found in earlier texts are conjoined in increasingly abstract forms.	Abstract numerologies of the type found in Shao Yong or Joachim of Fiore. Extreme syncretic-correlative systems with amplified magical properties in medieval and early modern times.

For detailed discussion of individual strategies, see Henderson, *Scripture, Canon, and Commentary* and Farmer, *Syncretism in the West*. For discussion of exegetical methods opposing these strategies, see Henderson, *The Construction of Orthodoxy and Heresy*.

Appendix B: Formal Algorithm/Program Information Flow

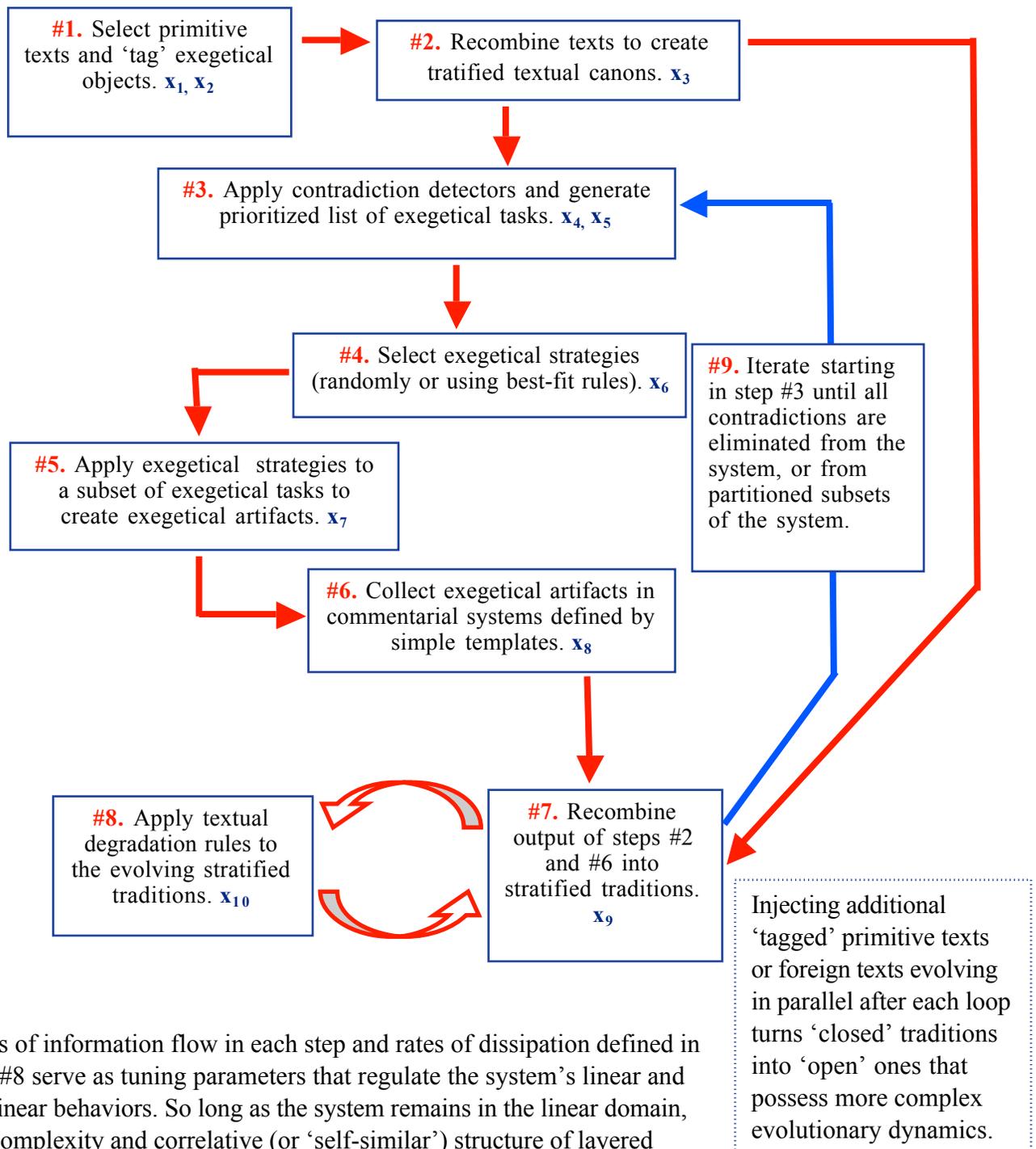
The following box contains a brief formal description of the algorithm used in the simulation described above. Program operators appear in italics; materials transformed by these operators in plain text.

```

Algorithm exegesis-process (prepared_sources)
  primitive_texts = select_subset_from (prepared_sources)
  tagged_primitive_texts = tag_concepts (primitive_texts)
  stratified_textual_canons = randomly sort and recombine_subsets_ (tagged_primitive_texts)
  loop until no contradictions
    contradictions = detect_contradictions (stratified_textual_canons)
    exegetical_tasks = prioritize_contradictions (contradictions)
    exegetical_strategies = select_exegetical_strategies (exegetical_tasks)
    exegetical_artifacts = apply (exegetical_strategies, exegetical_tasks)
    commentarial_systems = match_templates_to_artifacts (exegetical_artifacts)
    tradition = combine (commentarial_system, textual_canons)
    dtraditions/dt = apply_degradation_rules (tradition)
    tradition = dtraditions/dt + tradition
  end loop
end algorithm

```

Appendix C: Simulation Flow Chart



Rates of information flow in each step and rates of dissipation defined in step #8 serve as tuning parameters that regulate the system’s linear and nonlinear behaviors. So long as the system remains in the linear domain, the complexity and correlative (or ‘self-similar’) structure of layered textual traditions increase with each iteration.