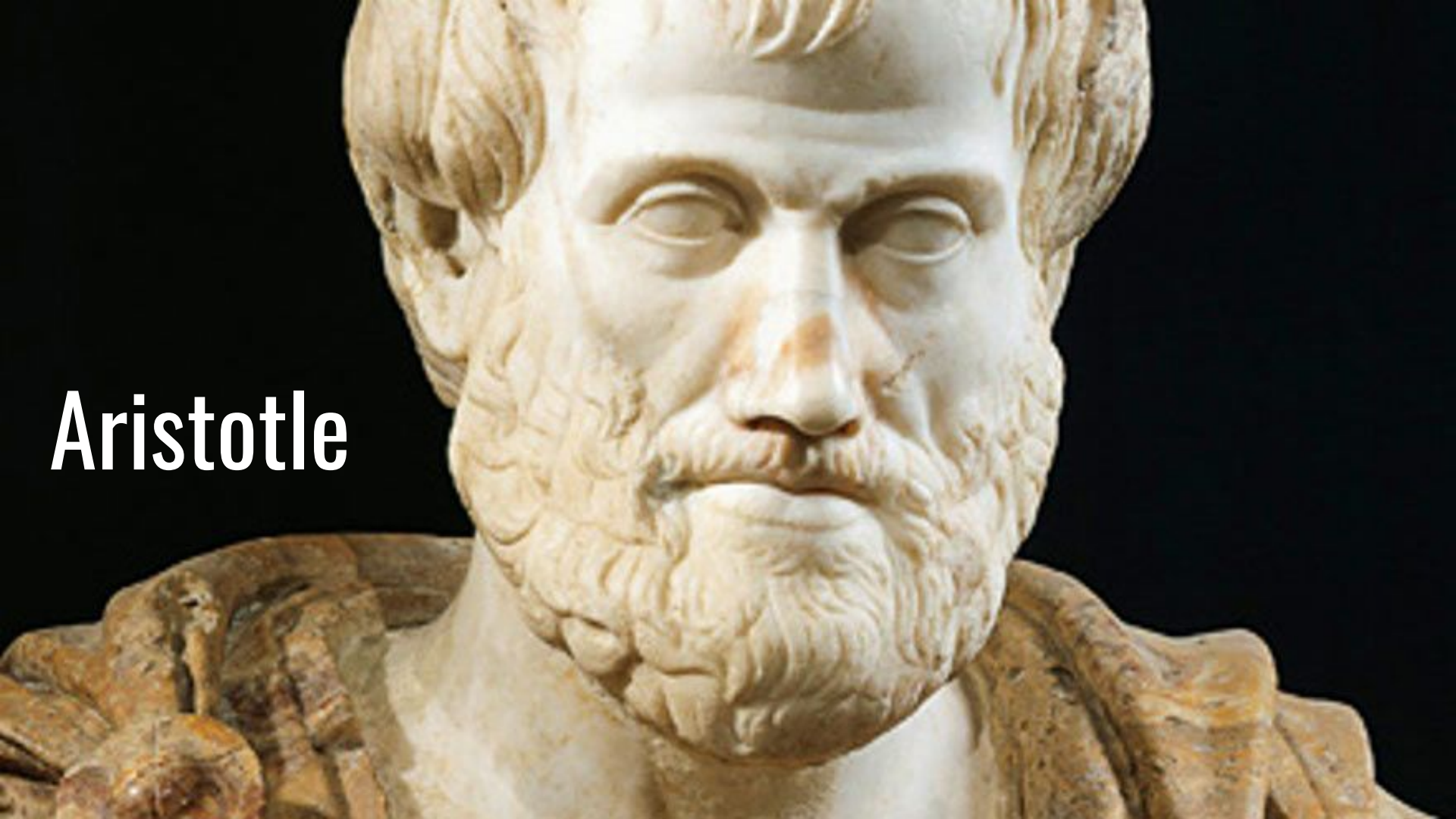
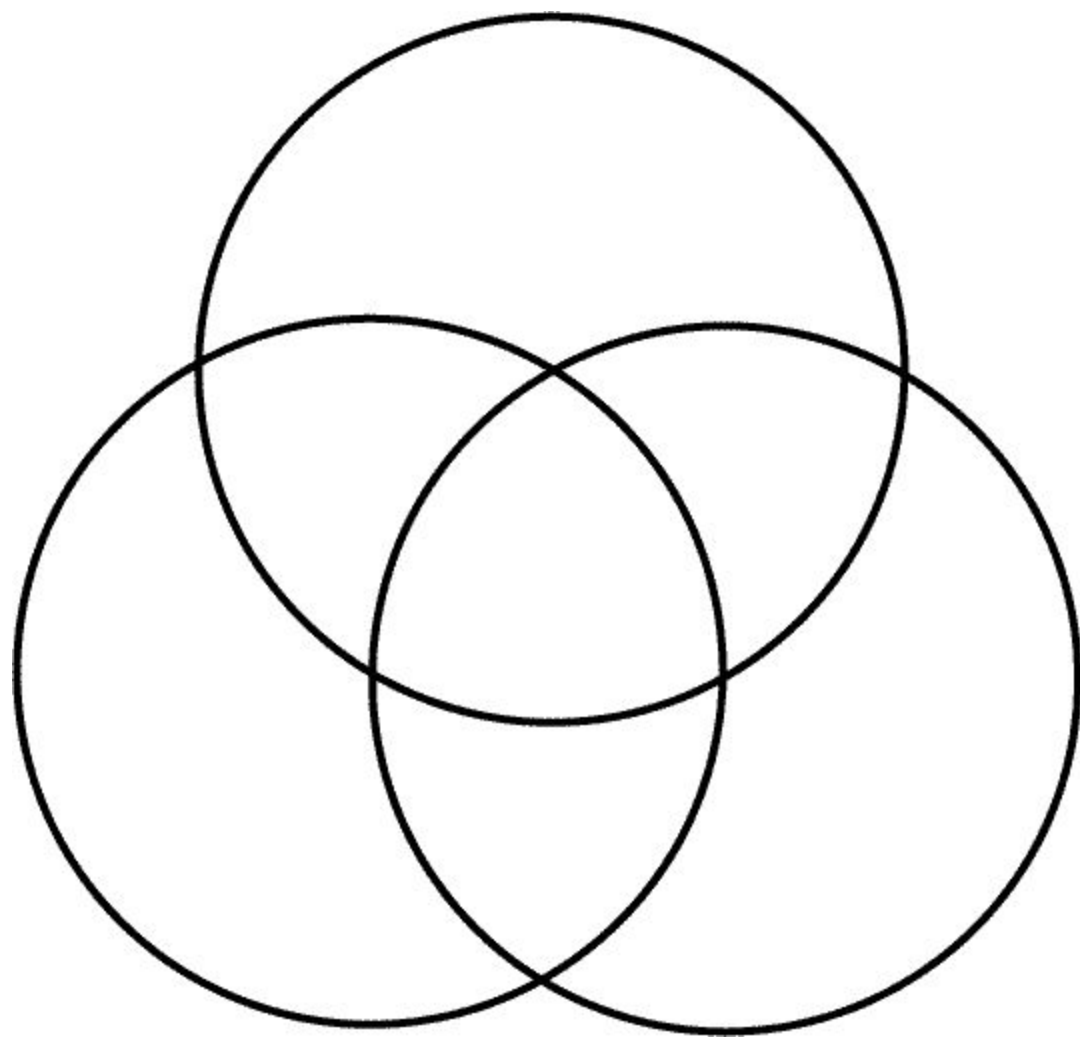
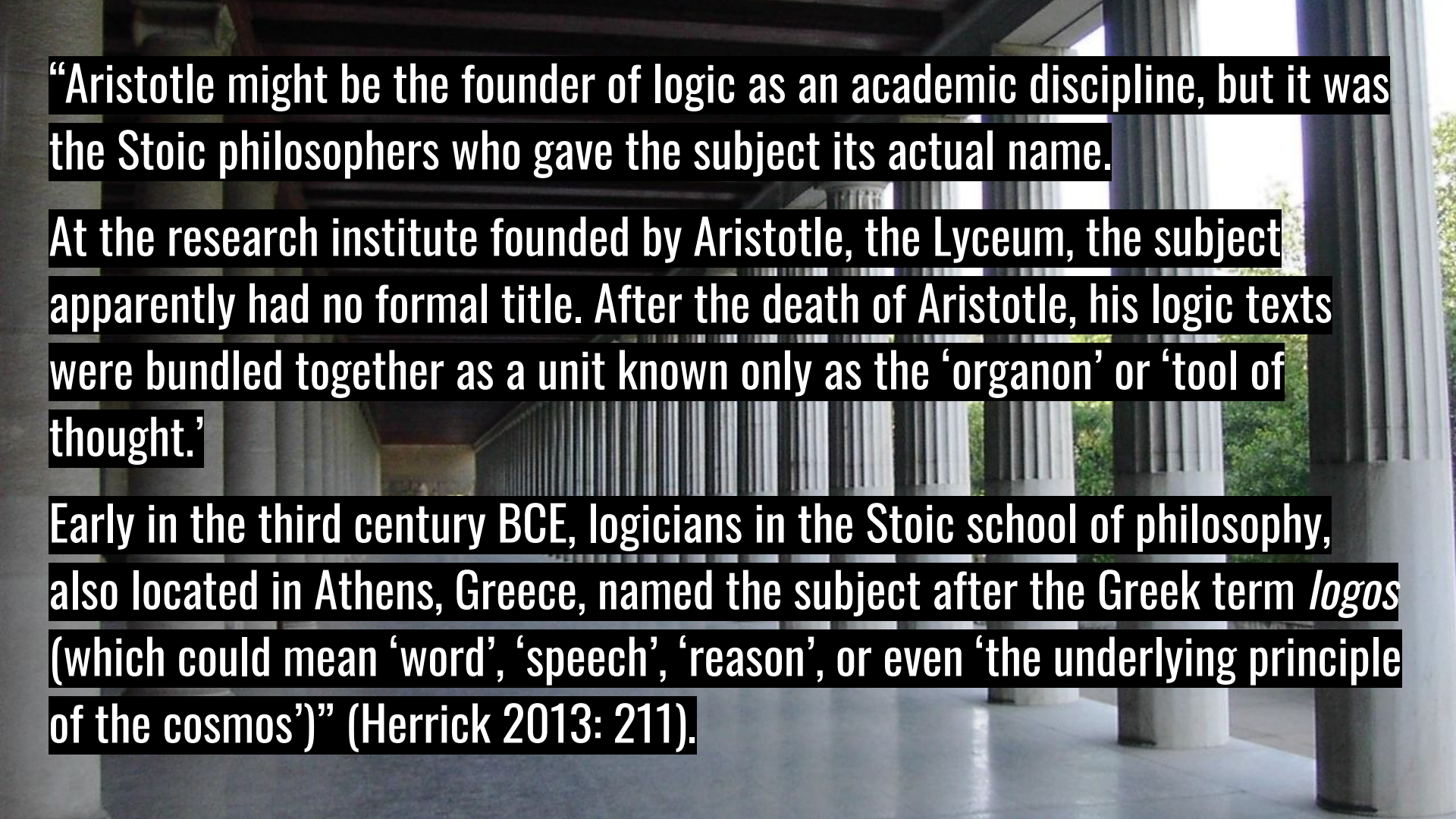


TL (Pt. I)

**Aristotle**







“Aristotle might be the founder of logic as an academic discipline, but it was the Stoic philosophers who gave the subject its actual name.

At the research institute founded by Aristotle, the Lyceum, the subject apparently had no formal title. After the death of Aristotle, his logic texts were bundled together as a unit known only as the ‘organon’ or ‘tool of thought.’

Early in the third century BCE, logicians in the Stoic school of philosophy, also located in Athens, Greece, named the subject after the Greek term *logos* (which could mean ‘word’, ‘speech’, ‘reason’, or even ‘the underlying principle of the cosmos’)” (Herrick 2013: 211).





# Truth-functional Logic: Important Concepts

Truth-functional Logic, aka Propositional Logic, is an approach to logical theory that breaks down reasoning to the level of complete declarative sentences, aka propositions.

A sentence is **truth-functional** if it can be true or false.

**Declarative sentences** are sentences that describe a state of affairs; they are the only type of sentences that are truth-functional.

A **proposition** is the *thought* expressed by a declarative sentence.

**E.g., of non-propositions**





**“What’s a pizookie?”**



**“Please stop talking.”**

***Shut up.***





**“АНННН!”**

Question:

How should we understand **propositions**?

---

# Storytime!

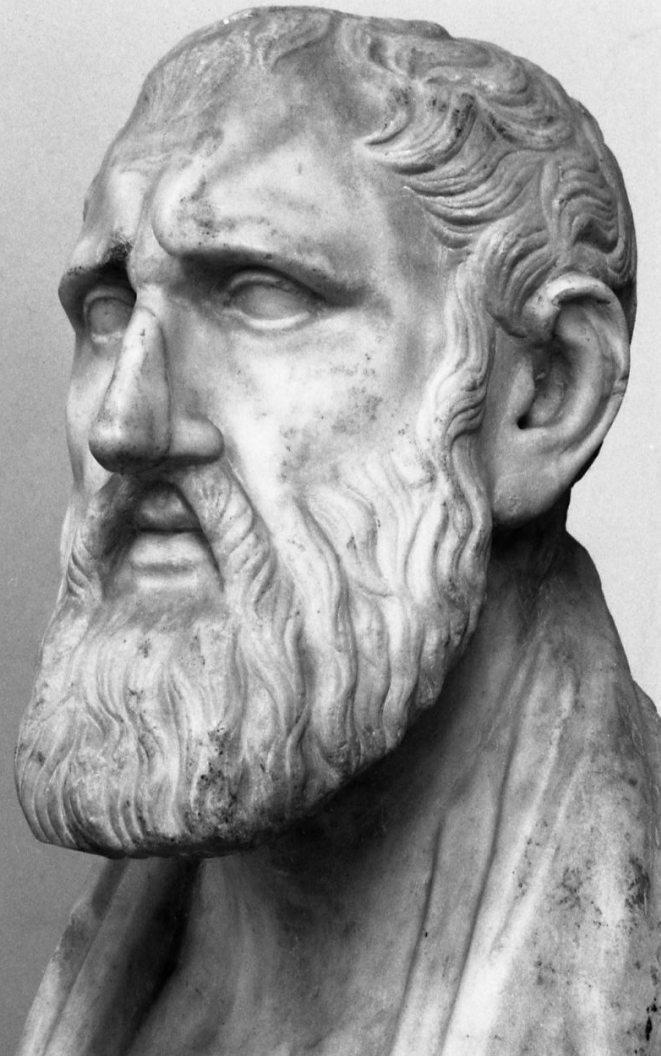


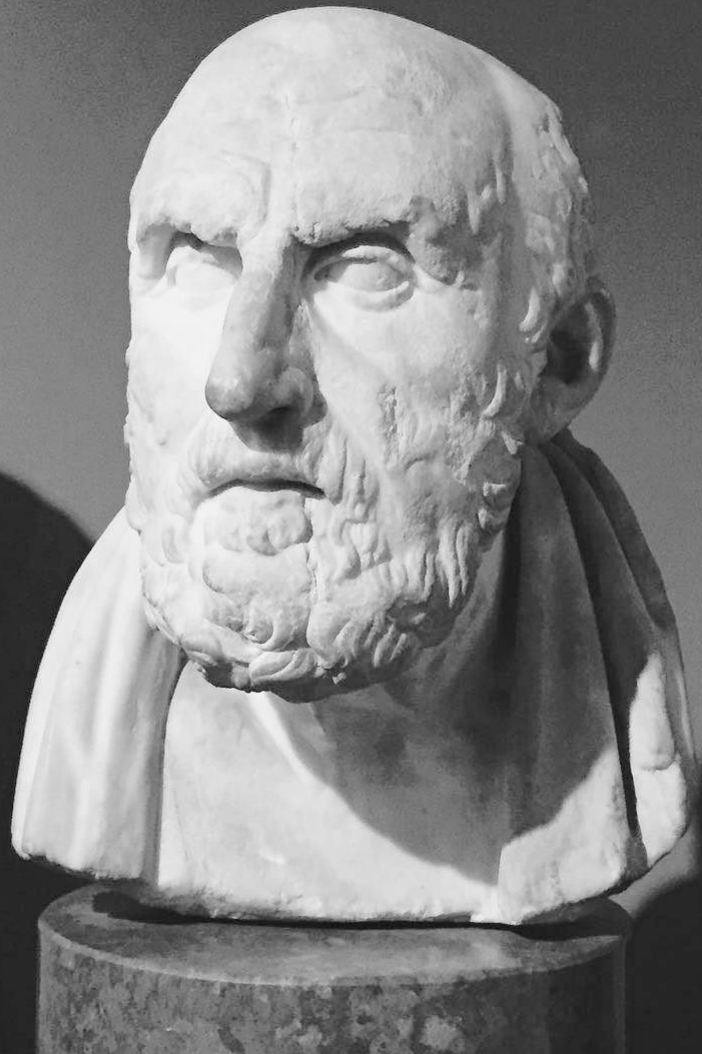


**“The Stoics argued that reason (*logos*) is the underlying basis of the *cosmos*—the Greek term for the universe understood as a systematically ordered whole...”**

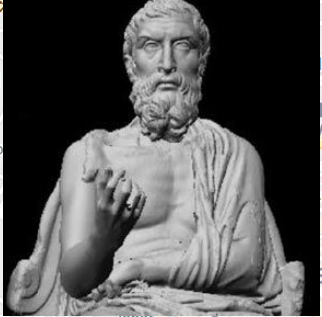


**“The Stoics [a school of Philosophy founded by Zeno of Citium, pictured right] are best known for their philosophy of ethics, which included the seed idea for the modern doctrine of universal human rights. Every human being, they argued, contains a spark of the divine reason, or logos, that pervades the universe and keeps the system in balance...”**





**“A department of logic was inaugurated by Chrysippus, the third head of the Stoa, who became one of the most prolific logicians of history... Chrysippus is generally considered the greatest logician of antiquity after Aristotle. However, from the start, the philosophers and logicians of the Stoa faced some stiff competition...”**



Map data ©2019 Google

**“Thus, by the time the Stoics appeared on the scene, an active community of logicians at Aristotle’s Lyceum dominated the field of logic, conducting research in every area of the subject, or *almost* every area.**

**The Stoic philosophers... stumbled on something the great Aristotle, and all of his students, had completely missed” (Herrick 2013: 213-14).**



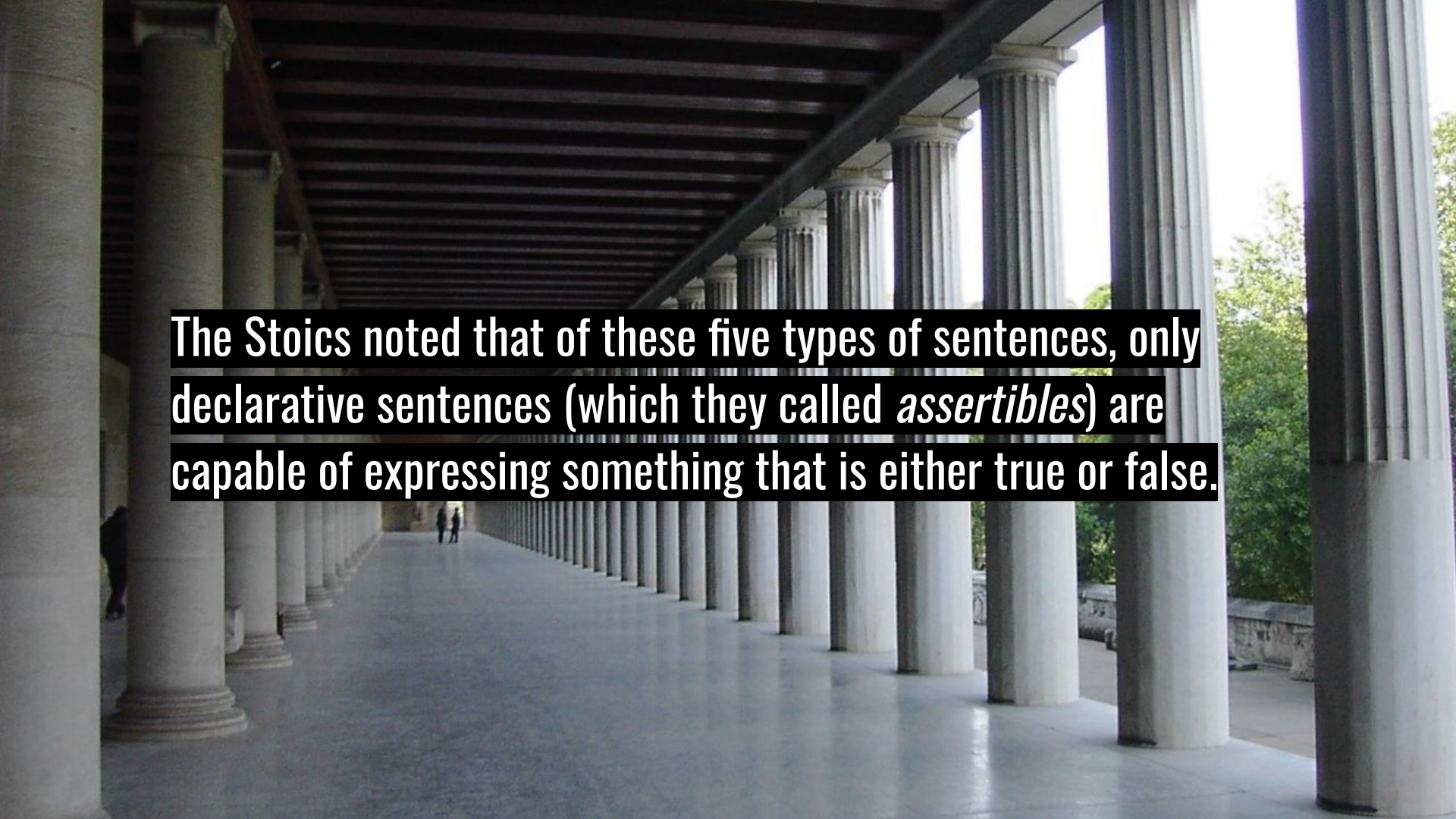
# Truth-functions

# The Five Kinds of Complete Sentences

1. Questions
2. Commands
3. Exclamations
4. Performatives
5. Declaratives

---

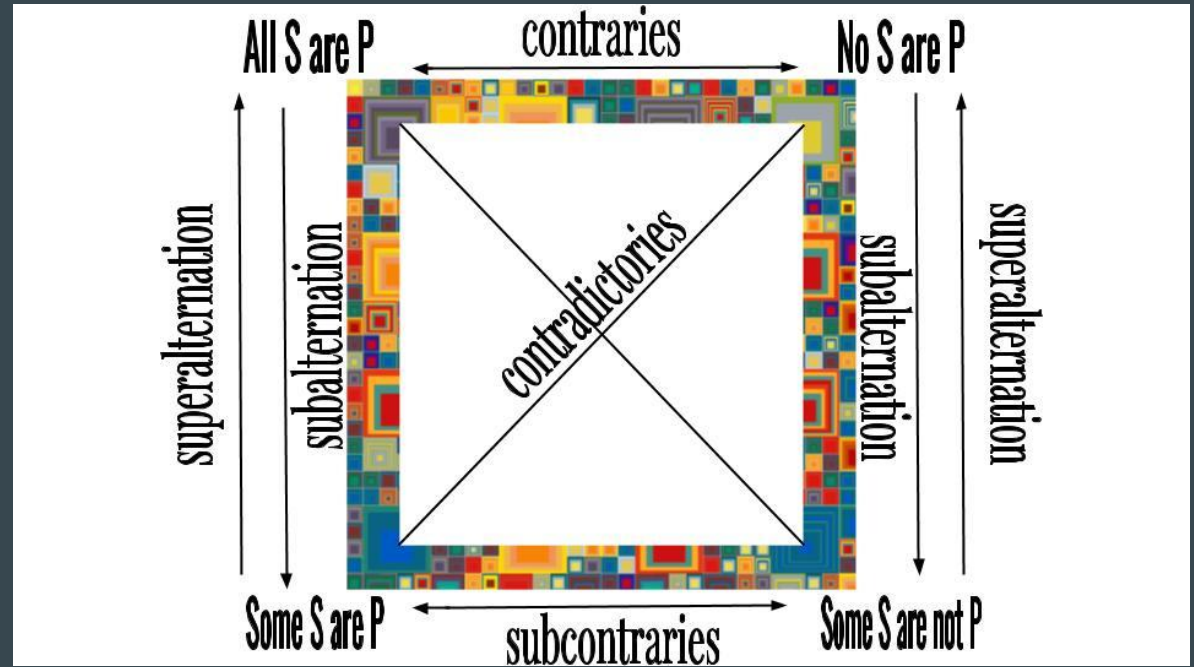




The Stoics noted that of these five types of sentences, only declarative sentences (which they called *assertibles*) are capable of expressing something that is either true or false.

## NOTE!

Since only propositions are truth-functional, the Stoics stipulated that a properly stated argument contains only **propositions**.



# Compound Sentences

A **compound sentence** is any sentence that contains one or more sentences and one or more sentence connectives.

E.g., “Blinky is home and Pinky is at school.”

---

# Component Sentences

A **component sentence** is a sentence within a compound sentence.

E.g., “**Blinky is home** and **Pinky is at school.**”

---

# Simple Sentences

A **simple sentence** is any sentence that is not a compound sentence.

E.g., “Blinky is home”

---

# Sentence Connectives

A **sentence connective** (also called a **sentence operator**) is a word or phrase that forms a compound sentence out of one or more sentences.

E.g., “Blinky is home **and** Pinky is at school.”

---



**Although Stoic logic concerned itself with only four connectives, we will look at a logical system with five connectives...**

# Truth-value

If a sentence expresses the truth, instead of simply calling it true, we shall say it has the **truth-value** of true.

---

# Functions

A **function** is a rule that relates one set of values to another set of values.

E.g., a successor function:

$$S(n) = n + 1$$

$$S(2) = 3$$

---

# Truth-functions

A **truth-function** is a rule that relates one set of truth-values to another set of truth-values.

---

## **Stoic insight:**

Truth-values and truth-functions reside within compound sentences with truth-functional connectives.

# Negations

If a sentence negated is true, the negation as a whole is false.

If a sentence negated is false, the negation as a whole is true.

---



Consider...

**It is not the case that**  
**Angie is an atheist**



# Conjunctions (*and* compounds)

Only when both conjuncts  
are true is the whole  
compound true.

---

Consider...

**Angie is an atheist**

**and**

**Lola's sister is  
pregnant.**



# Disjunctions (*or* compounds)

Only when both disjuncts  
are false is the whole  
compound false.

---

Consider...

**Angie is an atheist**

**or**

**Lola's sister is  
pregnant.**



# Conditionals (*if, then* compounds)

When the antecedent is true and the consequent is false, the conditional as a whole is false.

All other times, the conditional as a whole is true.

---

Consider...

**If Angie is voting,**

**then**

**Angie is over 18.**



# Biconditionals *(if, and only if compounds)*

Only when the truth-values  
match is the compound  
true.

---



Consider...

**You're divorced**

**if and only if**

**You signed the  
divorce papers.**



**Instead of using natural language,  
however, we will be using a specialized,  
or formal, language...**

# Sentence Connectives of TL—

- Tilde ( $\sim$ ): not
- Wedge ( $\vee$ ): inclusive or
- Ampersand ( $\&$ ): and
- Horseshoe ( $\supset$ ): if, then
- Triple bar ( $\equiv$ ): if, and only if



*Food for thought...*

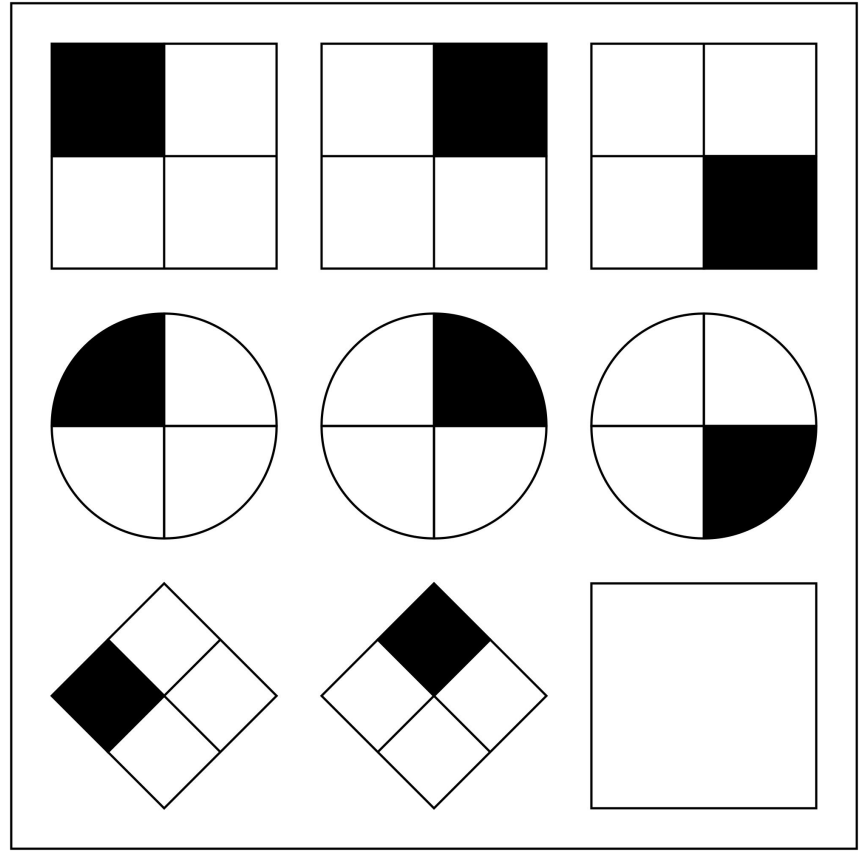
# Problems with Natural Languages

Ambiguity



# Problems with Natural Languages

Difficulty Defining  
Concepts



# Problems with Natural Languages

Meanings Change



# Problems with Natural Languages

## Euphemisms

**CARLSEN SUBARU**

**CERTIFIED PRE-OWNED**

**CERTIFIED PRE-OWNED**

- 7 YEAR/100,000 MILE POWERTRAIN COVERAGE
- 152 POINT VEHICLE INSPECTION
- 24/7 ROADSIDE ASSISTANCE
- CARFAX HISTORY REPORT







**Homework!**  
**Memorize all terms!**

