

7 Epilogue

Scientific theories are mostly wrong. It is a matter of time for any theory to be replaced by a better one. Naturally, most of the theories developed in the dawn of science (2600 years ago) have been replaced. This does not make them unscientific.

It is a good practice to study the history of science, recognize the past contributions and give credit to those who made them. This necessitates consulting original texts as citations by later authors, particularly to the works of the greatest minds, may distort the original meaning. And there is a lot of distortion, accompanied with remarkable arrogance, about the contribution of ancient scientists in geophysics—and hydrology in particular. Certainly, the ancient theories contain elements that are blatantly incorrect, according to modern knowledge, but these do not justify treating them with arrogance. Here we preferred to highlight the more correct elements, which justify our respect and admiration.

The study of the history of the development of scientific ideas is useful as it reveals the effectiveness of thought and logic, which were the basic tools of ancient philosophers, in compiling a sensible world vision with some admirable elements, even though other elements are inconsistent according to modern knowledge. As the information provided here shows, in addition to thought and logic, observation, experimentation and measurement were all used by ancient philosophers, particularly by Aristotle.

As evident from present day terminology (meteorology, climate, hydraulics), modern science is not independent from the ancient one. Advances of the Greek antiquity have been particularly seminal for the modern science after the Renaissance. We believe that they can be seminal even for present-day science, serving again as an ideal—an ideal that, unfortunately, is no longer fully appreciated in modern academia. To this aim, we summarize the following important elements of the ancient ideal that could be relevant in remedying modern weaknesses.

1. *Posing scientific questions* (e.g., the Nile paradox) and seeking scientific explanations was a crucial historical development, which did not prevail in earlier civilizations, as exemplified by Herodotus's contrast between Greek philosophers and Ancient Egyptian intellectuals (and priests).
2. Science and philosophy were not only invented but also defined, with their meaning clarified to be the *genuine pursuit of truth*, independently of other (e.g. economic) interests.
3. Science, then called *natural philosophy*, was developed as part of philosophy, with other parts thereof, i.e., metaphysics, epistemology, logic and axiology (ethics, aesthetics), being equally developed.
4. The development of (Aristotelian) *logic* offered a powerful instrument for science to distinguish sense from nonsense as well as deduction from induction, and the relative validity of the inference based on each of these two methods.
5. The gradual development of the *scientific method*, which constitutes part of philosophy, by incorporation of observation, experience and, at a later stage, experiment, provided a solid foundation of science.
6. Central in Ancient Greek thought was *reasoning* as the main tool for the search for truth. By no means does this imply that the philosophers of Ancient Greece tended to distrust observations, as incorrectly asserted by some modern scholars (where samples are given in the Introduction). Obviously, if this happened, it would contradict reasoning per se (it is totally unreasonable to dismiss observations).
7. *Clarity* (*σαφήνεια*) was also a desideratum so strong that Aristotle identified it with truth. This is also related to the accurate accounting of the phenomena and the attainment of accurate scientific knowledge (Leshner, 2010). The introduction of terminology, i.e., of sophisticated terms whose meaning may not be identical to colloquial one, is another reflection of the clarity desideratum.
8. Formulation of a *plurality of ideas* by different scholars, as well as their debate, were vital for the development of science. It is clear from the quotations given above that Ancient Greek scholars cite and discuss each other's' ideas

and theories, mostly with proper respect and sometimes with moderate irony. Thanks to these discussions, today we are aware of opinions of philosophers whose original works are totally lost.

9. The plurality of ideas and diversity of opinions, some of which necessarily were better than other, resulted in an evolutionary process which in turn enabled *scientific progress*. It appears that such recently promoted ideas as that of a “settled science” did have a place in the ancient environment of scientific inquiry.

10. An important development that expedited scientific progress was the *creation of Philosophical Schools*, functioning as centres of higher-level education and research, similar to modern universities. Plato’s Academy, Aristotle’s Lyceum (or Peripatetic School), Epicurus’s Kepos (meaning garden), Zeno’s Stoa (meaning arcade) were some of the most famous. After nine centuries of continuous operation, they were massively closed in 529 AD by an infamous emperor Justinian’s edict, which marked a societal paradigm shift and a millennium-long regression in scientific inquiry.

11. The communication of ideas among philosophers and to the public was organized in the form of books. Within this practice, a writing style or code was developed, characterized by critical literature review and expression of own thoughts, using a sophisticated language. This writing style is more or less followed even in present day, as can be inferred by inspecting several extracts from Ancient Greek texts given above.

12. According to Herodotus [OT22], the motivation of philosophers was their ambition to achieve reputation for wisdom. Notwithstanding that this does not look an unethical incentive, we may assert that the development of science complies with the development of axiology and of ethical values, including the promotion of the truth as an ethical value and the *modesty* of those seeking it. Even the term *philosophy* (*φιλοσοφία*) reflects this modesty. Notably, the term *philosopher* (*φιλόσοφος*) replaced the earlier term *sophos* (*σοφός*, translated in English as *sage* or *wise*, as in the expression “Seven Sages”; see section 2). According to an Heraclitian aphorism, *wise is only one* (*ἐν τῷ σοφῶν*, meaning something supernatural, i.e. God) and henceforth Pythagoras introduced the term *philosopher*, meaning *lover* (or *friend*) of *wisdom* (*φίλος σοφίας*). This is clarified in the following quotation:

Pythagoras was the first to name it philosophy and himself a philosopher [...] for no man is wise, but God alone.
(Diogenes Laertius, Lives of the Philosophers, 1.12; original: [OT41])

The above points may be useful to learn several lessons that are pretty relevant in our times. First—and with reference to point 2—it is useful to have in mind that, in accordance to Plato’s definition quoted in the Introduction, scientists are “lovers of the vision of truth”. The importance of seeking the truth is also highlighted by Aristotle in the following quotations:

Socrates is dear [friend], but truth is dearest. (Ammonius, Life of Aristotle; original: [OT41])

Still perhaps it would appear desirable, and indeed it would seem to be obligatory, especially for a philosopher, to sacrifice even one’s closest personal ties in defense of the truth. Both are dear to us, yet it is our duty to prefer the truth (Aristotle, Nicomachean Ethics 1096a11; original: [OT42]).

Arguably, this ancient ideal is forgotten in modern science, where research depends of funds in directions that are prescribed by economic or political interests and where academic careers depend on the success in attracting such funds. Mixing up of science with politics and economic interests has been promoted by many as a positive development, but in our opinion this is a negative development that only promises decadence. It is recalled that Plato, Aristotle and other Greek philosophers, while clarifying the meaning of science and philosophy, they used different terms for knowledge driven by political and economic interests and those seeking it, i.e., *sophistry* (*σοφιστεία*) and *sophist* (*σοφιστής*), respectively (see also Taylor, 1919; Horrigan, 2007; Papastephanou, 2015; Koutsoyiannis, 2021).

Regression in modern science also appears with respect to points 3-5. While the tradition has remained that the highest degree in education is called Philosophy Doctor, or PhD, little “Ph” (if at all) is actually contained in doctorate research, and

most PhD students are not aware of the philosophical premises of the scientific method. Furthermore, with reference to point 7, clarity may have ceased to be a desideratum, a development possibly influenced by politics. And finally, with reference to points 8-9, while diversity is currently promoted in several societal functions, diversity of opinion on scientific issues is often discouraged and scientific debate on some sensitive issues is virtually prohibited.

An additional lesson, perhaps not obvious from our discourse, is that it takes courage to formulate scientific theories—now as well as then. A relevant extract is the following, by Plutarch:

The first man to put in writing, most clearly and most courageously of all, the explanation of the moon's illumination and darkness, was Anaxagoras. But he was no ancient authority, nor was his account in high repute. It was still under seal of secrecy, and made its way slowly among a few only, who received it with a certain caution rather than with confidence. For people did not tolerate the natural philosophers and stargazers, as they were then called, because they reduced the divine agency down to unreasoning causes, blind forces, and necessary incidents. Even Protagoras was exiled, Anaxagoras was imprisoned and with difficulty rescued by Pericles, and Socrates, though he had nothing whatever to do with such matters, nevertheless lost his life because of philosophy. (Plutarch, Nicias, 23; translation by I. Velikovsky in *Anaxagoras*^{††††}; original: [OT43])

Note that Anaxagoras was charged of impiety and was sentenced to death by the Athenian court. He avoided this penalty by leaving Athens, and he spent his remaining years in exile. From Plutarch's information we may infer that Anaxagoras enjoyed the gratitude of his pupil Pericles. Similar is the relationship of Aristotle and his pupil Alexander the Great. This, however, does not happen all the time in history. (A remarkable modern counterexample is the contribution of Andrey Kolmogorov, Pavel Alexandrov and other students of Nikolai Luzin, to convict their mentor likely to death—an attempt which was prevented by intervention of Pyotr Kapitsa and ultimately by a decision of Stalin; Graham and Kantor, 2009). On the other hand, Socrates, even though he too had prominent pupils like Plato and Xenophon, paid off with his life the political actions that brought calamity to Athens of some other of his pupils, such as Critias and Alcibiades. Examples of prominent scientists who also lost their lives for their ideas in later periods are the Greek (female) astronomer, mathematician and philosopher Hypatia (c. 360 – 415 AD) and the Italian astronomer, physicist and engineer Giordano Bruno (1548 – 1600). A counterexample is Galileo Galilei (1564 –1642) who, despite publicly expressing his revolutionary scientific ideas that triggered the establishment's hostility, he was able to save his life. Bertolt Brecht also taught a lesson about this non-heroic path in his story “Maßnahmen gegen die Gewalt” (Measures against Authority; Fothergill, 2007).

Courage is a necessary condition for formulating scientific theories but it does not suffice for the acceptance of the theories, even if they are correct. Not even Authority is a sufficient condition. Certainly, the dilemma posed by Russell, Observation vs Authority (see Introduction), which we prefer to reformulate as Scientific Truth vs. Authority, is relevant. Undoubtedly, the opposition between Science and Authority is important in order to interpret the history of science. However, the above discourse points to another characteristic dilemma, Scientific Truth vs. Public Acceptance, where scientists are not to be excluded from Public. This is both diachronic and also very modern. The case of Aristotle's correct theory on the Nile flooding, which was also confirmed by observation through the first scientific expedition in history, is the most characteristic. Neither the fact that Aristotle was an Authority, nor the backing of the theory by Observation helped acceptance of the theory. Aristarchus's heliocentric model is another similar case. Both scientific theories were kept hidden or rejected for centuries. Mythology has been more popular than science not only in ancient times but also in modern ones (cf. the “nitre theory” on the Nile flooding).

As implied in several of the modern-day quotations given in the Introduction, the Authority of important ancient philosophers such as Plato and Aristotle, has been regarded an obstacle to subsequent scientific progress because of the

^{††††} <http://www.varchive.org/ce/orbit/anax.htm>. Note that I. Velikovsky also experienced extreme hostility from the 20th century scholars for his ideas.

tendency of later philosophers to accept their opinions almost without question. However, the spectacular scientific progress during the Hellenistic period and the above example of aversion to Aristotle's explanation of the Nile flows clearly refute such claims. We believe that it is the intellectual decadence, accompanied with the closure of the Philosophical Schools in the sixth century AD, that led to regression—not the preceded giants, who offered their shoulders for the next generations to stand on. Signs of similar decadence are also present in our era, particularly in the Western World, where ideas are being replaced by ideologies and reason by stereotypes of "correctness". Hopefully this is less the case in the Eastern World. As the Earth is round, the very terms Western and Eastern presuppose some reference point—and this is Greece. We, thus, believe that revisiting the values developed in the Greek antiquity is a proper measure against modern decadence.