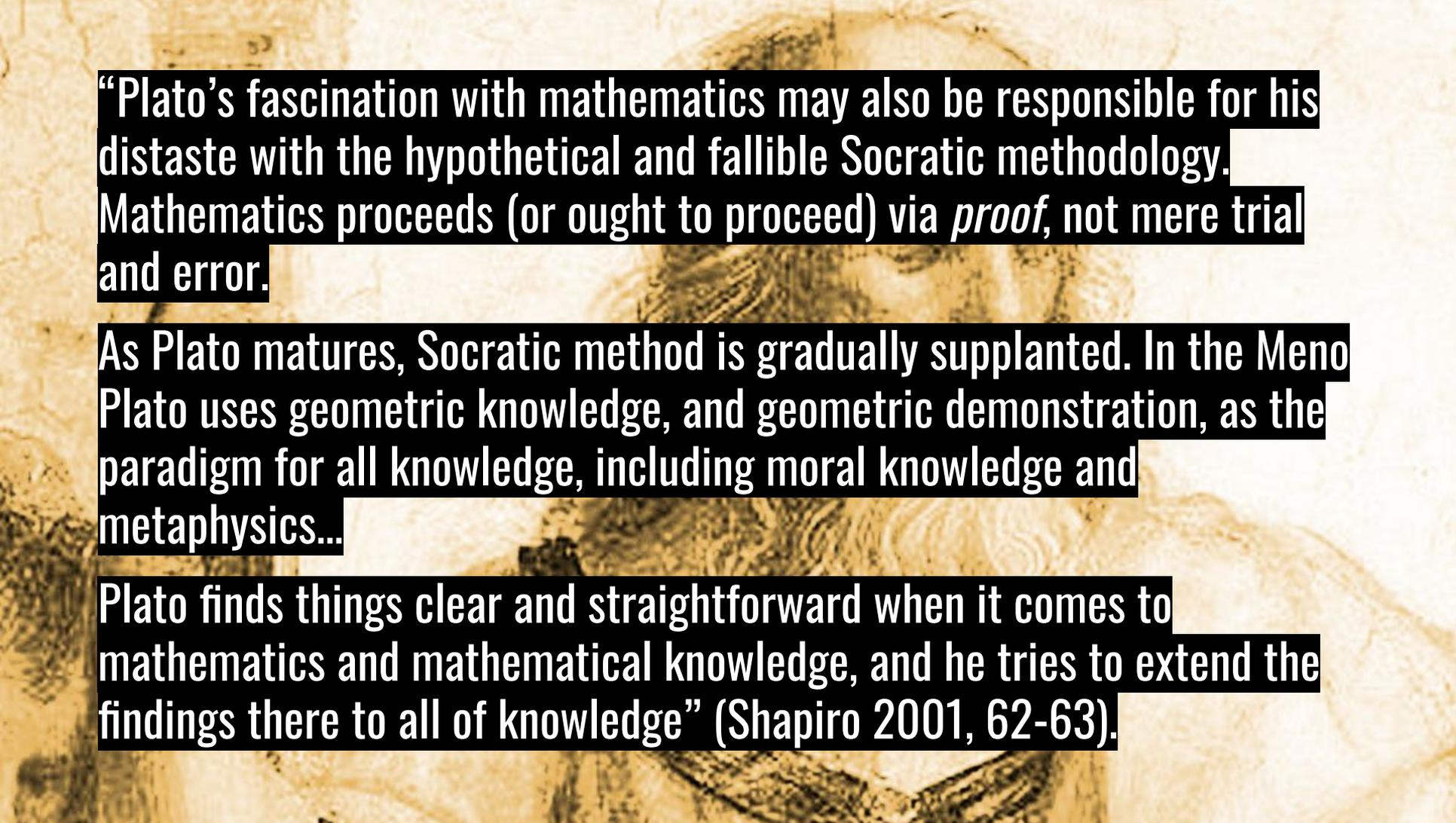




Appendix A: Plato on Math

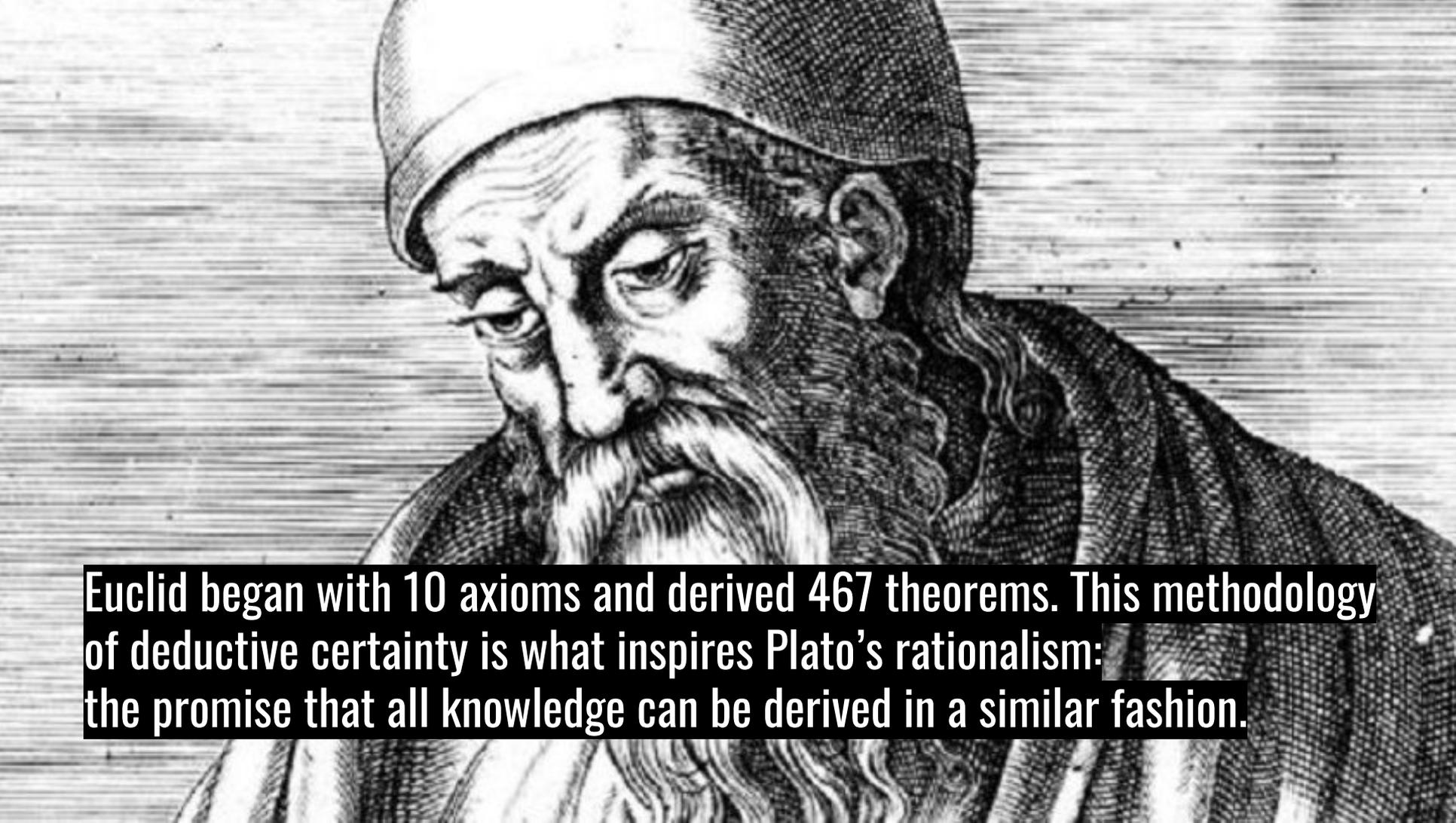
Understanding Plato



“Plato’s fascination with mathematics may also be responsible for his distaste with the hypothetical and fallible Socratic methodology. Mathematics proceeds (or ought to proceed) via *proof*, not mere trial and error.

As Plato matures, Socratic method is gradually supplanted. In the Meno Plato uses geometric knowledge, and geometric demonstration, as the paradigm for all knowledge, including moral knowledge and metaphysics...

Plato finds things clear and straightforward when it comes to mathematics and mathematical knowledge, and he tries to extend the findings there to all of knowledge” (Shapiro 2001, 62-63).



Euclid began with 10 axioms and derived 467 theorems. This methodology of deductive certainty is what inspires Plato's rationalism: the promise that all knowledge can be derived in a similar fashion.

600 BCE

500 BCE

400 BCE

300 BCE

Socrates (470-399) fights at
Battle of Delium in 424.

Aristotle (384-322)
opens the Lyceum in
335.

Alexander
(356-323) reigns
from 336-323.

Peloponnesian
War (431-404).

Greco-Persian
Wars
(499-449).

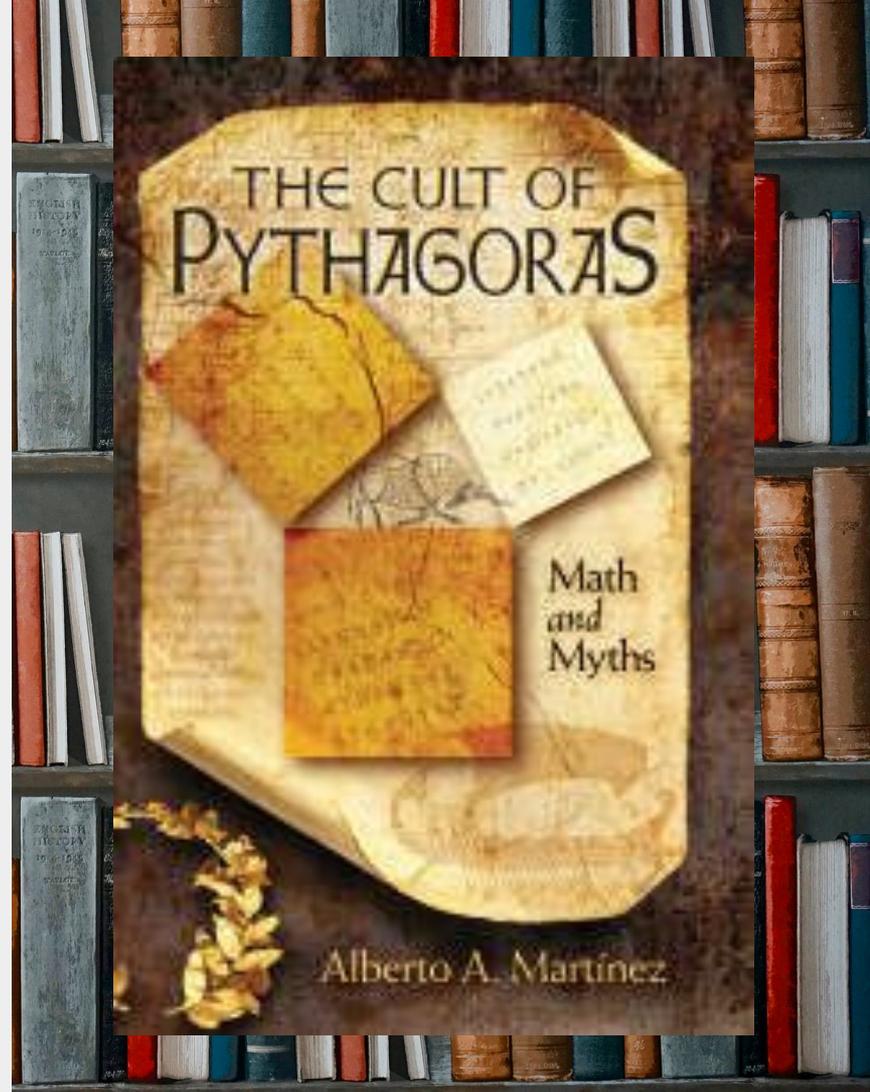
Plato (~425-348) opens the
Academy in 380.

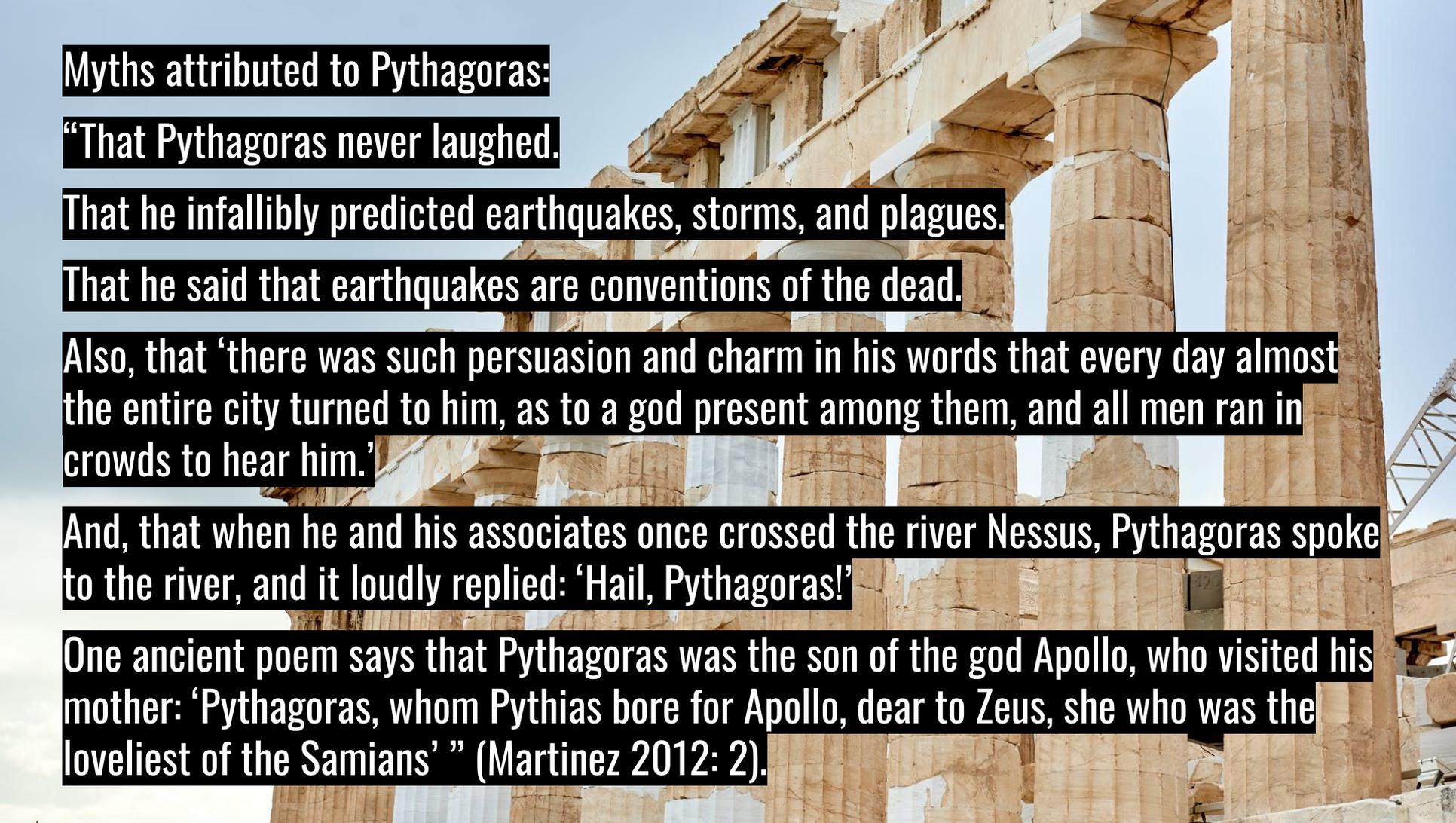
Zeno (~334-262)
finds his Stoic School
around 302.

Pythagoras (~570-~495)
initiates the Pythagorean
Brotherhood in ~530-520.

Euclid (~325-270)
publishes *Elements*
circa 300 BCE.

One also has to understand that through the history of their field, mathematicians have tended to exaggerate and mythologize some of their most cherished figures (see Martinez 2012).





Myths attributed to Pythagoras:

“That Pythagoras never laughed.

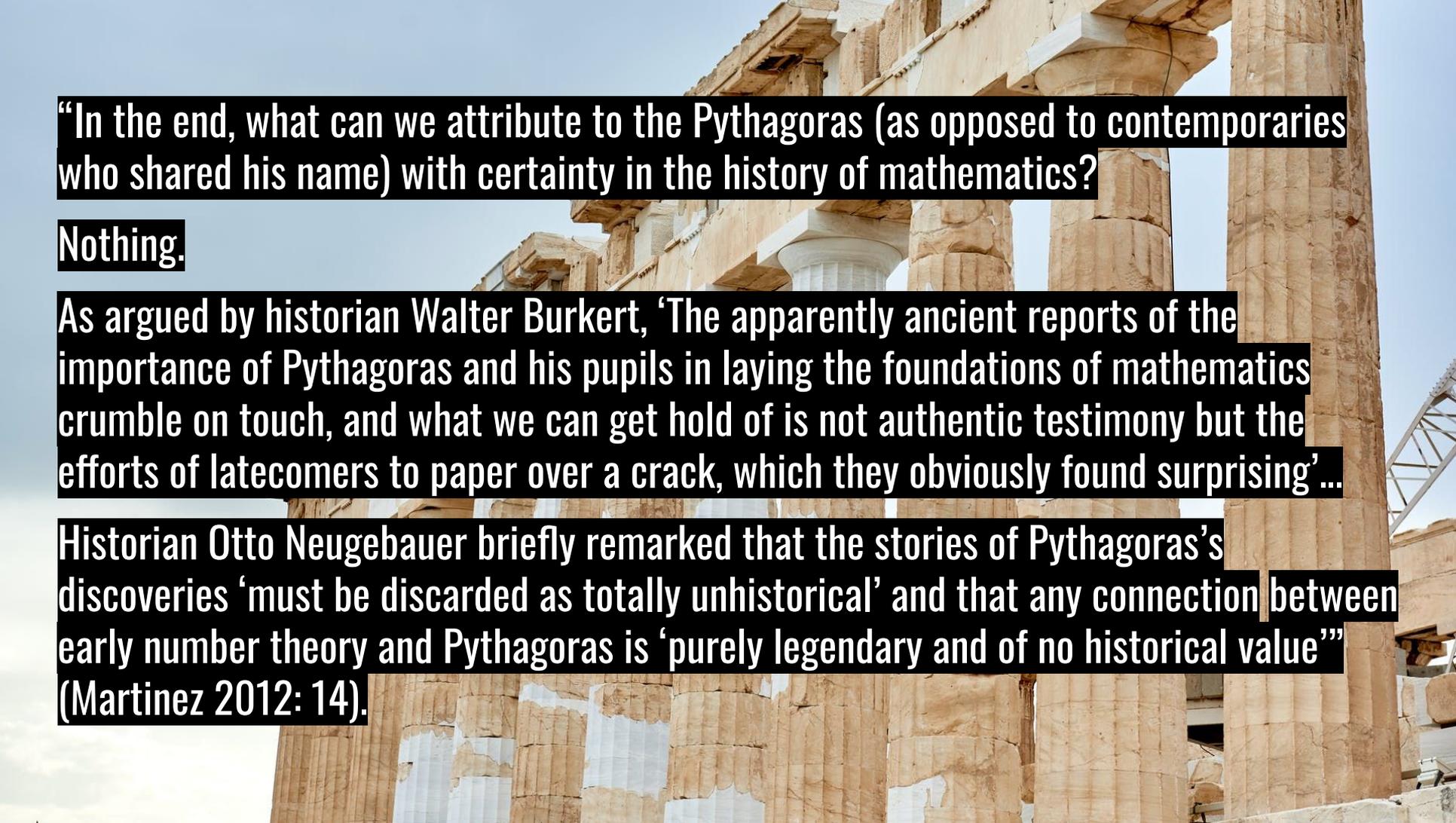
That he infallibly predicted earthquakes, storms, and plagues.

That he said that earthquakes are conventions of the dead.

Also, that ‘there was such persuasion and charm in his words that every day almost the entire city turned to him, as to a god present among them, and all men ran in crowds to hear him.’

And, that when he and his associates once crossed the river Nessus, Pythagoras spoke to the river, and it loudly replied: ‘Hail, Pythagoras!’

One ancient poem says that Pythagoras was the son of the god Apollo, who visited his mother: ‘Pythagoras, whom Pythias bore for Apollo, dear to Zeus, she who was the loveliest of the Samians’ ” (Martinez 2012: 2).

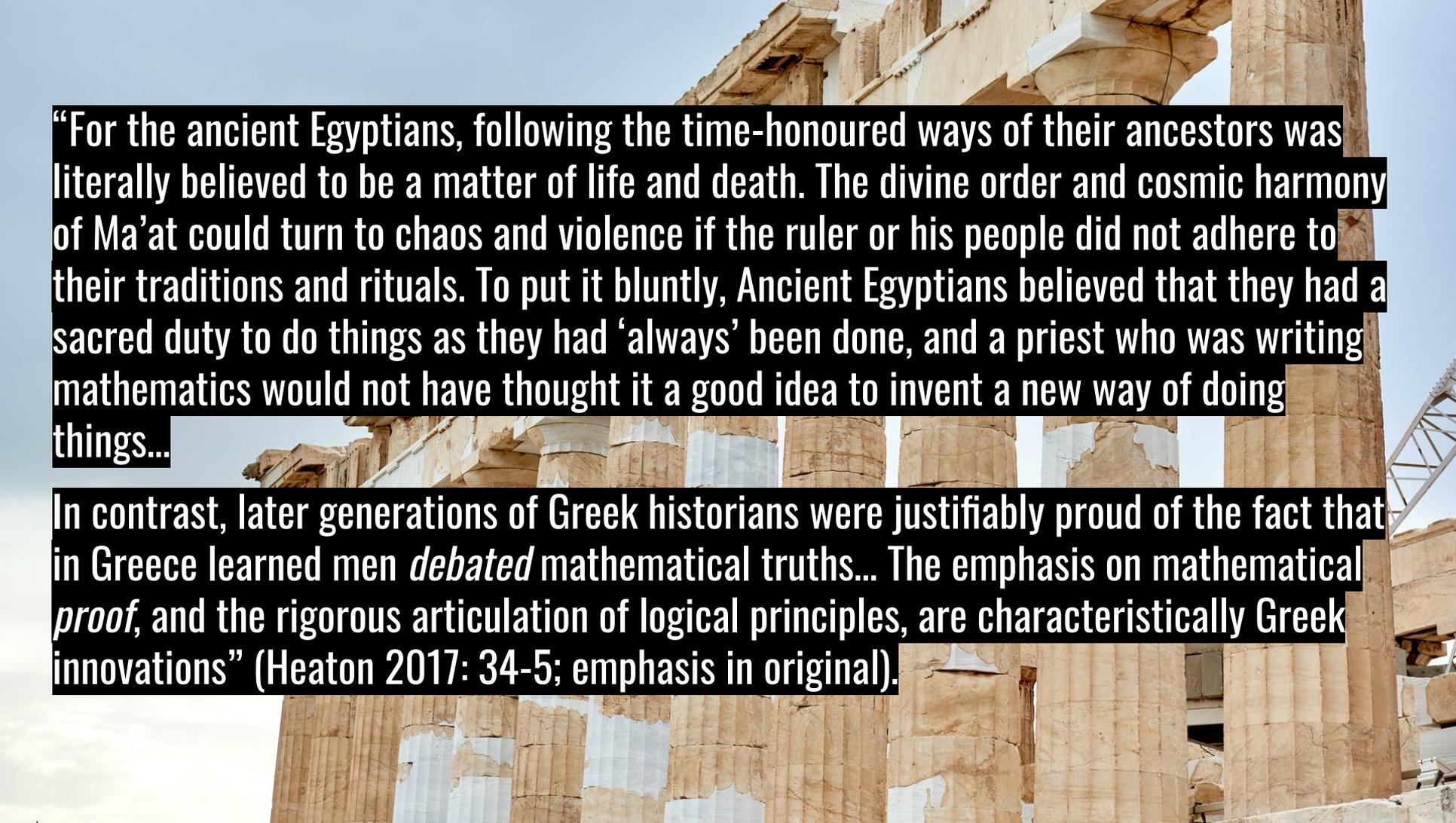
The background of the entire image is a photograph of ancient Greek temple architecture, featuring several tall, fluted columns made of light-colored stone. The columns are arranged in a row, and the sky is visible in the background. The text is overlaid on this image in white font with a black background for readability.

“In the end, what can we attribute to the Pythagoras (as opposed to contemporaries who shared his name) with certainty in the history of mathematics?”

Nothing.

As argued by historian Walter Burkert, ‘The apparently ancient reports of the importance of Pythagoras and his pupils in laying the foundations of mathematics crumble on touch, and what we can get hold of is not authentic testimony but the efforts of latecomers to paper over a crack, which they obviously found surprising’ ...

Historian Otto Neugebauer briefly remarked that the stories of Pythagoras’s discoveries ‘must be discarded as totally unhistorical’ and that any connection between early number theory and Pythagoras is ‘purely legendary and of no historical value’” (Martinez 2012: 14).

The background of the entire image is a photograph of an ancient Egyptian temple. It features several large, papyrus-bundle-shaped columns made of light-colored stone. The columns are arranged in a row, and some show signs of wear and repair with white patches. The sky is a clear, pale blue.

“For the ancient Egyptians, following the time-honoured ways of their ancestors was literally believed to be a matter of life and death. The divine order and cosmic harmony of Ma’at could turn to chaos and violence if the ruler or his people did not adhere to their traditions and rituals. To put it bluntly, Ancient Egyptians believed that they had a sacred duty to do things as they had ‘always’ been done, and a priest who was writing mathematics would not have thought it a good idea to invent a new way of doing things...

In contrast, later generations of Greek historians were justifiably proud of the fact that in Greece learned men *debated* mathematical truths... The emphasis on mathematical *proof*, and the rigorous articulation of logical principles, are characteristically Greek innovations” (Heaton 2017: 34-5; emphasis in original).

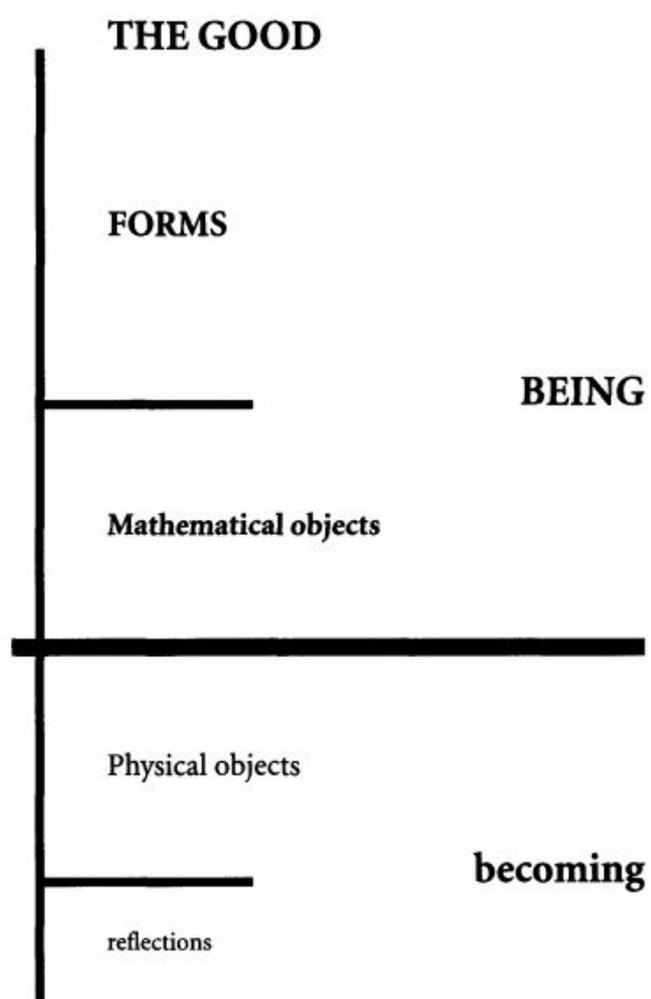
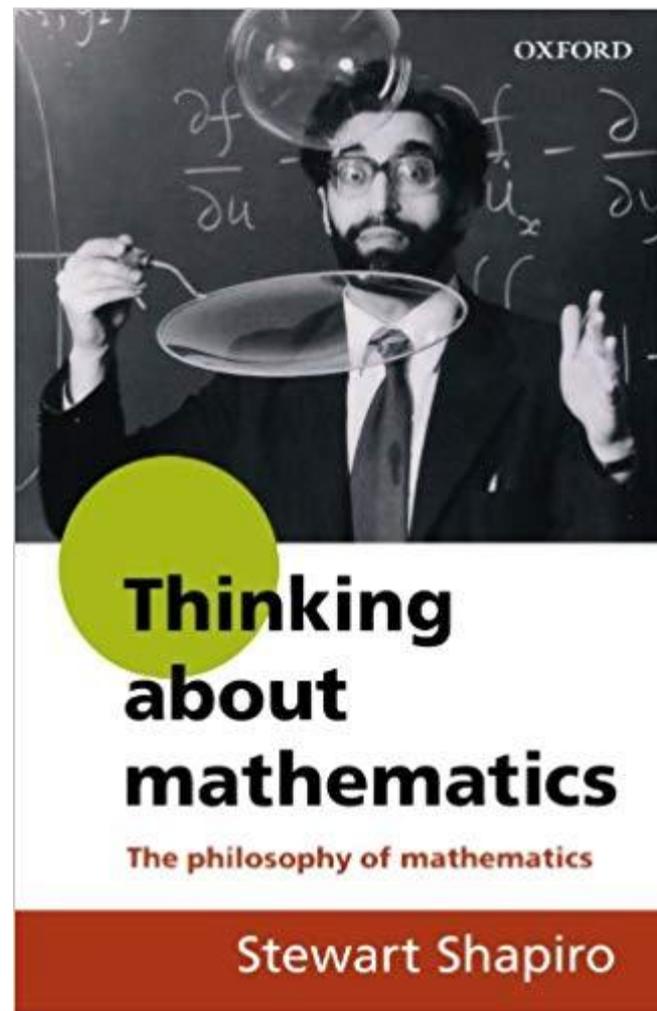
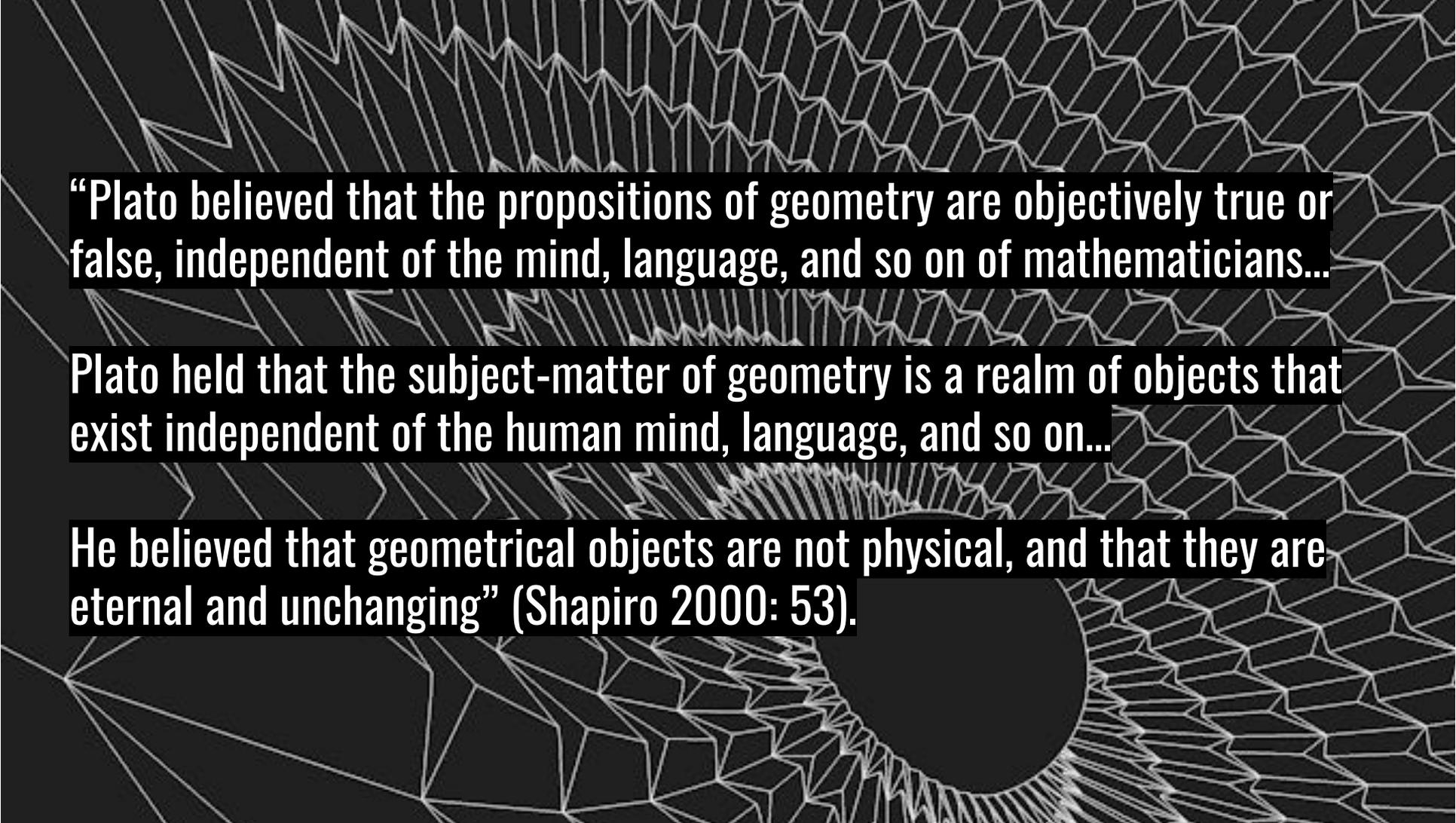


Fig. 3.1. The divided line





“Plato believed that the propositions of geometry are objectively true or false, independent of the mind, language, and so on of mathematicians...

Plato held that the subject-matter of geometry is a realm of objects that exist independent of the human mind, language, and so on...

He believed that geometrical objects are not physical, and that they are eternal and unchanging” (Shapiro 2000: 53).

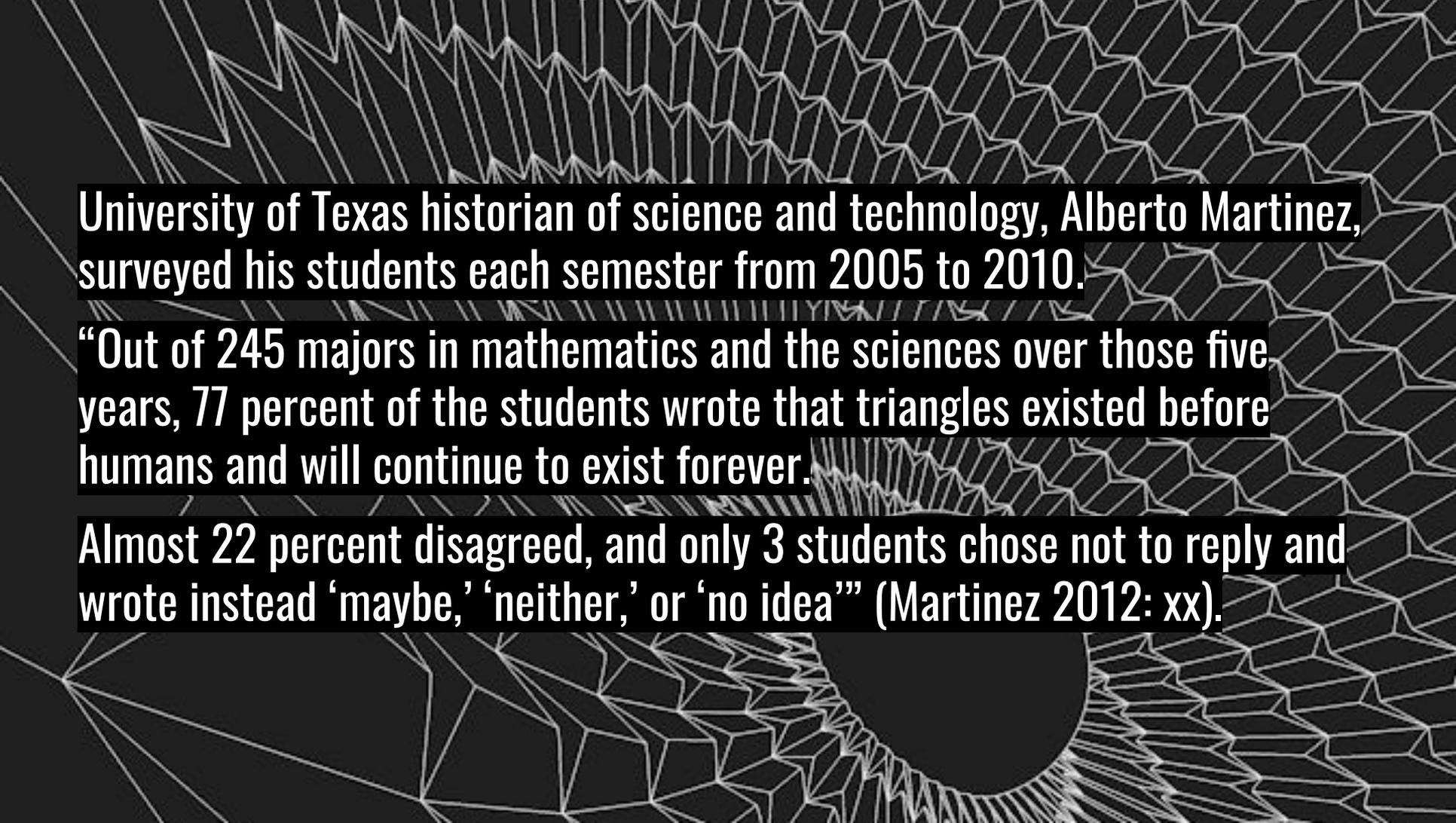
Some people might object that numbers are clearly made up. This might not be the way working scientists think of it, though...

For example two-thirds of respondents answered that the real numbers are “real” in a recent survey by *Physics World*...

In 2001, the magazine Physics World ran a poll on the philosophical view of physicists.

Among various questions, about the reality of electrons, genes, atoms, emotions, and lightwaves, the survey also asked about beliefs regarding numbers...

	Real	Not Real	Not Sure
The Earth	93%	3%	4%
Stones	93%	3%	4%
Genes	83%	8%	9%
Electrons	84%	9%	7%
Light Waves	68%	20%	12%
Real Numbers	66%	26%	8%
Imaginary Numbers	43%	44%	13%



University of Texas historian of science and technology, Alberto Martinez, surveyed his students each semester from 2005 to 2010.

“Out of 245 majors in mathematics and the sciences over those five years, 77 percent of the students wrote that triangles existed before humans and will continue to exist forever.

Almost 22 percent disagreed, and only 3 students chose not to reply and wrote instead ‘maybe,’ ‘neither,’ or ‘no idea’” (Martinez 2012: xx).