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THE STOIC SYSTEM: LOGIC AND KNOWLEDGE

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Introduction

1 The subject matter and aim of Stoic logic

The Stoic use of the term "logic" (*logikē*) is not as restricted as our modern use of the same term. The Stoics perceived of logic as a part of philosophy, alongside physics and ethics (Diogenes Laertius 7.39–41), and in their opinion its subject matter spanned the study of reason (*logos*) as expressed in all kinds of articulate speech.

The Stoics divided logic into rhetoric (*rhētorikē*) and dialectic (*dialektikē*) (Diog. Laert. 7.41–6). Rhetoric is the art of speaking well in the form of whole, continuous speeches. Dialectic, on the other hand, is the art of conducting discussions by means of short questions and answers; it is also defined, in a broader sense, as the science of what is true, what is false, and what is neither true nor false. Dialectic itself is subdivided into the topics of utterance and significations. The study of utterance includes linguistic and grammatical phenomena. The study of significations covers what is said by using all sorts of utterances, but mainly declarative sentences, that is, propositions, the relations between them, the arguments composed of them, and especially the validity of such arguments. It also covers how we distinguish true from false impressions, because it is on the basis of criteria for true impressions that we are able to determine which propositions are true. Hence, although it is Stoic dialectic which most closely corresponds to our conception of logic, the Stoics included under dialectic disciplines that we would nowadays refer to as theory of knowledge, philosophy of language, grammar, and linguistics (Gourinat 2000: 69–107).

Thus defined, Stoic logic provides us with a systematic knowledge of the rules of rationality that can assist us to think and discuss clearly and correctly, as well as protect us from being misled by fallacious arguments in all kinds of rational discourse. More generally, the aim of Stoic logic is the establishment of a true and stable understanding of the world, an understanding which is supposed to be essential to human beings if they are to survive and live a well-reasoned and ordered life (Diog. Laert. 7.46–8). That is why the Stoics came to think of logic as a particularly important part of philosophy, and that is why they insisted that the philosopher must be, more than anything else, a dialectician (Diog. Laert. 7.83). Given the Stoics' belief in the rationality of nature, logic turns out to be not only inseparable from the other parts of philosophy, but a prerequisite for the proper comprehension of the physical world as well as a necessary

component of a moral life. For, whereas the end of physics is knowing the world as it is, and that of ethics is living in accordance with the natural order, logic aims at distinguishing the true from the false, and thus makes it possible to find out the truths of the domains of reality which belong to the other parts of philosophy (Long 1978).

To show the special role of logic in the interrelation between the three parts of philosophy, the Stoics compared logic to the shell of an egg, to the surrounding wall of a fertile field, to the fortification of a city, or to the bones and sinews of a living being (Diog. Laert. 7.40; Sextus Empiricus *Math.* 7.19). These similes, however, should not be interpreted as implying that logic, according to the Stoics, is merely an auxiliary instrument as in the Aristotelian tradition. In fact, there seems to have been a considerable dispute in late antiquity over the issue of whether logic is a part or just an instrument of philosophy, a dispute which helps us to reconstruct the reasoning behind the Stoics' insistence on regarding logic as an integral constituent of philosophy (Alexander in *An. pr.* 1.4–4.29; Ammonius in *An. pr.* 8.15–11.21; Philoponus in *An. pr.* 6.19.20). Given the subject matter and aim of their logic, the Stoics had every reason to believe that it does not simply provide the other sciences with demonstrative methods; rather, Stoic logic deals with a particular domain of reality of its own, which is distinct from those of physics and ethics, namely it deals primarily with propositions and their interrelations.

2 Stoic logicians and their background

In the Hellenistic period ancient philosophers first became interested not only in understanding bodies of knowledge but in the question of the possibility of knowledge itself (Annas 1990; Frede 1999). The Epicureans and the Stoics were foundationalists in this sense that knowledge, according to them, is possible and has its origins in our grasp of some basic truths upon which the rest of our knowledge can securely rest. They defend the thesis that there are certain states of a person, for instance impressions of a certain kind, which by their nature are reliably, indeed infallibly, indicative of a fact about the world. They called a state of this kind a "criterion of truth" (*kritērion tēs alētheias*), a measure or instrument which enables us to judge the truth; and they suggested different criteria which are supposed to safeguard the possibility of knowledge.

As far as the Stoic logical system is concerned, the prevailing view in the nineteenth century was that it should be considered as a mere supplement to Aristotle's logic theory. Stoic logic, so it was alleged, does nothing more than either copy Aristotelian logic or develop it in a vacuous and formal way. It is only towards the middle of the twentieth century, after the important advances in symbolic logic, that it has become obvious that the Stoics constructed a logical system to prove the validity of a whole class of arguments of a different kind from those Aristotle focused on in his syllogistic (Frede 1974b; Barnes 1999).

Chrysippus was particularly instrumental in the development of logic and the Stoic theory of knowledge. It was said that he became so renowned in dialectic that it was the general opinion that if the gods had dialectic, it would be no different from that of Chrysippus (Diog. Laert. 7.180). Indeed, to confirm Chrysippus' reputation as the principal Stoic logician, one needs only to go through the long list of logical works attributed to him (Diog. Laert. 7.189–98; see Barnes 1996). But Chrysippus was not alone among the Stoics in his interest in dialectic. Although it is likely that Zeno, before Chrysippus, was not a logician in the sense that he constructed a formal logical system, he was interest-

in establishing the possibility of knowledge and used valid arguments of a considerable level of logical complexity in order to establish his philosophical doctrines (Schofield 1983; Ierodiakonou 2002). Also, logical studies in the Stoic school certainly did not die with Chrysippus. There is some evidence that Stoic philosophers, like Posidonius and Epictetus, made further additions to the Chrysippean system and even diverged from Chrysippus' logical theses on lesser issues (Barnes 1997).

The Stoic theory of knowledge

1 Impressions

According to the Stoics, human beings possess a sensory apparatus through which they can become fully aware of the external world. The external objects under appropriate conditions affect our sense organs, and these affections are then transmitted within the body to the soul, and in particular to its commanding or leading part, that is the mind. Taking into account the Stoic view that the soul is corporeal, the impressions which we thus receive actually constitute physical states that provide us with some kind of knowledge of the surrounding environment. Hence, the starting point in the Stoic theory of knowledge is the notion of *phantasia*, which is usually translated either as "impression" or as "appearance;" "appearance" keeps the connection to the verb *phainesthai*, "to appear," whereas "impression" follows Cicero's translation of the Greek term as "*impressio*" and alludes to Zeno's definition of *phantasia* as "an imprint on the soul" (Diog. Laert. 7.45). Besides, since the introduction of the wax-block image in Plato's *Theaetetus* (191c8–192c6), many philosophers, and not only in antiquity but throughout the history of philosophy, have used the image of imprints on wax in order to talk about impressions in the soul.

There is plenty of evidence that Chrysippus disagreed with his Stoic predecessors and in particular with Cleanthes, about the appropriateness of the wax-block image in explaining the Stoic definition of impressions. Sextus Empiricus, for instance, gives the following report of the disagreement between Chrysippus and Cleanthes:

So, according to them, an impression is an imprint on the soul; and they differed immediately about this. For Cleanthes took "imprint" in terms of depression and elevation—just like the imprint on wax made by seal-rings. But Chrysippus thought that such a view was absurd. For first, he says, this will require that when our mind has impressions at one time of a triangle or a tetragon, the same body will have to have in itself at the same time different shapes—triangular and tetragonal together, or even round—which is absurd. Next, since many impressions exist in us at the same time, the soul will also have many configurations. This is worse than the first problem. [Chrysippus] himself speculated, therefore, that "imprint" was used by Zeno to mean "alteration"; so that the definition becomes like this: "An impression is an alteration of the soul"; for it is no longer absurd that the same body at one and the same time (when many impressions exist in us) should receive many alterations. For just as the air when many people speak at once, receiving at one time an indefinite number of different blows, also has many alterations, so too the commanding part of the soul will experience something similar when it receives varied impressions.

(Sext. Emp. *Math.* 7.228–31; trans. B. Inwood and L. P. Gerson with changes)

Chrysippus' argument is clear: if impressions are understood to be like imprints on wax then we cannot explain how at the same time we may have many and different, or even conflicting, impressions; hence, impressions should rather be understood as modifications or alterations of the soul. That is to say, the soul as a whole, in coming to have an impression, becomes disposed differently than it was disposed before, in the sense that it is made to change in such a way as to think of what the impression is an impression differently than before; and nothing prevents it from becoming differently disposed many ways at the same time, even concerning the same object.

Nevertheless, in both Cleanthes' and in Chrysippus' interpretation of the Stoic notion of *phantasia*, what is significant is that the cause of the impression which we acquire through the senses is actually the external object. It is called a *phantaston*, that is, an impressor, and should be understood as the objective empirical source which triggers in us the process of obtaining knowledge, although the impression which it provides us with does not yet in itself constitute knowledge. To elucidate the connection between the impression and the impressor, the Stoics made use of an analogy to light: an impression is an illumination of the corresponding external object, for it reveals both itself and the object in the sense that it makes us aware of what has caused it (Aetii *Plac.* 4.12.1–5). Notice that the ancient sources do not attribute to the Stoics the view that an impression is some kind of mental picture of what is perceived. Rather, an impression is said to be an affection of the soul that should be thought of as a representation, which makes known to us itself as well as something in the external world. But the fact that it is such a representation does not mean that it is some kind of image likeness; for there are many forms of representation, of which some do not in any way involve likeness, for instance symbolic representations. Furthermore, given their role as representations, impressions as a class are distinguished from other affections of the soul which do not arise from an impressor; they are distinguished from affections of the soul that arise from the imagination of a figment, that is, a *phantasma*, as in the case of dreams and hallucinations (Diog. Laert. 7.50).

The Stoics suggested various ways of distinguishing between different kinds of impressions (Diog. Laert. 7.51; Sext. Emp. *Math.* 7.242–6). The fundamental distinction that between rational (*logikai*) and non-rational (*alogai*) impressions; most animals have non-rational impressions, whereas human beings after the age of seven or fourteen have rational impressions. For, according to the Stoics, reason emerges over time in the course of our natural development as a result of the acquisition of conceptions which are formed through a procedure involving experience and thought. More specifically, the Stoics described the emergence of reason in human beings in a way very similar to what Aristotle had said on the same subject (*Metaph.* A.1, 980a27ff.; *An. post.* 2.19, 99b36ff). Particular memories are obtained as a matter of the successful retention of impressions in the human soul, many similar memories result in experience, and on the basis of such experience we come to possess notions or conceptions (*ennoiai*) of things; some conceptions are naturally acquired, and the Stoics called them, following the Epicurean "preconceptions" (*prolēpseis*), for example, the conception of the color pink, some are culturally determined or technical, for example, the conception of a car (Brittain 2000; Dyson 2009; Crivelli 2010):

When a man is born, the Stoics say, he has the commanding part of his soul like a sheet of paper ready for writing upon. On this he inscribes each one of his conceptions. The first method of inscription is through the senses. For by

perceiving something, for example, white, they have a memory of it when it has departed. And when many memories of a similar kind have occurred, we then say we have experience. For the plurality of similar impressions is experience. Some conceptions arise naturally in the aforesaid ways and undesignedly, others through our own instruction and attention. The latter are called "conceptions" only, the former are called "preconceptions" as well.

(Aetius *Plac.* 4.11.1–3; trans. A. A. Long and D. N. Sedley)

Thus reason starts to grow slowly; for once we have simple conceptions, they naturally give rise to more complex ones, which in turn will enable us to have even more complex ones. In fact, some of the more complex conceptions are obviously not direct derivatives of sensory (*aisthētikai*) impressions; rather, we get them by various thought processes, like the processes of similarity, analogy, transposition, combination, opposition, transition, or privation (Diog. Laert. 7.53). For example, the conception of a Cyclops is formed by magnification from that of a man, while the conception of death by opposition. This is the reason why the Stoics claimed that from our rational impressions some are obtained directly through the senses, whereas others are obtained through thought. And this is why in the beginning the human soul has no content, but it has the ability to acquire a sufficiently rich set of conceptions, in terms of which it starts to think of things rationally, and thus human beings come to be distinguished from non-rational animals.

It should be stressed, however, that the distinction between sensory and non-sensory rational impressions does not imply that there are rational impressions which represent their objects in ways that do not presuppose conceptions; even the most primitive rational impression, like the impression of a pink car, already involves the representation of its object by means of conceptions. Rational impressions may be passive affections of the soul, but they involve already the operation of the mind; for they always presuppose conceptions, which ultimately arose during our childhood from sensory impressions that were not rational. So, rational impressions are thoughts (*noēseis*), and as thoughts they have a propositional content; when we say that we grasp an external object, what we really mean is that we grasp the fact "that something is the case."

2 Knowledge and the criteria of truth

As thoughts rational impressions present themselves to the human mind, and the mind either accepts or refuses to accept them. For as human beings develop, they come to have a critical distance from their impressions, since they often realize that their impressions might be false. Thus, according to the Stoics, the emergence of reason also involves the emergence of a new ability, the ability to give or to withhold assent (*sunkatathesis*), that is, to have the belief that the proposition which forms the content of the impression is true or false. The Stoics claimed that there are different kinds of assent, and Zeno is reported to have used a famous simile to illustrate them:

Zeno used to clinch the wise man's sole possession of knowledge with a gesture. He would spread out the fingers of one hand and display its open palm, saying "An impression is like this." Next he clenched his fingers a little and said, "Assent is like this." Then, pressing his fingers quite together he made a fist,

and said that this was cognition (and from this illustration he gave that mental state the name *katalēpsis*, which it had not had before). Then he brought his left hand against his right fist and gripped it tightly and forcefully, and said the knowledge was like this and possessed by none except the wise man.

(Cicero *Acad.* 2.145; trans. A. A. Long and D. N. Sedley with minor changes)

Note that Zeno did not claim that assent is followed by cognition, which is followed by knowledge. Rather, he suggests that assent, cognition, and knowledge are alternative reactions to impressions: assent refers to the mind's acceptance of an impression, regardless of its epistemological status, cognition is assent that cannot be wrong, and knowledge is assent that always remains unshakeable.

Cognition (*katalēpsis*) arises only when the mind assents to a special kind of impressions, the so-called "cognitive impressions" (*katalēptikai phantasiai*). The Stoics described cognitive impressions as imprints on the soul that:

- (i) arise from what is;
- (ii) are imprinted and impressed on the soul in exact accordance with what is; and
- (iii) could not arise from what is not.

(Cicero *Acad.* 2.18; 77; Diog. Laert. 7.46; Sext. *Emp. Math.* 7.248;

Leaving aside for the time being the third clause, let us examine more closely the first two (Sedley 2002). In the first place, the cognitive impression must come from an existing object; in other words, the external object the impression presents itself as a cognitive impression of, should be a real object rather than a figment of our imagination. Second, the impression must be according to that existing object; a Stoic example of an impression that is not according to the existing object is that of Elektra received by mad Orestes, for in so far as he had an impression of an existing thing it was true, in so far as he had an impression of a Fury it was false. It seems that the second clause is supposed to amount to the requirement that the impression be clear and distinct, as opposed to obscure and confused (Diog. Laert. 7.46; Sext. *Emp. Math.* 7.171–3; 2.403–4; 408). So, when we receive an impression of a car such that we are able to say "I see a car," although we are not able to discern all its properties, our impression is true but it is non-cognitive because it is unclear. As to the distinctness of cognitive impressions, this feature corresponds to the fact that cognitive impressions represent their objects in such detail as to fit only them. Hence, cognitive impressions, being the most accurate form of impressions, were said to be evident (*enargeis*).

It is, of course, the case that cognitive impressions directly guarantee only the truth of their own propositional content. On the other hand, they also give rise to the impressions which the mind forms naturally on the basis of cognitive impressions, which in turn allow us to have further cognitive impressions. Moreover, the truth of the propositions certified by cognitive impressions will guarantee the truth of further propositions derived by deductive inference, that is, by demonstration, from the first propositions. Cognitive impressions, therefore, guarantee the truth of whatever is known by human beings. Indeed, by establishing the possibility of knowledge or the mind's assent to cognitive impressions, the Stoics gave them a very central role in their theory of knowledge, namely that of the criterion of truth (Diog. Laert. 7.54).

The Stoics, just like the Epicureans, believed that we can secure the possibility of our knowledge of the external world by postulating criteria that help us discriminate truth from falsehood. But although the Epicureans claimed that all of our sensory impressions are true and have the status of such a criterion, the Stoics denied that all sensory impressions are true, and put forward the thesis that it is only our cognitive impressions which may constitute the basis of our knowledge. They even denied that all true sensory impressions are cognitive; for if one perceives an object under abnormal conditions, there is no guarantee that the impression one receives, even if it should happen to be true, necessarily is true. That is to say, truth cannot be the distinctive characteristic of cognitive impressions that is responsible for their exclusive place as the Stoic criterion of truth; rather, cognitive impressions were regarded as such because they are evident. For the Stoics insisted that in order for an impression to serve as a criterion of truth, it not only has to be true, but it also has to be guaranteed to be true; and they assumed that cognitive impressions are those which, given the way they come about, cannot fail to be true. If, for instance, we perceive an object under normal conditions, the cognitive impression we receive is guaranteed to be true, since cognitive impressions are evident.

According to the Epicureans, sensory impressions constitute reliably faithful representations of the external objects, because they are true, and hence evident. The Stoics, on the other hand, specified as a further requirement for cognitive impressions to be evident that they should reveal the external objects in a clear and distinct way. In other words, given that the Stoics assumed that no two objects are qualitatively completely alike, when we receive a cognitive impression of an external object, it not only faithfully represents the external object which is its cause, but more importantly, it represents the external object in a way which allows us to discern all the features of that object in such detail that no other object could match that impression. This may suggest a subtle shift in the understanding of the notion of something's being evident; for in the case of cognitive impressions, it seems to become at least in part a matter of an intrinsic distinctive character of the impression itself, though the precise nature of this character remains unclear. And it seems that this is the point on which the Sceptics focused in order to rebut the Stoic attempts to secure a reliable basis for knowledge by appealing to the evident character of cognitive impressions.

More specifically, the Sceptics seriously questioned the Stoic doctrine that there actually are cognitive impressions and that human beings can distinguish them from non-cognitive ones (see Vogt, this volume). Since we are commonly prone to assenting also to unclear and confused impressions, the Sceptics argued, it could be really difficult for us to determine which among our impressions do in fact have the privileged status of a cognitive impression. The Stoic reply to this Sceptic challenge, which probably triggered the third clause of the definition of cognitive impressions, seems to indicate that it is nature herself that provides us with the possibility of distinguishing cognitive from non-cognitive impressions; cognitive impressions are irresistible to the human mind, such that they force our assent automatically by a causal process, and not on the basis of an argument. Indeed, it has been suggested that the Stoics defended the view that the intrinsic distinctive mark of cognitive impressions is a causal feature they have which is independent of the external object and which makes the mind react in a distinctive way, so that it is able to discriminate cognitive and non-cognitive impressions (Frede 1983; Hankinson 2003). To support this, some Stoic illustrations have been brought to our attention that allude to the strength of the causal relation between cognitive

impressions and their instantaneous acceptance by the mind; for instance, the Stoics claimed that cognitive impressions are instantaneously ceded to like weights by a scale (Cicero *Acad.* 2.38), grasp us as if by our hair (Sext. *Emp. Math.* 7.257), and differ from other impressions in the way horned snakes differ from other snakes (Sext. *Emp. Math.* 7.252).

Even this suggestion, however, raises various questions. For instance, what is human nature which brings it about that we are seized by the evidence of cognitive impressions? Also, if the human mind assents to cognitive impressions automatically, why did the Stoics say quite generally that it is up to us whether we assent or refrain from assenting to impressions? Given these difficulties, there is a temptation to think that, precisely because cognitive impressions stand in a privileged relation to external objects, we can learn to recognize the intrinsic distinctive character in virtue of which they are evident. For the evident character of cognitive impressions seems to be, according to the Stoic theory of knowledge, not a matter of subjective feeling or conviction. If it produces conviction, it is a conviction which is based on recognition of a feature of impressions which they objectively have, because they are appropriately related to the external objects to be known (Lefebvre 2007; Ierodiakonu 2011).

The Stoics never seem to have addressed the Sceptics' question whether there actually are cognitive impressions. They assumed that there must be such impressions if there is to be knowledge, and that nature has constructed things in such a way that they have such cognitive impressions which in no way misrepresent the external object. It is only in this way that they could defend their view that knowledge is possible and that it ultimately comes from the senses. Of course, what the Stoics presupposed here is that the corresponding conditions for the production of cognitive impressions are in fact normal. And there is sufficient evidence that at some point the Stoics gathered conditions establishing normality under five headings: the condition of the sense organ, that of the object, its placing, the way the object is sensed and the agent's state of mind must all be in a normal condition (Sext. *Emp. Math.* 7.424). So, even if the Stoics never defined knowledge by making use of the notion of normality, normal conditions were meant to be necessary and sufficient for its production.

As mentioned earlier, the Stoics claimed that only the wise man has the system of and rationally grounded knowledge (*epistēmē*) that remains unshakeable, in the sense that one cannot be persuaded to withdraw by any argument to the contrary. Nevertheless, not even the wise man is in a position to know all truths, but only those whose truth is guaranteed by cognitive impressions; for if his ability to avoid false belief is unlimited, his ability to know is certainly restricted. So there are many impressions which the wise man does not give assent to, but at least there are no false impressions which he accepts as true. On the other hand, the ordinary person has ignorance (*agnoia*), because he is prone to emotional disorder caused by his passions and he cannot avoid false beliefs. Even the truths of which he has cognition are not really firm and lack the coherence and systematicity which characterize knowledge; in this sense ignorance is treated as the contradictory of knowledge. However, the ignorance of the ordinary person is not, according to the Stoics, not only to weak assent to cognitive impressions, but also to assent to non-cognitive impressions; it is then treated as mere opinion (*doxa*) and defined as assent to false or unclear impressions. Still, many of these opinions, though not knowledge, are true or even cognitive, and thus afford the ordinary man a basis to acquire knowledge (Sext. *Emp. Math.* 7.151–2).

The Stoic logical system

1 Sayables and assertibles

Knowledge presupposes, for the Stoics, assent of a certain kind to rational impressions or thoughts; and to give assent to a rational impression is to have the belief that the proposition which forms the content of the impression is true. That is to say, we assent to rational impressions by assenting to their corresponding propositions, what the Stoics called "assertibles" (*axiōmata*), which can be true or false. But in order to fully grasp the Stoic definition of an assertible, we first need to get some idea about a more basic Stoic notion, the notion of a sayable (*lekton*).

The term "*lekton*" is derived from the verb "*legein*," that is, "to say," and it is what has been or gets said or something which can be said. In their linguistic theory the Stoics posited three things that are linked together; namely, an expression which signifies something (*sēmmainon*), that which is signified (*sēmmainomenon*), and the external object (*tunchanon*):

There was another disagreement among philosophers [concerning what is true]: some took the sphere of what is true and false to be "the signification," others "utterance," and others "the process that constitutes thought." The Stoics defended the first opinion, saying that three things are linked together, "the signification," "the signifier," and "the name-bearer." The signifier is an utterance, for instance "Dion"; the signification is the actual state of affairs revealed by an utterance, and which we apprehend as it subsists in accordance with our thought, whereas it is not understood by those whose language is different although they hear the utterance; the name-bearer is the external object, for instance, Dion himself. Of these, two are bodies—the utterance and the name-bearer; but one is incorporeal—the state of affairs signified and sayable, which is true or false.

(Sext. Emp. *Math.* 8.11–2; trans. A. A. Long and D. N. Sedley)

So, the states of affairs signified are the sayables, which are placed between mere vocal sounds or written sentences, on the one hand, and the objects in the world, on the other; roughly speaking, sayables are the underlying meanings in everything we say and think, what we understand but foreigners do not, though they hear the spoken word. But not everything which gets thought gets said, and not everything which can be said gets thought. There are indeed many things which never get thought or said, although they are there to be thought or said. In other words, Stoic sayables are not mind-dependent items; at the same time, though, they certainly do not exist in the way bodies exist in the world. The Stoics stressed that sayables are incorporeal, like void, place, and time (Sext. Emp. *Math.* 10.218), and in order to characterize their mode of being, they introduced the notion of subsistence (*huphistanai*), as opposed to existence (*einai*). Reality, they claimed, is not just constituted by corporeal entities, but also by predicates true of bodies and propositions true about bodies. Hence, in Stoic ontology sayables are given some status, namely the status, not of bodies, but of incorporeal somethings; they are defined as what subsists in accordance with a rational impression, that is as the content of our thoughts (Sext. Emp. *Math.* 8.70; see Frede 1994).

The Stoics divided sayables into complete and incomplete (Diog. Laert. 7.63). Incomplete sayables include predicates, for instance what is meant by "sleeps." Complete sayables include questions, oaths, invocations, addresses, commands, curses; but most important kind of complete sayables are declarative sentences or propositions instance "Socrates sleeps," and this the Stoics called an "assertible" (*axiōma*) (Diog. I 7.65; Sext. Emp. *Outlines of Pyrrhonism* 2.104). An assertible is mainly defined by the fact that it is the kind of item that in saying this sort of thing one is asserting something and it differs from other kinds of complete sayables by the property of being true or false. Being a particular class of sayables, assertibles do not exist as bodies do, but they can be said to subsist. In addition, the Stoics make a further distinction: if an assertible is false it only subsists, but if it is true, it is a fact and thus also can be said to exist (*huparchein*). In this sense, true assertibles correspond to the world's having certain features, and they are available to be thought and expressed whether anyone is thinking about them or not. On the other hand, since false assertibles are said only to subsist, the philosophical question of how false statements and thoughts are possible gets a reasonable answer; false assertibles are the contradictories of facts, and hence have some status.

The main characteristic of the Stoic logical system is that the inferences which are studied are about relations between assertibles which have the structure of propositions (Mates 1953; Frede 1974a; Bobzien 1999; Ierodiakonou 2006). Whereas Aristotle focused his attention on inferences which involve relations between terms, and he introduced a logical system similar to what we nowadays call "predicate logic," Stoic logic marks the beginning of what is now called "propositional logic." To say, though, that Stoic logic is propositional may be somewhat misleading, since the Stoics have quite a different understanding of what a proposition is. For instance, while propositions are timelessly true or false, Stoic assertibles are asserted at a particular time and have a particular tense. That is to say, an assertible can in principle change its truth value without ceasing to be the same assertible; for example, the conditional "If Dion is alive, Dion will be alive" is an assertible that is not true at all times, for there will be a time when the antecedent will be true and the consequent false (Simplicius in *Ph.* 1299.36–1300.10). Also, since Stoic assertibles include token reflexive elements, like for instance "this" or "I," they may cease to exist and presumably also, though this is not clearly stated, begin to exist at definite times. For a Stoic assertible requires that its subject exists, otherwise it is said to be destroyed; for example, the assertible "This man is dead" is destroyed at Dion's death, if "this man" refers to Dion (Alexander in *An.* 177.25–178.1).

Finally, assertibles are divided into simple and non-simple assertibles (Brunschwig 1994). Simple assertibles are those which are not composed either of a repeated assertible or of several assertibles; they are subdivided into definite (for example, "This one sleeps"), indefinite (for example, "Someone sleeps"), and intermediate (for example, "It is day" or "Socrates sleeps") (Sext. Emp. *Math.* 8.93–8). In addition, the Stoics classified among simple assertibles three different kinds of negative assertibles: negation (for example, "Not: it is day"), denials (for example, "No one sleeps"), and privation (for example, "This man is unkind") (Diog. Laert. 7.69–70). Note that the scope of the negative particle is, according to the Stoics, the entire assertible, which means that the assertible, for instance, of the form "It is not day" is treated as affirmative and not negative. Hence, the negative particle "not" was not considered by the Stoic logicians as a connective; connectives bind together parts of speech, and the negative particle does not do that (Diog. Laert. 7.58).

Non-simple assertibles, on the other hand, are those which are composed either of a repeated assertible or of several assertibles which are combined by one or more connectives (Sext. Emp. *Math.* 8.95). The main types of non-simple assertibles studied by the Stoics are the following (Diog. Laert. 7.71–4; Sext. Emp. *Math.* 8.125–7):

1. A conjunctive assertible is one which is conjoined by the conjunctive connective “both ... and ...” (for example, “Both it is day and it is light”). A conjunctive assertible is true when all its conjuncts are true.
2. A disjunctive assertible is one which is disjoined by the disjunctive connective “either ... or ...” (for example, “Either it is day or it is night”). The Stoics understand the disjunctive relation as exhaustive and exclusive; that is to say, a disjunction is true when one and only one disjunct is true.
3. A conditional assertible is one linked by the conditional connective “if” (for example, “If it is day, it is light”). A conditional, according to the Stoics, is true when the contradictory of its consequent conflicts with the antecedent; for instance, the conditional “If it is day, it is day” is true, since the contradictory of its consequent “Not: it is day” conflicts with its antecedent “It is day.”

The Stoics also discussed modal assertibles in their logic (Diog. Laert. 7.75). A possible assertible is that which admits of being true, and is not prevented by external factors from being true, for example, “Dion is alive.” An impossible assertible is that which does not admit of being true, or admits of being true but is prevented by external factors from being true, for example, “The earth flies.” A necessary assertible is that which is true and does not admit of being false, or admits of being false but is prevented by external factors from being false, for example, “Virtue is beneficial.” A non-necessary assertible is that which is capable of being false, and is not prevented by external factors from being false, for example, “Dion is walking.” A plausible assertible is that which invites assent to it, for example, “If someone gave birth to anything, she is its mother.” A probable or reasonable assertible is that which has higher chances of being true than false, for example, “I shall be alive tomorrow” (Bobzien 1993).

2 Arguments

The Stoics define an argument (*logos*) as a complex or a compound of premises and a conclusion. The following is a typical Stoic argument (Diog. Laert. 7.76–7; Sext. Emp. *Pyr.* 2.135–6):

If it is day, it is light.
But it is day.
Therefore it is light.

Moreover, the Stoics discussed arguments in terms of their modes (*tropoi*), which are the abbreviations of particular arguments; for instance, the mode of the previous argument is:

If the first, the second.
But the first.
Therefore the second.

The ordinal numbers here stand for assertibles, and have exactly the same role as letters of the alphabet in Aristotelian logic. Finally, the Stoics also used the so-called “mode-arguments” (*logotropoi*), in which the assertibles are given in full when occurring, but are then replaced by ordinal numbers, obviously for purposes of simplicity and clarity:

If Plato is alive, Plato is breathing.
But the first.
Therefore the second.

It was the orthodox Stoic view that an argument must have more than one premise though it seems that some Stoics accepted single-premise arguments, as for instance (Sext. Emp. *Math.* 8.443; Apuleius *Int.* 184.16–23):

You are seeing.
Therefore you are alive.

Of arguments, some are valid, others invalid. Invalid arguments are those the contradictory of whose conclusion does not conflict with the conjunction of the premises (Diog. Laert. 7.77). For instance, the argument:

If it is day, it is light.
But it is day.
Therefore Dion is walking.

is invalid, because the contradictory of its conclusion, that is, “Not: Dion is walking does not conflict with the conjunction of its premises, that is, “Both if it is day it is light and it is day” (Sext. Emp. *Pyr.* 2.137; *Math.* 8.416, 421). Of valid arguments, some are just “valid,” others “syllogistic” (*sullogistikoi*). The Stoics define syllogistic arguments those which either are what they call “indemonstrable” (*anapodeikttoi*) or can be reduced to the indemonstrables (Diog. Laert. 7.78). Indemonstrable arguments, or simple syllogisms, are those whose validity is not in need of demonstration, given that it is obvious in itself (Diog. Laert. 7.79–81; Sext. Emp. *Pyr.* 2.157–8; *Math.* 8.223–7). The lists of indemonstrable arguments which are to be found in our ancient sources vary, but there is no doubt that Chrysippus himself distinguished five different types of such arguments

- (i) A first indemonstrable argument is constructed out of a conditional and its antecedent as premises, and the consequent as conclusion, for example,
If it is day, it is light.
But it is day.
Therefore it is light.
- (ii) A second indemonstrable argument is constructed out of a conditional and the contradictory of its consequent as premises, and the contradictory of its antecedent as conclusion, for example,
If it is day, it is light.
But not: it is light.
Therefore not: it is day.

- (iii) A third indemonstrable argument is constructed out of a negated conjunction and one of its conjuncts as premises, and the contradictory of the other conjunct as conclusion, for example,
 Not: both Plato is dead and Plato is alive.
 But Plato is dead.
 Therefore not: Plato is alive.
- (iv) A fourth indemonstrable argument is constructed out of a disjunction and one of its disjuncts as premises, and the contradictory of the other disjunct as conclusion, for example,
 Either it is day or it is night.
 It is day.
 Therefore not: it is night.
- (v) A fifth indemonstrable argument is constructed out of a disjunction and the contradictory of one of its disjuncts as premises, and the other disjunct as conclusion, for example,
 Either it is day or it is night.
 Not: it is day.
 Therefore it is night.

In suggesting this particular list of the five types of indemonstrable arguments, Chrysippus was not trying to introduce the smallest possible number of different types of indemonstrable arguments. Rather, it seems that he included in his list all types of argument which just rely on the argumentative force of the different basic types of connectives known to him. In the case of the fourth and fifth indemonstrables, they just rely on what it means to use the disjunctive connective, namely to say that if one of the disjuncts holds the contradictory of the other holds too, and if the contradictory of one disjunct holds the other disjunct holds too.

To demonstrate the syllogistic validity of any argument whatsoever, the Stoic logicians considered it necessary to reduce it to one or more of the indemonstrable arguments, which are thus regarded as the first principles of the Stoic logical system. Indeed, there are several ancient texts which suggest that the Stoic logicians believed that all other arguments are thought to be validated by reference to the five indemonstrables (Diog. Laert. 7.79; Sext. Emp. Pyr. 2.156–7; 166–7, 194). Therefore, we may infer that some claim of completeness was made by the Stoic school, but it is not at all clear what precisely the Stoics' definition of completeness was, if they ever offered one (Mueller 1979; Milne 1995). The procedure of reducing non-simple syllogisms to indemonstrable arguments was called by the Stoics "analysis." To carry out this procedure, the Stoic logicians had at least four logical rules, the so-called "*themata*" (Diog. Laert. 7.78; Galen *Plac.* 2.3.18–19; Apuleius *Int.* 191.5–10; Alexander in *An pr.* 278.11–14). We know only the first and the third Stoic *thema*, and it is on the basis of extremely meager evidence that modern scholars have suggested their different reconstructions of the other two.

A Stoic example of a non-simple syllogism with three premises is the following (Sext. Emp. *Math.* 8.234–6):

If things evident appear alike to all those in like condition and signs are things evident, signs appear alike to all those in like condition.
 But signs do not appear alike to all those in like condition.
 And things evident do appear alike to all those in like condition.
 Therefore signs are not things evident.

Its mode is:

If both the first and the second, the third.
 But not the third.
 But also the first.
 Therefore not the second.

Sextus suggests that this argument can be reduced to two indemonstrables, namely second and a third indemonstrable, by going through the following steps:

- (i) By combining the first premise with the second premise, we get a second indemonstrable:
 If both the first and the second, the third.
 But not the third.
 Therefore not: both the first and the second.
- (ii) By combining the conclusion of this indemonstrable with the third remaining premise, we get a third indemonstrable:
 Not: both the first and the second.
 But the first.
 Therefore not: the second.

The logical rule which validates the use of the conclusion of the second indemonstrable in the construction of the third indemonstrable is the so-called "dialectical *thema*," according to which the conclusion which is deduced from some of the premises of an argument is implicitly contained in the argument, though it is not expressly stated (Sext. Emp. *Math.* 8.231). This theorem, according to our ancient sources, is supposed to do the same job as the second, third, and fourth *themata* together (Alexander in *pr.* 284.10–17).

Finally, a scientific demonstration or proof (*apodeixis*) is a syllogistic argument with true premises which by means of deduction reveals, that is, gives knowledge of, a non-evident conclusion (Sext. Emp. Pyr. 2.140–3). For instance, the following argument was treated by the Stoics as an example of a proof:

If sweat flows through the surface, there are ducts discoverable by thought.
 But sweat flows through the surface.
 Therefore there are ducts discoverable by thought.

It is exactly the revelation of this non-evident conclusion by the force of the premises that constitutes the requirement of a genuine proof, and it is this discovery after which knowledge aspires (Brunschwig 1980; Barnes 1980).

3 Paradoxes

Finally, there is abundant evidence of the Stoics' interest in solving the following logical paradoxes:

(i) *The Liar*

Various versions of the Liar paradox were known in antiquity, but there is no single text which gives us with certainty the precise formulation of the argument (Cicero *Acad.* 2.95; Gellius *NA* 18.2.9–10). A plausible reconstruction reads as follows: "If you say that you are lying, and you say so truly, you are lying, and if you are lying, you are telling the truth." Presumably it was Eubulides who invented this paradox in the fourth century, but there is no doubt that it was Chrysippus who more than anyone else in ancient times tried to solve it. The peculiarity seems to be, not only that we are not able to find out what the truth of the statement is, but also that in this case there is no truth of the matter. So perhaps Chrysippus' view was that in cases like this the statement is neither true nor false. However, if this is correct, the solution would put the very notion of an assertible under great pressure and would force a reconsideration of its definition (Cicero *Acad.* 2.95; Plutarch *Comm. not.* 1059D–E; see Cavini 1993; Mignucci 1999).

(ii) *The Sorites*

The name *Sorites* comes from the Greek noun "sōros," which means "heap" or "pile." This paradox exploits the vagueness of certain predicates, like for instance "heap": Is a single grain of wheat a heap? The answer is obviously "No." Are two grains a heap? The answer is again "No." If we continue adding one grain to the previous quantity we never get a heap (Galen *Med. exp.* 17.1). Chrysippus is reported to have claimed that this paradox does not pose any real difficulty, because the wise man knows at which moment he should stop replying to questions of the form "Are so-and-so many grains a heap?" (Cicero *Acad.* 2.94; see Bobzien 2002).

(iii) *The Veiled Man*

According to one version of this paradox (Lucian *Vit. auct.* 22), Chrysippus asks someone whether he knows his own father. The person replies that he does. Next Chrysippus asks him again what he would have said if a veiled man were to be placed in front of him and was asked whether he knows him. The same person replies that he would have said that he doesn't know him. Chrysippus concludes, if the veiled man were his father, the person would have thus admitted that he both knows and does not know his own father.

(iv) *The Horned Man*

In Diogenes Laertius (7.187) we find the following formulation of this paradox: "If you have not lost something, you have it still. But you have not lost horns. Therefore you still have horns."

Unfortunately, there is no evidence as to the way in which the Stoics tried to solve the last two paradoxes.

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Related chapters

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32. Epicurus' Garden: physics and epistemology
34. The Hellenistic Academy
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32

EPICURUS' GARDEN: PHYSICS AND EPISTEMOLOGY

Tim O'Keefe

Introduction

Epicurean "physics" (from the Greek word *physis*, or "nature") encompasses the study of the natural world in general. Thus, it ranges more widely than contemporary physics, which includes theorizing about the basic building blocks of the world, as well as cosmology, biology, and psychology. According to Epicurus, understanding the workings of the world is not good intrinsically, but only instrumentally, for the sake of securing peace of mind. Nonetheless, physics is invaluable, since it is impossible to have peace of mind while suffering from fear of the gods and fear of death, and natural science (*physiologia*) is needed to dispel these fears (*Sent. Vat.* 11–13). It does so by showing us that the gods have nothing to do with the workings of the world and that death is simply annihilation, and hence neither good nor bad, rather than a hazardous transition to some afterlife. As the Epicurean poet Lucretius puts it, the terrifying darkness that envelops the mind will be dispelled not by the rays of the sun, but only by a systematic account of the principles of nature (*Lucr.* 1.146–8).

Epicurean physics draws its inspiration from the atomism of the pre-Socratic Democritus. With typical lack of charity, Cicero claims that Epicurus copied almost all of his principles from Democritus, and wherever he deviated from Democritus, his changes were for the worse (*Cic. Nat. D.* 1.73, 1.69–70). This assessment is unfair. Epicurus appropriates Democritus' doctrine that the world is fundamentally composed of untable bodies—atoms—flying through void, with all else being the result of purposeless atomic interactions. But Epicurus has to refurbish the Democritean world view against the challenges of later thinkers like Plato and Aristotle. Plato argues (in *Timaeus*) that the world is the product of a beneficent divine craftsman. He also asserts (for example, in the *Phaedo*) that a person is an immaterial soul temporarily housed in a body, which moves from body to body in a cycle of reincarnation. Aristotle argues that the functioning of organisms reveals that nature is purposive. All these errors must be rebutted.

Epicurus also works to overcome problems internal to Democritean atomism, such as among them fatalism and skepticism. Having every future occurrence settled by past positions and motions of atoms (as Democritus does) would render us helpless,