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How to Open Pandora's Box: A Tractable Notion of the History of Knowledge

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Introduction

At first sight, the concept "history of knowledge" may seem too unwieldy to be covered by any definition. After all, is there any human activity that cannot be seen as "knowledge"? We may try to open Pandora's box more cautiously, however, so as to keep the history of knowledge tractable. Over and above the history of science, many would agree that the history of knowledge should include the history of other knowledge disciplines such as the humanities and the social sciences.¹ A first tractable notion of the history of knowledge could thus correspond to the history of the (natural and social) sciences and the humanities taken together.²

Even if in the end we want to arrive at the most inclusive notion of the history of knowledge possible, our first limitation already leads to an immensely wide palette of knowledge: from knowledge of the sky to knowledge of language, from knowledge of mechanics to knowledge of art, from knowledge of plants to knowledge of music—to name just a few. While it is a truism that the common goal of all these disciplines is *to try to understand the (natural and cultural) worlds*, it is the historian's task to understand what "understanding the world" meant in different periods and places.³

I shall argue in this essay that trying to understand the world involves trying to identify *patterns* in the world and the underlying *principles* that explain these patterns. Patterns and principles are referred to in different terms in different languages and periods, but the concepts themselves are remarkably global and may even be universal. A pattern can be seen as a rule or a regularity—with or without exceptions—observed in the natural or cultural world, while a principle is a generalization that brings together different patterns under a single denominator and aims at explaining these regularities.⁴ It is important to stress that patterns and principles may not correspond to "truth"—they differ across time and place—but the *search* for patterns and principles is less context-dependent. In addition to searching for patterns and principles in planetary movements, diseases, and animal behavior, humans in different parts of the world have searched for patterns and principles in historical processes, linguistic expressions, and artistic styles.

Thus, a further specification of a tractable notion of the history of knowledge is that it *can be taken as the history of patterns found and principles proposed in the study of nature and culture*. Elsewhere, I have referred to this notion of knowledge as "systematic" knowledge.⁵ Not all knowledge is systematic, however. A list of, for instance, the (sur)names of someone's family members is not a form of systematic knowledge.

¹ See, for example, Bod, *New History*, 7, 10; Daston, "History of Science"; Bod et al., "Flow of Cognitive Goods."

² It should be kept in mind that the distinction between "humanities" and "science" only emerged in the nineteenth century (Krämer, "Shifting Demarcations"). The use of the terms "humanities" and "science" is therefore anachronistic when referring to disciplines before the nineteenth century. But since the historiography of science has typically left out the history of those disciplines that are today referred to as the humanities (Bod, *New History*), we believe along with Nicolas Jardine that certain anachronisms are productive rather than harmful (Jardine, "Uses and Abuses").

³ As Hansson, "Science and Pseudo-Science" puts it: "the natural and social sciences and the humanities are all parts of the same human endeavour, namely systematic and critical investigations aimed at acquiring the best possible understanding of the workings of nature, people, and human society."

⁴ On pattern, see for example, McAllister, "Ontology of Patterns"; and Bod, *New History*. On principle, see, for example, Musgrave, *Realism and Rationalism*, 326–49.

⁵ Bod, *Wereld vol patronen*, 15–16.

Only if there is the gist of an underlying regularity or pattern in the list of names (for example, in terms of ancestral lineage) can knowledge of it be called systematic.⁶ The extension of the term “knowledge” to any enumeration of facts or observations without any internal structure falls beyond the scope of systematic knowledge. Our notion of knowledge does not exclude vernacular, artisanal, financial, political, or other kinds of knowledge that may also be pattern- and principle-based. But, as explained above, it is only as a first step that I will explore a united history of the scientific and humanistic disciplines. For reasons of space, I will refer to these disciplines by their current and admittedly Western terms in this essay.

A united history of the sciences and the humanities remains untrodden ground, which is surprising because in languages other than English a single term exists for the humanities and the sciences, such as *wetenschap* in Dutch, *scienza* in Italian or *hayka* in Russian. This is not to say that there is no previous work on an integrated history of the sciences and the humanities, but in most of this work the humanities play a marginal role. For example, the historical overview of knowledge edited by Renn focuses on the history of science, medicine, and technology, with one chapter on the history of writing and textuality but no other humanistic practices or disciplines.⁷ The volumes by Jacob and Burke deal with institutions, libraries, states, and churches but give no overview of the history of humanistic and scientific disciplines.⁸ Lloyd deals with the role of elites in various disciplines, but his relatively short book deals mainly with antiquity.⁹ Insightful studies on the circulation of knowledge have also appeared, such as Östling et al.¹⁰ And there are the classics by Sarton, Störig, Foucault, and Gusdorf, but these works cover only a few disciplines within the humanities, mainly linguistics and historiography.¹¹

During the last few years, a new, recognizable subfield has emerged: the history of humanities, which aims at studying the integrated history of all humanistic disciplines.¹² This field was launched in 2008 with the annual conference series *The Making of the Humanities*, which resulted in a series of open access volumes as well as in monographs like *A New History of the Humanities*.¹³ In addition, the journal *History of Humanities* was founded in 2015, and several academic programs in the field were set up. But while these activities have been important for emancipating the history of humanities as a field, they had little to say about how it could be united with the history of science as a field.

In the following, I will discuss some episodes from the history of the humanities and the history of the sciences by focusing on their joint practice of searching for patterns and principles. Next, I will discuss—within the limitations of this short essay—the types of patterns and principles that can be traced together with a long-term tendency that can be identified. My examples are necessarily patchy, and I refer to Bod for a more systematic treatment.¹⁴

The Awareness of Patterns

While the oldest extant patterns are probably the dash patterns on mammoth tusks that are believed to reflect the periodic phases of the moon, the first written texts that describe patterns are found in the Babylonian Empire.¹⁵ The hundreds of thousands of extant clay tablets indicate that the Babylonians were zealous pattern seekers in many different knowledge activities, ranging from astronomy, mathematics, economics, and law to history, literature, music, and medicine. It is less well known that the Babylonians were also looking for patterns in language. In fact, the Babylonians had a problem. Their empire was born of a unique combination of Sumerians and Akkadians, two peoples with completely different and unrelated languages. Around 2000 BCE, the Akkadian language became more dominant in Babylon, but all of the ancient literature and documents were in Sumerian. Thus, the Babylonian scholars mapped the structures of the two languages. They weren't just trying to compose a dictionary—they were interested in finding patterns in declensions, conjugations, and compositions.¹⁶

⁶ See also Hoyningen-Huene, *Systematicity*.

⁷ Renn, *Globalization of Knowledge*.

⁸ Jacob, *Lieux de savoir*, vol. 1; Burke, *Social History, Social History*, vol 2.

⁹ Lloyd, *Disciplines in the Making*.

¹⁰ Östling et al., *Circulation of Knowledge*.

¹¹ Sarton, *History of Science*; Störig, *Kleine Weltgeschichte*; Foucault, *Order of Things*; Gusdorf, *Les Sciences humaines*. For an overview of books on the history of knowledge, see Burke, *Social History*.

¹² While it seems impossible to establish the exact number of humanistic disciplines, the *Lexikon der Geisteswissenschaften* mentions forty-one distinctive ones. See, Reinalter and Brenner, *Lexikon*.

¹³ Bod, *Making of the Humanities, New History*.

¹⁴ Bod, *Wereld vol patronen*.

¹⁵ North, *Cosmos*, 5–6.

¹⁶ Huber, “Babylonian Understanding of Grammar.”

In doing so, the Babylonians discovered a fascinating linguistic pattern: the discontinuous relationship, that is, the bond between two parts of a word composition that is preserved even when other elements are placed between them. **Table 1** shows this discontinuous relation for some forms of the verb *gar* (to put) from a clay tablet where the relation between *gar* and the affix *ib* (meaning to make or cause) is maintained even though it is separated by other particles.

The Babylonians were apparently surprised by this as they painstakingly recorded that this particular discontinuous relation did not occur in their own language, at least not for the verb “to put.” It must have been an “aha” experience for the Babylonians to see that a meaningful unit can change in the middle of a Sumerian word while the rest around it remains the same. In English one can also find discontinuous relations, not in word formation but in syntactic constructions, for example, between subject and verb, as in “The dog on the hill barked.” In this sentence it is of course not the hill but the dog that barks, resulting in a discontinuous relationship between “dog” and “barked.”

Islamic historians in the eighth century CE had a problem as well: they needed to reconstruct the life of the prophet Mohammed who had died in 632. By the eighth century, there was no one alive who had experienced the prophet in the flesh, so historians had to make do with the stories passed down over generations. But how could they know if these stories were true? They developed a new method to investigate their reliability. Each story was provided with an *isnad*, meaning a “chain of human reporters,” from the time of Muhammad to determine exactly who had passed the story down to whom (**Figure 1**).

In addition, Islamic historians checked whether the reporters could have actually met each other, whether their meeting had been recorded, whether one of them might have had an invested interest in coloring or changing the story, etc. This meticulous work enabled them to define a set of principles for estimating any story's reliability on a scale from one to four, from “very reliable” to “completely concocted.” In this way, Islamic historians laid the foundation for what has become known as historical source criticism, which is used in many scholarly fields today.¹⁷

From Patterns to Principles and Back

The following are just a couple of examples of early searches for patterns and underlying principles. They culminate into what we now call the empirical method or even better: the *empirical cycle*. This cycle comes down to understanding patterns observed in the world based on underlying principles, which are then tested against new data, adjusted, tested once again, and so on and so forth.¹⁸

While we can find the empirical cycle in all periods, it gained a particularly strong foothold in the fifteenth century, where it occurred especially—somewhat surprisingly—in disciplines that we nowadays associate with the humanities. The empirical cycle was used in fifteenth-century art theory to uncover the principles of perspectival practices by the humanist Leon Battista Alberti. And in fifteenth-century philology, the empirical cycle was employed by Angelo Poliziano to uncover the principles of textual transmission. Moreover, in musicology, Vincenzo Galilei (the father of Galileo Galilei) used the empirical cycle in trying to determine the underlying principles of consonant and dissonant intervals.¹⁹ In some fields the empirical cycle led to dramatic insights: the sixteenth-century historian and philologist Joseph Scaliger determined that all known historical events could have never taken place in the space of the six thousand years recorded in the Bible, although Scaliger and later historians still did their best to cram most of their sources into that

Table 1: Transcribed conjugations of the Sumerian verb *gar* (to put) with translations in Akkadian showing the discontinuous relations between *gar* and the affix *ib*. The conjugations are from clay tablet OBGT VI. Adapted from Huber, “Babylonian Understanding of Grammar: A Reexamination of OBGT VI-X.” *Journal of Cuneiform Studies* 59 (2007), 5.

Sumerian	Akkadian	
gar- bí -ib	šuškin	(make someone put it)
gar-ra- ni -ib	šuškiššu	(make him put it)
gar- mu -ub	šuškinanni	(make me put it)
ga- ri -ib-gar	lušašikika	(make me put it for you)

¹⁷ For a comparison between the *isnad* and historical source criticism, see Bod, *New History*, 150–51.

¹⁸ The term empirical cycle was introduced by de Groot 1961. See De Groot, *Methodologie*.

¹⁹ Walker, “Musical Theory.”

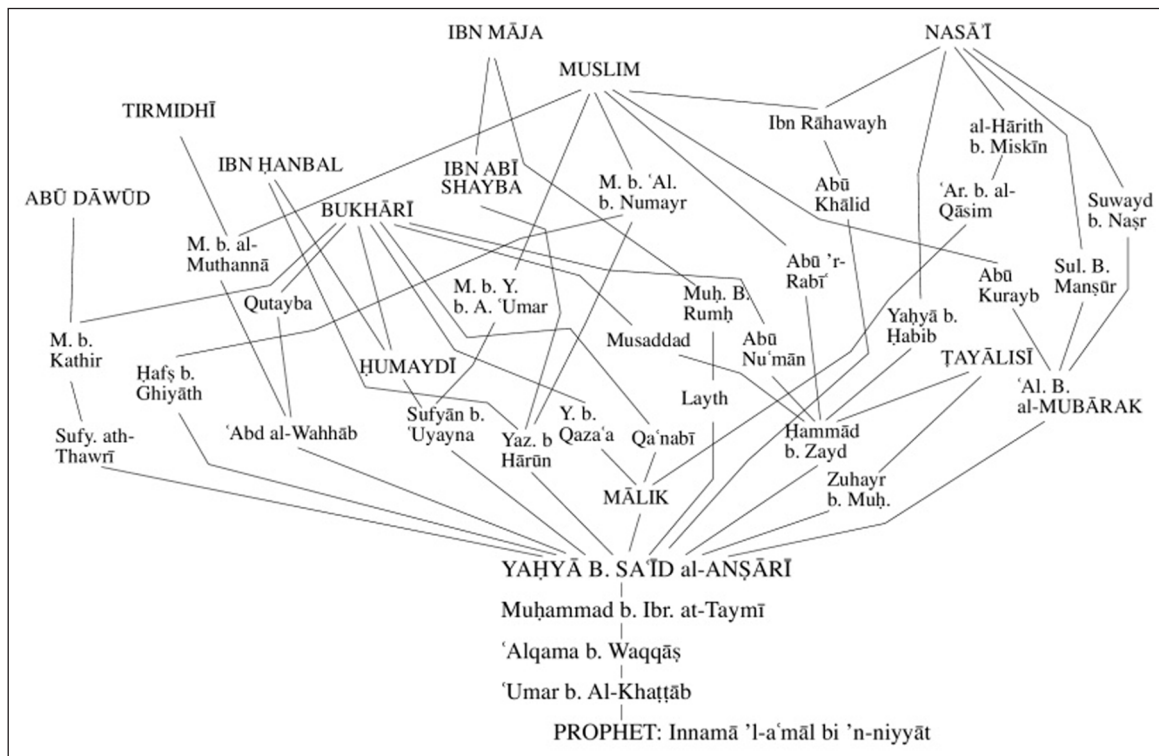


Figure 1: An *isnad*, meaning a “chain of human reporters,” describing who had passed a source down to whom. From G. H. A. Juynboll, *Encyclopedia of Canonical Hadith* (Leiden, NL: Brill, 2007), xxi. Courtesy of Brill Publishers.

period of time. But the net result was that it slowly became accepted that the Earth is older than 6000 years and the Bible is not reliable as a historical source.²⁰

It wasn't until the late sixteenth century that the empirical cycle was widely adopted in the study of nature—from astronomy and mechanics to physiology. This was possible because most actors in these disciplines, such as Copernicus, Kepler, and Galileo, were also educated in philology, and many of them even published in this domain. For example, Kepler is nowadays mainly known as an astronomer and a mathematician, but in the seventeenth century he was also famous as a philologist and a historian. He showed that the assumed date of the birth of Christ had to be adjusted by at least four years, and he corrected other philologists, including Scaliger, in their textual emendations.²¹ As a result, the various disciplines were tightly interwoven. The same applies to the connection between disciplines in other regions: the seventeenth-century Chinese philologist Gu Yangwu used the empirical cycle for philological text reconstruction, an approach that was widely commented on by Chinese astronomers and physicians who took over Gu Yangwu's strictly empirical approach.²²

Polycentric Perspectives

We need to look beyond a single continent if we want to understand how knowledge develops in different regions and centers around the world. By treating these centers as being on a par with each other we may arrive at what I will call a *polycentric* view of the history of knowledge.²³ For example, the Chinese had adopted the practice of inoculation against smallpox as early as in the sixteenth century. This practice was subsequently adopted by the Ottomans and in parts of Africa—but it didn't arrive in Europe until much later. It is often recounted that inoculation was invented by Edward Jenner in the late eighteenth century.²⁴ But Jenner discovered another very important thing: that inoculation with cowpox could also protect humans against smallpox, which led to an even safer practice. The term for inoculation was changed to vaccination because the material was taken from cows (*vacca* in Latin).

²⁰ Grafton, “Joseph Scaliger.”

²¹ Kepler, “Geburtsjahr Christi.”

²² Peterson, “Life of Ku Yen-wu.”

²³ Ganeri, “Polycentered History of Science.”

²⁴ Gross and Sepkowitz, “Myth of Medical Breakthrough,” 54–60.

The Chinese knew in the sixteenth century that by making people a little bit sick one could prevent them from becoming very sick. With this in mind, they took samples from the crusts of wounds and mixed them with powder or liquid, which was then inserted into the bodies of others via their noses.²⁵ The Chinese had even caught on to the fact that there were minuscule creatures living in the fluid, and they understood the principle of immunity. The practice of inoculation spread from China to India, the Ottoman Empire, and to Ethiopia. Inoculation was also highly ritualized. In boys, the fluid was inserted through the right nostril and in girls, through the left. This made the practice appear rather superstitious to most Europeans. However, Lady Mary Montagu, the wife of a British diplomat in Constantinople, noticed that child mortality from smallpox was much lower in the Ottoman Empire than it was in England. She managed with great success to convince her fellow Europeans to give inoculation a try.

All these examples—from the Babylonians to the Arabs, the Europeans to the Chinese—show how people from different regions sought to recognize patterns and principles in very different phenomena, contexts, and circumstances. What is remarkable about all this is that, broadly speaking, the search for patterns was carried out the same way in different regions. One of the insights that can be drawn from the long-term history of knowledge is that in every region of the world, people start to understand (natural and cultural) phenomena by looking for patterns. But not only do they want to find patterns, they also want to discover connections among them. They look for explanations behind these patterns until, at some point, a principle emerges and that principle is explicitly defined. Perhaps the oldest principles ever proposed were those by the Greek philosopher Thales and the Indian linguist Panini, both from the sixth century BCE. Thales believed that everything was made of water. He was incorrect, but his attempt to arrive at an explanation of the patterns observed was telling. Panini, instead, tried to find a single principle for all sentence constructions. He believed it could be found in the concept of recursion, which is still a foundational principle in many linguistic theories.²⁶

An Alternative Chronology from a Global Perspective

An integrated history of the humanities and the sciences thus suggests a long-term chronology that differs from traditional chronologies which take the Scientific Revolution as its pinnacle. Although the “Scientific Revolution” has been under debate for several years now, it remains a dominant concept in much historiography of knowledge.²⁷ In our alternative chronology, the Scientific Revolution is not excluded, but the main turning points are different, namely: (1) the awareness of patterns, (2) the awareness of principles, and (3) the discovery of cyclic interactions between patterns and principles. These turning points do not appear in all places at the same time, but they do appear in all regions—and in a specific order. This leads to the following chronology:

- *The awareness of patterns*: Everywhere in the world people start with the awareness of patterns and explicit descriptions thereof. While the first evidence of patterns is found at least 40,000 years ago on mammoth tusks, we find textual descriptions of patterns from 2700 BCE onward in Babylonia.
- *The awareness of principles*: The first principles that try to explain patterns may have been supernatural beings or gods. The first rational principles that do not depend on supernatural explanations are found around 600 BCE in Greece (for nature) and India (for language).
- *The discovery of cyclic interactions between patterns and principles*: Only at a third stage do people become aware of the cyclic interaction between principles and patterns, resulting in the empirical cycle. The first full-fledged use of the empirical cycle is not found in the Western sciences but in the fifteenth-century disciplines that we currently associate with the humanities.

This alternative chronology provides an idea of the promise a global history of the humanities and the sciences may hold.²⁸ We must keep in mind that not all patterns and principles proposed in the past are valid today—the history of systematic knowledge is not cumulative! But our polycentric history does suggest a global tendency that crosses disciplines, periods, and regions, namely the development from patterns to principles to cyclic interactions between these two. Other tendencies have been found as well—such as a

²⁵ Needham and Lu Gwei-Djen, *Science and Civilization*, 154.

²⁶ Bod, *New History*, 290–97.

²⁷ See, for example, Shapin, *Scientific Revolution*; Cohen, *Modern Science*.

²⁸ See also the discussion in Raj, “Beyond Postcolonialism.”

process from descriptive to prescriptive practices and back to descriptive practices—and many more may be found as long as we are prepared to investigate the many different knowledge centers and disciplines on a par with each other.²⁹

Competing Interests

The author has no competing interests to declare.

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²⁹ See Bod, *Wereld vol patronen*, 162, 171.

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