

# Increased Affluence Explains the Emergence of Ascetic Wisdoms and Moralizing Religions

Nicolas Baumard,<sup>1,2,\*</sup> Alexandre Hyafil,<sup>2</sup> Ian Morris,<sup>3</sup> and Pascal Boyer<sup>4,5</sup>

<sup>1</sup>Philosophy, Politics and Economics Program, University of Pennsylvania, 311 Claudia Cohen Hall, 249 S 36th Street, Philadelphia, PA 19104, USA

<sup>2</sup>Département d'Études Cognitives, Ecole Normale Supérieure, 29 Rue d'Ulm, 75005 Paris, France

<sup>3</sup>Department of Classics, Stanford University, Building 110, 450 Serra Mall, Stanford, CA 94305-2145, USA

<sup>4</sup>Department of Psychology, Washington University, Saint Louis, MO 63130, USA

<sup>5</sup>Université de Lyon, 14 Avenue Berthelot, 69007 Lyon, France

## Summary

**Background:** Between roughly 500 BCE and 300 BCE, three distinct regions, the Yangtze and Yellow River Valleys, the Eastern Mediterranean, and the Ganges Valley, saw the emergence of highly similar religious traditions with an unprecedented emphasis on self-discipline and asceticism and with “otherworldly,” often moralizing, doctrines, including Buddhism, Jainism, Brahmanism, Daoism, Second Temple Judaism, and Stoicism, with later offshoots, such as Christianity, Manichaeism, and Islam. This cultural convergence, often called the “Axial Age,” presents a puzzle: why did this emerge at the same time as distinct moralizing religions, with highly similar features in different civilizations? The puzzle may be solved by quantitative historical evidence that demonstrates an exceptional uptake in energy capture (a proxy for general prosperity) just before the Axial Age in these three regions.

**Results:** Statistical modeling confirms that economic development, not political complexity or population size, accounts for the timing of the Axial Age.

**Conclusions:** We discussed several possible causal pathways, including the development of literacy and urban life, and put forward the idea, inspired by life history theory, that absolute affluence would have impacted human motivation and reward systems, nudging people away from short-term strategies (resource acquisition and coercive interactions) and promoting long-term strategies (self-control techniques and cooperative interactions).

## Introduction

The term “Axial Age” was coined in 1947 by the German philosopher Karl Jaspers to describe the concomitant emergence of a range of doctrines that eventually lead to the emergence of world religions. Jaspers argued that this period was pivotal in the sense that the questions that people ask today about the way they should live their lives and the answers they get from today's religions and philosophies were all invented at that time. “Man, as we know him today, came into being” wrote Jaspers [1].

Indeed, to most people, believers and nonbelievers alike, it seems obvious that religion is on the side of the spiritual

rather than the material world and that it fosters self-discipline and selflessness rather than license and greed. However, such spiritual and moral concerns are recent in human history [1, 2]. In hunter-gatherer societies, early chiefdoms, and archaic states, religions focused on performing rituals, offering sacrifices, and respecting taboos in order to ward off misfortune and ensure prosperity [3, 4]. By contrast, between roughly 500 BCE and 300 BCE, new doctrines appeared in three places in Eurasia (the Yellow and Yangzi rivers, the Ganga Valley, and the eastern part of the Mediterranean; see Figure 1). These doctrines all emphasized the value of “personal transcendence” [5], that is, the notion that human existence has a purpose, distinct from material success, that lies in a moral existence and in the control of one's own material desires, through moderation (in food, sex, ambition, etc.), asceticism (fasting, abstinence, detachment), and compassion (helping, suffering with others). This higher purpose is reflected in the constitution of the universe itself (e.g., through *karma* or *logos*). Beyond this material world lies another reality in which human existence acquires a new meaning. In this other reality, humans are not just bodies anymore. They are endowed with a soul and can survive the death of their bodily incarnation. Most importantly, in this other reality, individuals pursuing material success are doomed. Only moderation and moral behavior guarantee salvation [2].

The emergence of spiritual and moralizing religions is well documented, occurring over a short period, between the fifth century BCE and the third century BCE (some of them became culturally dominant a few centuries later). In the Ganges Valley, Buddhism, Samkhya, Ajivikism, and Jainism appeared in the Magadha and Kosama kingdoms in the late fifth century BCE [6, 7], although ascetic movements were probably present already. These movements spread rapidly to the rest of India under the Mauryan Empire (ca. 320–185 BCE). Vedism, in turn influenced by these spiritual movements, underwent a massive transformation, integrating asceticism and karma in the new Brahmanic orthodoxy [6, 8, 9].

In the Mediterranean, self-discipline and ascetic doctrines, combined with a moral outlook, appeared in Greek city-states in the late fifth century BCE [10, 11], with precursors in Orphism and Pythagoreanism [12]. This spiritual trend grew stronger and spread outside continental Greece in the fourth century, developing into the Hellenistic movements known as Stoicism, Epicureanism, Skepticism, and Cynicism. Beliefs that the gods and the universe were on the side of the moral good [9, 13] and that good behaviors would be rewarded in the afterlife (see, for instance, Plato's *Republic* and Pindar's *Odes*) [9, 14] emerged during the same period. Although these ideas were still marginal in the fifth century BCE, literary works such as Virgil's *Aeneid* and Plutarch's *On Superstitions* suggest that they had become mainstream among elite Romans by 100 CE [15, 16].

In China, although the *Daodejing* and the *Zhuangzi* are now recognized as late compilations, recent studies have traced the beginning of self-discipline doctrines go back to the fourth century BCE [17–20], the same time Confucius started his moral teaching. Similarly, the belief in divine punishment

\*Correspondence: [nbaumard@gmail.com](mailto:nbaumard@gmail.com)

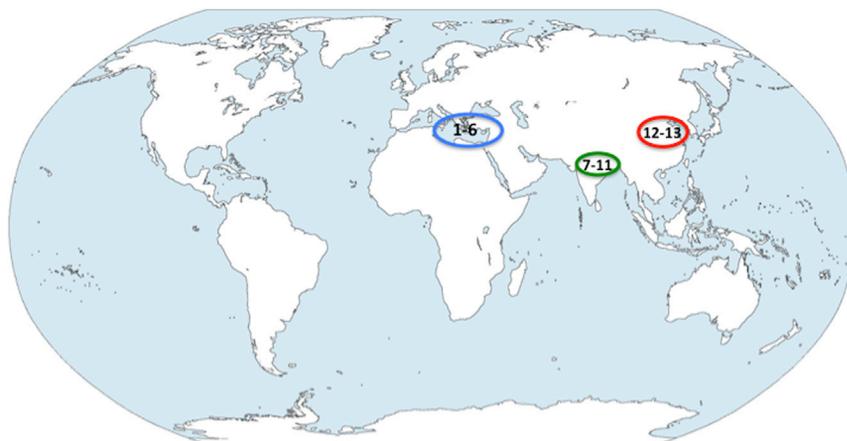


Figure 1. Map of Axial Religions and Movements  
Some Axial Age religions and spiritual movements: 1, Pythagoreanism; 2, Orphism; 3, Platonism; 4, Stoicism; 5, Epicureanism; 6, Second-Temple Judaism; 7, Ajivika; 8, Samkhya; 9, Buddhism; 10, Jainism; 11, Hinduism; 12, Taoism; 13, Confucianism.

(through the celestial bureaucracy), previously thought to have come from Buddhism between the first and third centuries CE, may have appeared before the Han empire [21]. The rising popularity of Lao Zi in the late Han empire and the appearance of Daoist mass movements such as the Celestial Masters confirm the gradual influence of ascetic and spiritual ideologies early in the Common Era.

These processes raise the following question: why did these similar movements emerge simultaneously? These innovative religious movements could not have resulted from the emergence of large-scale state polities (Sumerian, Egyptian, Mayan, Inca, and Zhou empires), many of which had priestly organized religions but lacked this focus on asceticism and morality. The puzzle may be solved by recent advances in evolutionary psychology that suggest that absolute affluence has predictable effects on human motivation and reward systems [22–24], moving individuals away from “fast life” strategies (resource acquisition and coercive interactions) and toward “slow life” strategies (self-control techniques and cooperative interactions) typically found in axial movements. In line with this idea, quantitative studies reveal a sharp increase in energy capture (a reliable proxy for affluence [5]; see Figure 2) occurring at the same time in three distinct regions of Eurasia (the Yellow and Yangzi rivers, the Ganga Valley, and the eastern part of the Mediterranean). At the end of the first millennium BCE, these regions reached an economic level (>20,000 kcal/capita/day) that greatly surpassed the economic level of previous societies, from 4,000 kcal for hunter-gatherer societies to 15,000 kcal for archaic large-scale civilizations like Egypt or Sumer [5].

In this paper, we sought to formally test for a potential link between the emergence of axial religions and the affluence of the societies in which they emerged. We computed the extent to which different social variables were associated with the emergence of axial religions. Specifically, we developed and compared stochastic models (formally, an inhomogeneous Poisson process) in which the probability of the emergence rate during a given time period depends on the value of one factor. This can be viewed as one special form of logistic regression (classically used to assess the classification power of one of several explaining factors) that simply takes into account the duration between successive data points. All models were divided into the following two subsets: (1) models based on variables indexing the level of affluence, which were referred to as affluence proxy models, and (2)

models based on factors reflecting political success, which were referred to as political complexity proxy models. We used classical Bayesian methods to select the model under which the observed data are most likely to occur. The Akaike information criterion (AIC) measures those likelihoods and allows comparison between political complexity proxy models, affluence proxy models, and a null model (homogeneous Poisson, i.e., zero-factor model).

## Results

First, all four political complexity proxy models failed to account for the emergence of axial religions better than the null model, except for the state population model, which outperformed it by a small margin (Figure 3A). In contrast, five out of the six affluence proxy models accounted for the occurrence of Axial Age religions significantly better than the null model and the state population model. Overall, the main city population model and the energy capture model were the most likely according to the data, with a differential AIC value of 8. In other words, whereas political complexity models fail to explain the data (i.e., they did not perform better than the null model), the affluence parameters are 4,900 and 3,200 times more likely to be true than the null model.

In the maximum-likelihood energy capture model, there was a sharp transition around 20,000 kcal/capita/day, before which there was virtually a null probability of appearance of axial religion and after which there was a high probability of appearance within a few centuries (Figure 3B), confirming predictions from our first qualitative approach. On the contrary, maximum-likelihood models for any political complexity proxy displayed much weaker modulation of probability of appearance by the associated factor.

Second, because one of the political success proxies (state population) provided a (slightly) better-than-chance account of the data, we wanted to know whether that predictive power of state population, with respect to appearance of axial religions, was complimentary to or absorbed in the predictive power of affluence proxies. To that end, we coupled state population and energy capture (the best predicting proxy for affluence) to build a two-factor model in which appearance rate was dependent on the joint values of those two variables. There was still less evidence for the two-factor model than for the single energy capture model (Figure 4), suggesting that knowing state population did not add any predictive power to knowing energy capture. We found the same trend when using the second-best predicting proxy for affluence (main city population). This confirms that whereas affluence proxies provide very good indicators for the emergence of axial religions, political success proxies do not.

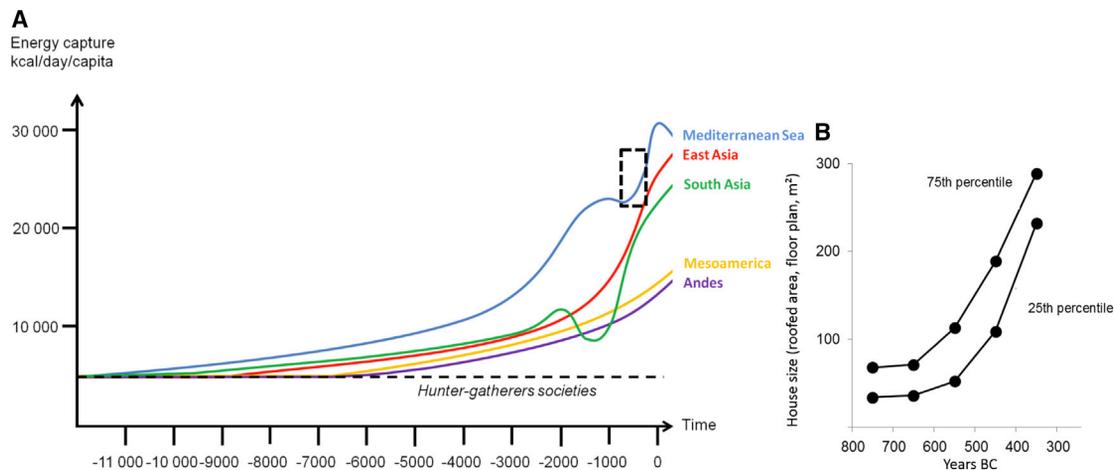


Figure 2. Evolution of Energy Capture since the Neolithic Revolution

(A) Evolution of energy capture in the five most-intensive agricultural zones from 11,000 BCE to 0 CE. The dotted line represents the level of energy capture in hunter-gatherers societies. The dotted square represents the evolution of energy capture during the period represented in (B).

(B) Evolution of Greek house size, a proxy for energy capture, adapted from [24].

## Discussion

The results support our initial hypothesis that economic development rather than political complexity explains the emergence of axial religions. This is congruent with the qualitative description of some religious historians, who, following Jaspers, noted that Axial Age movements did not appear in the largest archaic states (i.e., Assyria, Babylon, Egypt, Persia) but rather in smaller prosperous polities, such as the Greek city-states, the richest Mahājanapada, and the most developed of the Chinese warring states.

Before discussing the possible interpretations of this analysis, it is important to note that more data would be needed to adequately test the robustness of this conclusion. The proxies we used for affluence and political complexity remain very crude, and we hope that better data will become available in the near future. It is all the more important that the data used in this analysis probably lead to an underestimation of the role of material prosperity. First, we used a very crude measure of urbanization (size of the main city) that greatly underestimates the astonishing rates of urbanization of Greece, China, and India during the Axial Age [25, 26]. Second, absolute energy capture does not take into account the distribution of resources within a given society (e.g., the Gini index). Because the small Greek *poleis*, for instance, were considerably more egalitarian than the great empires of Egypt or Persia, it can be assumed that the energy capture available to the upper middle class in Greece (within the axial movements emerged) was probably much greater than what was available to the corresponding class in Persia or Egypt. Finally, the lack of reliable and extensive archaeological data precluded the inclusion of many non-Eurasian empires (Hawaii, Yoruba, Kongo, etc.) as well as many preaxial ancient empires (Phoenicia, Nubia, etc.) that would have provided additional independent cases for comparing economic and political factors. Given what we know about the absence of spiritual and moral religions in all of these societies [1–4], their inclusion in the sample would greatly strengthen our model.

Although our analysis suggests that the Axial Age may be the product of an increase in standard of living in the most affluent societies of antiquity, it leaves open the question of

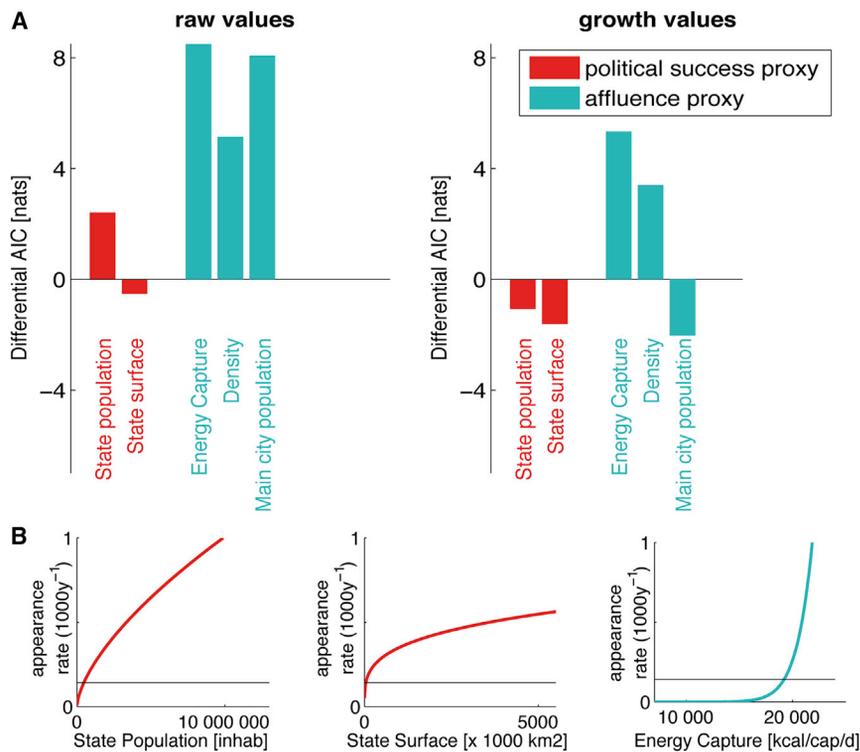
the proximate mechanisms by which affluence leads to the emergence of new kinds of religions. One possibility, originally proposed by Jaspers [1], is that axial religions resulted from the emergence of a new class of scholars or priests who had the resource and the time to elaborate more abstract religions. Additionally, economic prosperity could have changed religions through the development of literacy and schooling, giving rise to more educated believers.

Although this hypothesis explains the clear increase in cognitive sophistication in religious doctrines during the Axial Age, it does not account for their specific content (rising importance of morality and spirituality) and the practice they are associated with (generosity, asceticism). In particular, it does not account for why the new upper class would have been particularly attracted by the condemnation of earthly pleasures, food, luxury, or social status.

Another possibility is that affluence may have promoted a new way of life through the emergence of more cosmopolitan, open, and diverse societies in which generosity, universality, and self-control became more attractive. This alternative fits very well with the importance of main city population in our model, a proxy for the development of urban life, and with the social recruitment of the axial movement among the better off.

Finally, the effect of affluence on religion could be understood in terms of life history theory [2], specifically focusing on the contrast between a “fast” strategy, with short-term investment of resources (e.g., early reproduction, more offspring, and less nurturing), and a “slow” strategy, with opposite characteristics [23, 27]. Shifts of strategies are known to be triggered by environmental cues, such as the harshness or unpredictability of environments; they result in lower or higher degree of cooperation [22, 24, 28] and in investment in the self [29], a phenomenon originally described by Maslow in his “pyramid of needs” model [30, 31].

In this life history perspective, a massive increase in prosperity and certainty during the Axial Age may have triggered a drastic change in strategies, shifting motivations away from materialistic goals (acquiring more wealth, higher social status) [23] and short-term aggressive strategies (“an eye for an eye”) [24], typical of fast life strategies, toward long-term



**Figure 3. Comparison of Differential AICc for Single-Factor Models**

(A) Comparison of all single-factor models for the emergence of axial movements. The left panel uses raw variables as factor; the right panel uses their growth over time. Orange bars represent political success proxies; green bars depict affluence proxies. Differential AIC (equal to the difference between the null model AIC and the single-factor model) indexes the support for each model from the data: higher values indicate larger support.

(B) Appearance rate as a function of state population (left), state surface (center), and energy capture (right) in each of the corresponding maximum-likelihood models (see [Supplemental Information](#) for more information). Energy capture model shows a very sharp transition around 20,000 kcal/capita/day from lower values, where appearance is very likely, to higher values, where appearance is very unlikely, showing that energy capture provides a strong predictor for the appearance of axial religion. By contrast, for both state population and state surface, over most of the range of values, the appearance rate remains in an intermediate region where appearance is moderately likely, indicating that these two variables provide poor predictors for the appearance of axial religions.

investment in reciprocation (“do unto others...”) and in self-development (variously described as the “good life” or “self-actualization” in Maslow’s original theory). This shift in priorities progressively would have impacted religious and intellectual traditions through a transmission bias, in favor of doctrines and institutions that coincided with the new values [2, 4, 32]. In a nutshell, at some point in the middle of the first millennium BCE, old “ritual” religions emphasizing short-term strategies would have been supplanted by new “spiritual” religions that emphasized long-term strategies through asceticism and self-control techniques.

In this perspective, it would be relevant to investigate whether axial societies also exhibited other characteristics specific to slow strategies, such as a high parental investment or long-term monogamy [33]. Another possible area of investigation could be to study parallel phenomena later in history where more detailed historical series are available. A case in point is the concomitant emergence in medieval Europe of ascetic and moralizing movements both inside the church (e.g., the Franciscans, the Dominicans, the Beguines, etc.) and outside the church (e.g., the Humiliati, the Waldesians, or the Cathars) [34].

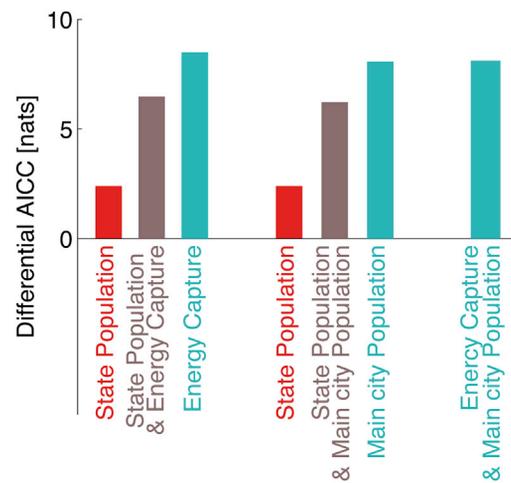
**Experimental Procedures**

We used energy capture as a proxy for affluence but also relied on more classical, albeit indirect, proxies for affluence, such as population density, population growth, and the population of the main city: population density is a proxy for economic development that allows more inhabitants in a given area, population growth requires increased survival rates and thus is correlated with economic prosperity, and main city population is a proxy for urbanization, another good indicator of economic prosperity.

We used state population and state surface as a proxy for political complexity of the main state of the area of interest. These variables, commonly mentioned in the historical literature, assess large-scale cultural changes. It has been generally assumed in classical scholarship of religion that there was a connection between social structure and the contents of

religious doctrines. More recently, some authors have argued that moral religions emerged because they were indispensable to ensuring large-scale cooperation in large-scale societies [5].

As all historical models predict that world religions only appear in complex societies, we only considered the eight most advanced areas of antiquity (Egypt, Mesopotamia, Greece, Anatolia, India, China, Mesoamerica, and the Andes). Using Morris’s work [5], we created time series for energy capture in Greece, Egypt, Mesopotamia, Anatolia, and China. We reconstructed changes in energy capture in India, Mesoamerica, and the Andes using the same parameters (see [Supplemental Information](#) available online). We used evidence from political geography for state size and state



**Figure 4. Comparison of Differential AICc for Double-Factor Models**

Comparison of differential AICc for single-factor models (state population and energy capture state population) with differential AICc for two-factors models, showing (1) that coupling any of the two best-predicting proxies for affluence with state population did not improve evidence for the model and (2) that coupling the two best-predicting proxies for affluence did not improve the affluence model.

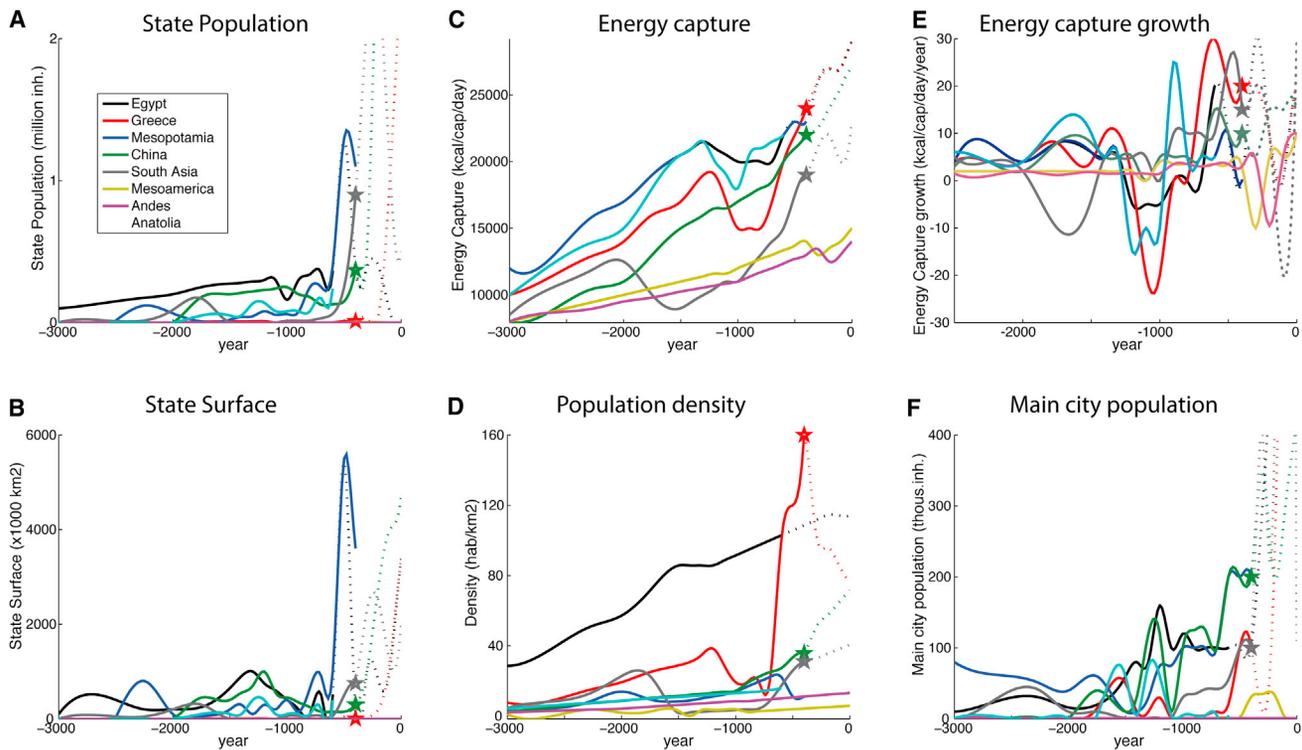


Figure 5. Evolution of Environmental Variables

Evolution of each environmental variable, per century and per area of interest, and the emergence of axial movements (stars) at 400 BC.

population [35, 36] and evidence from historical demography for population growth, main city population and density [37, 38].

We used the standard list of axial movements described in the literature. One problem with cross-cultural studies is that cultural phenomena are often not independent from each other (because, for instance, they have all been in contact with Christian missionaries), and their comparisons may produce spurious correlations [39]. To avoid this case of “Galton’s problem,” we considered only one data point per cultural area (e.g., all Greek sects counted as only one axial case) and excluded one cultural area—Israel—for which cultural independence could not be proven (due notably to the influence of Egypt, Mesopotamia, and Hellenistic Greece throughout its history). Finally, we could not include Zoroastrianism due the lack of reliable historical dating of the movement (estimates typically range from 1500 BCE to 600 BCE).

Although our data set comprised only eight independent cultural regions (three of which hosted the emergence of axial religions), the very long temporal depth of the time series (e.g., more than 3,000 years in the case of Egypt and Mesopotamia) allowed us to robustly survey the ecological factors favoring the emergence of axial religions. Thus, whereas cross-cultural studies of religions usually compare multiple societies taken at a single point in time, we used data from a few regions over a long time interval.

Historical data were thus available for eight distinct areas of interest (Egypt, Greece, Mesopotamia, Anatolia, China, India, Mesoamerica, and the Andes) from 3000 BCE to 0 CE, in intervals of one to five centuries, and consisted of time series for six different factors: energy capture, population, density, state population, state surface, and main city population (see Figure 5). Although the absolute level of affluence seems crucial, its dynamics could also play a role (i.e., stagnation or decline may interact with absolute level of affluence). We thus extended our analysis by adding single-factor models based on the growth rate of each parameter rather than on its absolute value. We computed the rate of growth for these factors (excluding the first data point in each region) simply defined for time series  $x_t$  as  $(x_t - x_{t-1}) / (t_t - t_{t-1})$ , where  $t_t$  is the date corresponding to the data points. Note that once axial religions appear they may coexist with nonaxial practices (as was the case in the remote provinces of the Roman Empire after the conversion of Constantine). We thus studied the dependence between various factors and the appearance of spiritual religions, not the existence of such religions.

All of the models are stochastic models (Poisson processes) whereby, in each region and at each time step, spiritual religions have a certain probability of appearing based on some emergence rate. The form of that emergence rate depends on the model.

- (1) In the null model (or homogeneous Poisson model), the rate is constant over time (i.e., the appearance of spiritual religions does not rely on any factor):  $\lambda(t_i) = \alpha$ . This model is used as a control model.
- (2) In single-factor models, the rate depends upon one factor, e.g., energy capture. The dependence is taken to be of the general form  $\lambda(t_i) = \alpha x_i^\beta$ , where  $x_i$  is the value of the factor at the corresponding time and  $\alpha$  and  $\beta$  are some unknown parameters to be estimated. Growth parameters can take negative values that are inconsistent with the rate formula above, so for those parameters, we used instead  $\lambda(t_i) = \alpha(x_i - x_{\min})^\beta$ .
- (3) In two-factor models, the rate depends upon two factors, e.g., energy capture and state population. The general form now writes as  $\lambda(t_i) = \alpha x_i^\beta y_i^\gamma$ , where  $x_i$  and  $y_i$  are the two factors and  $\alpha$ ,  $\beta$ , and  $\gamma$  are the unknown parameters.

Maximum-likelihood parameters in each type of model can be estimated using gradient descent on the log likelihood (LLH) of data. They can also be determined analytically by searching for sets of parameters where the LLH gradient vanishes, yielding the following:

- (1) For the null model,  $\hat{\alpha} = n_{\text{trans}} / \sum_i dt_i$ , where  $n_{\text{trans}}$  is the number of transitions in the data set and  $dt_i$  is the duration of time step  $i$  (in other words, the estimated rate is simply equal to the number of observed transitions divided by the overall durations of observations combined with the overall regions of observations).
- (2) For single-factor models,

$$n_{\text{trans}} \sum_i dt_i \log(x_i) x_i^\beta = \sum_i dt_i x_i^\beta \sum_{i \in \text{trans}} \log(x_i)$$

$$\hat{\alpha} = \frac{n_{\text{trans}}}{\sum_i dt_i x_i^\beta}$$

(3) For two-factor models,

$$\hat{\alpha} \sum_i dt_i \log(x_i) x_i^{\hat{\alpha}} y_i^{\hat{\beta}} = \sum_{i \in \text{trans}} \log(x_i)$$

$$\hat{\alpha} \sum_i dt_i \log(y_i) x_i^{\hat{\alpha}} y_i^{\hat{\beta}} = \sum_{i \in \text{trans}} \log(y_i)$$

$$\hat{\alpha} = \frac{n_{\text{trans}}}{\sum_i dt_i x_i^{\hat{\alpha}} y_i^{\hat{\beta}}}$$

Models were compared using the corrected AIC (AICc, which corrects the maximum a posteriori LLH (LLH<sub>max</sub>) for the number of estimated parameters:

$$\text{AICc} = -2\text{LLH}_{\text{max}} + 2k + \frac{2k(k+1)}{N-k-1}$$

where k is the number of parameters in the model (from 0 to 2) and N is the number of data points. The model with the lowest AICc is the most likely (a model can be said to capture data significantly better than another one if its AICc score is at least 3–4 bits lower than the other). Here, we used differential AIC, i.e., the difference between AICc for the null model and AICc for the model under consideration. A higher-differential AIC thus means a more-likely model.

#### Supplemental Information

Supplemental Information includes Supplemental Experimental Procedures and one figure and can be found with this article online at <http://dx.doi.org/10.1016/j.cub.2014.10.063>.

#### Author Contributions

N.B. proposed the hypothesis, designed the study, and produced the time series. I.M. provided the time series for energy capture. A.H. built the model and ran the analysis. All the authors wrote the paper.

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