ISSN:1984-4247
e-ISSN:1984-4255

Revista de Filosofia
ARGUMENTOS

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Syntactic and semantic aspects in the expression of a thesis by Anaximander of Miletus

Aspectos da sintaxe e da semântica na expressão de uma tese por Anaximandro de MIleto

ABSTRACT

Nowadays, there is an interesting controversy about the factors or elements that are more important in the human mind. In this way, while certain frameworks claim that the intellectual activity is mainly syntactic, other approaches insist that our mind basically takes semantic representations into account. There is no doubt that this discussion can make sense in cognitive science and in the studies on human reasoning. However, the essential aim of this paper is to show that this debate is irrelevant from the linguistic point of view, since even very abstract and complex ideas can be captured by means of both syntactic forms and semantic models, with the possibility of identifying clear relationships between such forms and models too. This last point is supported with arguments based on the thesis about infinity by Anaximander of Miletus, which is used as an example.

Keywords: Anaximander of Miletus. Infinity. linguistic expression. Semantics. Syntax.

RESUMO

Hoje em dia, há uma controvérsia interessante sobre os fatores ou elementos que são mais importantes na mente humana. Desta forma, enquanto certos quadros afirmam que a atividade intelectual é principalmente sintática, outras abordagens insistem em que nossa mente basicamente leva em consideração as representações semânticas. Não há dúvida de que essa discussão pode ter sentido na ciência cognitiva e nos estudos sobre o raciocínio humano. No entanto, o objetivo essencial deste trabalho é mostrar que este debate é irrelevante do ponto de vista linguístico, pois mesmo idéias muito abstratas e complexas podem ser capturadas por meio de formas sintáticas e modelos semânticos, com a possibilidade de identificar relacionamentos claros entre tais formas e modelos também. Este último ponto é

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suportado com argumentos baseados na tese sobre o infinito de Anaximandro de Mileto, que é usada como exemplo.

Palavras-chave: Anaximandro de Mileto. Infinito. Expressão linguística. Semântica. Sintaxe.

Introduction

There is a very engaging discussion in cognitive science today. It is debated whether what is more relevant in the human intellectual performance is syntax or semantics. In this way, some frameworks, for example, the mental logic theory (e.g., O'BRIEN, 2014), argue that inferences are made and conclusions are drawn by means of syntactic structures. However, other theories, for example, the mental models theory (e.g., JOHNSON-LARID, KHEMLANI & GOODWIN, 2015), propose that such activities can be made only by taking semantic representations into account. In this way, a particular aspect of this controversy is whether or not the logical formulae corresponding to sentences can consider all the expressive richness that can be given in a purely semantic model.

Nevertheless, this paper, following works such as, for example, that of López-Astorga (2017a), is intended to show that, from the linguistic perspective, the question about the possibility of this last aspect does not really make sense, since we can speak about obvious semantic correlates of the syntactic logical forms and about evident syntactic correlates of the semantic models. Undoubtedly, the controversy is important and needs to be solved from the cognitive point of view and if we want to actually explain the true way human reasoning works. Nonetheless, I will try to argue here that, even in the case of very hard and complex theses allowing different interpretations, it is possible to find correspondences between the formal structures and the semantic representations that can be assigned to sentences.

In other words, this means that the point of this paper will be that, although the separation between syntax and semantics can be cognitively deemed, in linguistics that is very difficult to do, as the links seem to be clear. Thus, to better account for all of this, I will resort to a very abstract thesis by Anaximander of Miletus that is expressed in different fragments about his thought that are kept. The thesis is the one about infinity and, from among all of those fragments, I will mainly focus on that by Aristotle in *Physica* Γ 4, 203 a 16, which is also Fragment 104 in Kirk and Raven (1977).

So, the paper will have three sections. In the first one, I will explain Anaximander's thesis about infinity in details, comment on the mentioned fragment, and indicate some of its possible interpretations. The second one will be devoted to the theories claiming that the formal structures are undoubtedly important in the human mind, and, in this way, logical formulae will be attributed to those possible interpretations. Lastly, the third one will basically address the mental models theory and its idea that what people really do is to think about

semantic iconic representations suitable for sentences, which in turn will lead to build semantic models appropriate for those very interpretations.

Obviously, the idea is to end making it clear that the syntactic structures of the second section can be easily linked to the semantic representations of the third one. To put it another way, the final goal is to show that the formulae of the second section can be considered to be just syntactic versions of the semantic models of the third one, or, if preferred, that the semantic models of the third section can be considered to be just semantic versions of the formulae of the second one. But, as said, the first task that will done is to deal with the Aristotelian fragment in *Physica* Γ 4, 203 a 16.

Anaximander of Miletus and τὸ ἄπειρον

As stated, the thesis about infinity by Anaximander appears in several fragments coming from different ancient sources. Some of them can be, for example, the versions of Theophrastus' interpretation of this issue given by Simplicius (*Physica* 24, 13), Hippolytus (*Refutatio Omnium Heresiarum* I 6), and Pseudo-Plutarch (*Στρωματεῖς* 2), which are included together in Fragment 103 in Kirk and Raven (1977), and other references by Aristotle as well (e.g., *De Generatione et Corruptione* B 5, 332 a 19, which is Fragment 105 in KIRK & RAVEN, 1977; or *Physica* A 4, 187 a 12, which is Fragment 106 in KIRK & RAVEN, 1977). However, I will only reproduce here Fragment 104 in Kirk and Raven (1977) because it is illustrative enough and seems to indicate Anaximander's idea in a very simple and clear way. This last fragment is as follows:

> οἱ δὲ περὶ φύσεως πάντες ὑποτιθέασιν ἑτέραν τινὰ φύσιν τῷ ἀπείρῳ τῶν λεγομένων στοιχείων, οἷον ὕδωρ ἢ ἀέρα ἢ τὸ μεταξὺ τούτων.

["All the physicists make the infinite a property of some other nature belonging to the so-called elements, such as water or air, or that which is intermediate between these" (translation by KIRK & RAVEN, 1977, p. 108)].

As this fragment already reveals, the thesis causes interpretation problems. Those problems are because of the different meanings of τὸ ἄπειρον (infinity; in the fragment above, τῷ ἀπείρῳ, in dative case), and Kirk and Raven (1977) refer to some of the writers that have addressed such problems, for example, Cherniss (1935). Likewise, more references to studies dealing with these difficulties can be found in works such as that of Cervio (2014), who also mentions, for instance, Reale (1987). Nonetheless, in any case, what is important about these interpretations for this paper is that, following Kirk and Raven (1977, p. 109), it appears that two great interpretations are possible:

[1] τὸ ἄπειρον means 'indefinite' for Anaximander of Miletus.
[2] τὸ ἄπειρον means 'unlimited' in time and space for Anaximander of Miletus.

The difference between [1] and [2] is clearly relevant. As it is well known, Anaximander of Miletus used the words τὸ ἄπειρον to describe what he deemed as

the ἀρχή ('origin'), that is, as the first elemental principle from which everything is made. In this way, if the interpretation adopted is [1], we can understand that what Anaximander meant is that everything is created from an element that has no form (or, at least, that, if that element has a form, that form cannot be similar to the one of elements such as water, fire…, that is, to the one of elements known by us). On the other hand, if, on the contrary, the option is [2], we can assume that Anaximander's actual idea was that the ἀρχή was infinite in space and in time, a possibility being also, of course, that it was immortal (due to its infinity in time).

However, the situation can be even more complicated. The disjunction linking [1] and [2] can be interpreted as inclusive, and not as exclusive, what would lead to think about an ἀρχή that is both indefinite or without form and infinite or unlimited at the same time, that is, to think about this third account:

[3] τὸ ἄπειρον means both 'indefinite' and 'unlimited' in time and space at the same time for Anaximander of Miletus

As far as I understand it, Kirk and Raven's (1977) explanation is coherent with [3] too. Nevertheless, what this paper tries to clarify is not how Anaximander actually understood his ἀρχή. What is interesting here is, as indicated, whether or not any expression can be properly captured both by formal structures and by semantic representations. Undoubtedly, [1], [2], and [3] are examples that are complex enough, and, for this reason, they can offer an opportunity to find evidence in that regard. I begin with the possible logical forms that could be assigned to these interpretations.

The theories claiming the importance of logical forms and τὸ ἄπειρον

I have named the mental logic theory as an approach that proposes that sentences are related to logical forms and that people resort to such forms to make inferences. Nevertheless, it is not the only theory of this kind. There are also other similar frameworks, and simply two more examples of them can be those of Henlé (1962) or Rips (1994). Of course, there are differences between these frameworks and all of them do not support exactly the same theses. Nonetheless, something they appear to have in common is the idea that once the logical forms corresponding to sentences are identified, formal rules more or less akin to those of classical logic are used with them (see, e.g., JOHNSON-LAIRD, 2010, to a better understanding of certain theses these approaches share). The expression 'more or less' is essential with regard to these theories, since it refers to what mainly differentiates them from each other. Indeed, the formal rules admitted by them are not always the same. However, the point that is truly interesting here is exactly the step previous to the execution of inferences in which logical forms are assigned to sentences.

Actually, this is not the first paper in which something like that is addressed. In fact, in works such as the one of López-Astorga (2017b), it is tried to relate logical forms to theses of ancient philosophy as well. In particular, López-Astorga (2017b) deals with the thesis about the soul by Thales of Miletus. Nevertheless, my

aim in this section is just to check whether or not logical forms can clearly express the differences between [1], [2], and [3]. In my view, the clearly can. Let us suppose a language akin to the one of first-order predicate logic and these equivalences:

∃: existential quantifier
∧: conjunction
¬: negation
P: to be the nature of τὸ ἄπειρον
Q: to be the nature of water
R: to be the nature of air
S: to be the nature of which is intermediate between water and air
T: to be indefinite

Given these equivalences, we can build the following formula:

[I] $\exists x (Px \wedge \neg Qx \wedge \neg Rx \wedge \neg Sx \wedge Tx)$

Obviously, [I] captures what, if interpreted as [1], is said by Aristotle in *Physica* Γ 4, 203 a 16, as it provides that 'there is an x such that x is the nature of τὸ ἄπειρον, is not the nature of water, is not the nature of air, is not the nature of which is intermediate between them, and is indefinite'.

But, if we also want to capture what that very fragment claims under interpretation [2], it is only necessary to assume one more equivalence:

U: to be unlimited in time and space

This allows us to construct this new formula:

[II] $\exists x (Px \wedge \neg Qx \wedge \neg Rx \wedge \neg Sx \wedge Ux)$

Which means that 'there is an x such as x is the nature of τὸ ἄπειρον, is not the nature of water, is not the nature of air, is not the nature of which is intermediate between them, and is unlimited in time and space'.

However, all the equivalences above together enable to give a formal or syntactic structure of [3] too. Certainly, it is almost trivial to say that the following formula can be formed with those equivalences as well:

[III] $\exists x (Px \wedge \neg Qx \wedge \neg Rx \wedge \neg Sx \wedge Tx \ Ux)$

Which, evidently, indicates that 'there is an x such that x is the nature of τὸ ἄπειρον, is not the nature of water, is not the nature of air, is not the nature of which is intermediate between them, is indefinite, and is unlimited in time and space'.

So, there are three formulae, [I], [II], and [III], which capture without difficulties the three interpretations of the thesis about τὸ ἄπειρον by Anixamander of Miletus mentioned above, that is, [1], [2], and [3]. Nevertheless, a semantic approach such as the one of the mental models theory is also able to express what is indicated by those interpretations. But this last theory does that by means of iconic models, and not of logical formulae.

The mental models theory and τὸ ἄπειρον

A lot of bibliography on the mental models theory is to be found in the specialized literature. However, maybe, apart from the works cited above, a good overview of it can be that presented in Johnson-Laird (2012), and perhaps another important more recent text can be the one of Quelhas, Rasga, and Johnson-Laird (2017), where the theory is called 'the unified theory of mental models'. In any case, in many of the works supporting this theory it is stated that its framework has deep links to Peirce's (1931-1958) philosophy. This is so because the mental models theory appears to propose that people never consider logical forms in a natural way, but only representations that work in the same manner as icons and that symbolically represent reality. Those representations are named 'models' and, although they remind the concept of 'possible worlds' of modal logic (see, e.g., KRIPKE, 1963a, 1963b, 1965), they are very different from these last worlds. They are only possible iconic scenarios in which, if referred to the same sentence, only one element changes. Thus, it can be thought that, under its framework, [1], [2], and [3] can be represented as three possible scenarios that are similar and that only present a little variation with regard to each other.

This last point is the interesting one for this paper. The potential of the mental models theory has been shown not only by means of many experimental studies, whose exact references can be found in works such as those ones mentioned, but also, as pointed out for the theories claiming logical forms in the mental activity in the previous section, applying some of its theses to the analysis of ancient philosophical arguments (see, e.g., LÓPEZ-ASTORGA, 2017b as well). However, this section is aimed to review just its possibilities in connection to [1], [2], and [3], and, as far as this issue is concerned, it can be said that an iconic model describing [1] could be as follows:

[A] (the nature of τὸ ἄπειρον is different from water) & (the nature of τὸ ἄπειρον is different from air) & (the nature of τὸ ἄπειρον is different from which is intermediate between water and air) & (the nature of τὸ ἄπειρον is indefinite).

[A] represents not only what is explicitly indicated in it, but also the entire reality. It is an iconic model of the world and what is expressed in it is not the set of the only characteristics the world has, but just the aspects of reality that are relevant for the thesis that is being considered. In this case, as it evident, it states that τὸ ἄπειρον has a nature that is different from water, air, and which is intermediate between them, and that it is indefinite. In other words, it captures interpretation [1] of Fragment 104 in Kirk and Raven (1977).

But it is obvious that the machinery of the mental models theory can also allow building a model providing what the same Aristotelian passage communicates if interpreted under [2]:

[B] (the nature of τὸ ἄπειρον is different from water) & (the nature of τὸ ἄπειρον is different from air) & (the nature of τὸ ἄπειρον is different from which is intermediate between water and air) & (the nature of τὸ ἄπειρον is unlimited in time and space).

Actually, [A] and [B] describe very similar worlds. As it can be noted, there is only one little difference between them. In [A] τὸ ἄπειρον is indefinite and in [B] it is unlimited in time and space.

In this way, it is absolutely evident that, based on all of this, it is possible to offer a model referring to [3] too. It is, again, almost trivial to state that that model could be the following:

[C] (the nature of τὸ ἄπειρον is different from water) & (the nature of τὸ ἄπειρον is different from air) & (the nature of τὸ ἄπειρον is different from which is intermediate between water and air) & (the nature of τὸ ἄπειρον is indefinite) & (the nature of τὸ ἄπειρον is unlimited in time and space).

Clearly, [B] and [C] are not very different either. Everything is the same in both worlds, except that in [C] τὸ ἄπειρον, in addition to be unlimited in time and space, is also indefinite.

So, the mental models theory is able to capture what is expressed following interpretations [1], [2], and [3] as well. However, the most interesting point in this way is that effort is not required to check that there are clear relationships between, on the one hand, [I], [II], and [III] and, on the other hand, [A], [B], and [C].

Conclusions

Indeed, the fact that they are formulae does not imply that the rest of the world in the circumstances in which [I], [II], and [III] are true cannot be identical. From this point of view, it can be thought that [I] provides the same information as [A], that [II] provides the same information as [B], and that [III] provides the same information as [C]. And this is so even though [I], [II], and [III] are elements of a type obviously different from that of [A], [B], and [C]. The three first ones are syntactic structures, while the three second ones are semantic models. Still, from both perspectives, it is possible to consider [1], [2], and [3], that is, three manners the thesis about τὸ ἄπειρον by Anaximander of Miletus can be understood. Hence, it can be said that what differentiates such interpretations can be provided both syntactically or formally, by means of formulae, and semantically or iconically, by means of mental models, especial effort not being necessary in none of those two cases.

Therefore, the theoretical discussion between approaches such as those deemed in the two last sections does not appear to be linguistically relevant. The sentences with a meaning that can be shown resorting to mental models seem to refer, in the same way, to underlying syntactic forms, which can be thought to be correlates of such models. Accordingly, this paper can be considered as further evidence in favor of theses such as those supported in works such as the one of López-Astorga (2017a), in which it is clearly held the existence of correlates of that kind.

A different matter is the problem of human reasoning. The cognitive science literature apparently suggests that what is really used when inferences are made is iconic representations as described by the mental models theory (see, for a number of references arguing in this direction, e.g., JOHNSON-LAIRD *et al.*, 2015).

This is an interesting fact that is acknowledged by López-Astorga (2017a) too. So, it appears that it cannot be claimed that human beings reason in accordance with the basic syntactic rules of classical logic, but, at most, simply, that, while the way people usually make inferences is semantic, such semantic processes can also be connected to syntactic structures consistent with them, and that these last structures can be related to each other as well (e.g., LÓPEZ-ASTORGA, 2017a).

But, as said, this is in the cognitive level. In this last level, there is no doubt that the debate between syntax and semantics can still makes sense. In fact, that is the actual level in which frameworks such as the mental models theory and the mental logic theory often discuss. Nonetheless, in the linguistic level, the situation appears to be different. As shown, from the linguistic point of view, neither syntax nor semantics seem to have priority, whether temporal or mental. And this is so because, apparently, for any sentence, a logical form expressed as an underlying formula can be always identified and, likewise, its content can be, at the same time, always described by means of an iconic model, the point key being here that both of them, the formula and the iconic model, appear to be clearly linguistically linked.

References

CERVIO, P. Anaximandro. In: FERNÁNDEZ LABASTIDA, F. & MERCADO, J. A. (Eds.). *Philosophica:* Enciclopedia filosófica on line, 2014. Available on: http://www.philosophica.info/archivo/2014/voces/anaximandro/Anaximandro.html [January 18th, 2018].

CHERNISS, H. F. *Aristotle's Criticism of Presocratic Philosophy*. Baltimore, MD: The Johns Hopkins Press, 1935.

HENLÉ, M. On the relation between logic and thinking. *Psychological Review*, v. 69, 1962. p. 366-378.

JOHNSON-LAIRD, P. N. Against logical form. *Psychologica Belgica*, v. 5, n. 3/4, 2010. p. 193-221.

_____. Inference with mental models. In: HOLYOAK, K. J. & MORRISON, R. G. (Eds.). *The Oxford Handbook of Thinking and Reasoning*. New York, NY: Oxford University Press, 2012.

_____., KHEMLANI, S., & GOODWIN, G. P. Logic, probability, and human reasoning. *Trends in Cognitive Sciences*, v. 19, n. 4, 2015. p. 201-214.

KIRK, G. S. & RAVEN, J. E. *The Presocratic Philosophers:* A Critical History with a Selection of Texts. London, UK, & New York, NY: Cambridge University Press, 1977.

KRIPKE, S. A. Semantical considerations in modal logic. *Acta Philosophica Fennica*, v. 16, 1963a. p. 83-94.

_____. Semantical analysis of modal logic I: Normal modal propositional calculi. *Zeitschrift für Mathematische Logik und Grundlagen der Mathematik*, 9, 1963b. p. 67-96.

_____. Semantical analysis of modal logic II: Non-normal modal propositional calculi. In: ADDISON, J. W., HENKIN, L., & TARSKI, A. (Eds.). *The Theory of Models:*

Proceedings of the 1963 International Symposium at Berkeley. Amsterdam, The Netherlands: North-Holland Publishing Co, 1965.

LÓPEZ-ASTORGA, M. Mental models are compatible with logical forms. In: LÓPEZ-VARELA AZCÁRATE, A. (Ed.). *Interdisciplinary Approaches to Semiotics*. Rijeka, Croatia: InTech, 2017a.

_____. Thales of Miletus and the semantic possibilities of his view of the soul. *Aisthema*, IV(1), 2017b. 101-112.

O'BRIEN, D. P. Conditionals and disjunctions in mental-logic theory: A response to Liu and Chou (2012) and to López-Astorga (2013). *Universum*, v. 29, n. 2, 2014. p. 221-235.

PEIRCE, C. S. *Collected papers of Charles Sanders Peirce*. HARTSHORNE, C., WEISS, P., & BURKS, A. (Eds.). Cambridge, MA: Harvard University Press, 1931-1958.

QUELHAS, A. C., RASGA, C., & JOHNSON-LAIRD, P. N. A priori true and false conditionals. *Cognitive Science*, v. 41, n. 55, 2017. p. 1003-1030.

REALE, G. *Storia della filosofia antica, Volume I. Dalle origini a Socrate*. Milan, Italy: Vita e Pensiero, 1987.

RIPS, L. J. *The Psychology of Proof:* Deductive Reasoning in Human Thinking. Cambridge, MA: Massachusetts Institute of Technology (MIT) Press, 1994.

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Recebido em 18/1/2018
Aprovado em 20/6/2018

Como referenciar esse artigo

LÓPEZ-ASTORGA, Miguel. Syntactic and semantic aspects in the expression of a thesis by Anaximander of Miletus. *Argumentos*: Revista de Filosofia. Fortaleza, ano10, n. 20, p. 18-26, jul.-dez. 2018.