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Available in: http://www.redalyc.org/articulo.oa?id=28100803

Intensional Expressions:
A Proposal of Analysis
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Expresiones intensionales:
propuesta de análisis de un filósofo polaco

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Resumen. El objetivo de este artículo es presentar la propuesta de un filósofo polaco acerca de un problema particular en el análisis de las expresiones lingüísticas, así como su solución. Kazimierz Ajdukiewicz (1890-1963) debate la existencia de expresiones conocidas como intensionales, y propone la eliminación de la intensionalidad misma recurriendo a un determinado análisis de la estructura sintáctica de las oraciones complejas que contienen un verbo intensional como "creer".
Palabras clave: creencia, metalingüística, connotación, denotación, identidad, intensional, intensionalidad.

Abstract. The object of this article is presenting the proposal of a Polish philosopher about a particular problem in the analysis of linguistic expressions, as well as its solution. Kazimierz Ajdukiewicz (1890-1963) discusses the existence of expressions traditionally called intensional, and proposes the elimination of intensionality itself by means of a particular analysis of the syntactic structure of compound sentences with an intensional verb as "to believe".
Keywords: belief, metalinguistic, connotation, denotation, identity, intensional, intensionality.

This article aims to present a polish philosopher's proposal concerning a particular problem in the analysis of linguistic expressions, as well as its solution. In a chapter of his *Pragmatic Logic* (1974) Kazimierz Ajdukiewicz[2] discusses the existence of expressions traditionally called intensional; with a radical solution: the elimination of intensionality itself by means of a different analysis of the syntactic structure of sentences.

Intensional expressions are of two kinds:

A) expressions which can be transformed into different and not equivalent expressions[3] by replacing one of its constituents[4] by an equivalent expression. For example, in the sentence:

(1) *Newton knew that 8 > 5*

which is true, if we replace the constituent *8* by the equivalent expression *the atomic number of oxygen* we obtain the sentence:

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advancement of knowledge and exercised a profound influence upon the intellectual life of their country. Ajdukiewicz was interested in a wide range of subjects. The logical analysis of language and the relationship of language to knowledge were the dominating interest of his life. He was one of the philosophers who contributed to the appreciation of the profound influence of language upon knowledge. While he did not share the hope of Bertrand Russell that language may help us understand the structure of the world, he felt sure that our conception of language is largely responsible for what we recognize as valid knowledge.

Major works by Ajdukiewicz are *Z metodologii nauk dedukcyjnych*, Lvov, 1921; *Zalozenia logiki tradycyjnej*, Warszawa, 1927; *Elements of methodology and formal logic* (in pol.), Warszawa, 1928; *Logiczne podstawy nauczania*, Warszawa, 1934; *Propedeutyka filozofii*, Lvov, 1938; *Zarys logiki*, Warszawa, 1956; *Jezyk i poznanie*, Warszawa, 1960-65; and posthumously, *Pragmatic Logic*, 1965.

[3] Equivalence is a relationship either between two names with the same denotation, or between two sentences with the same truth value, or between two non-binding operators with the same number of arguments and which form equivalent expressions when they are combined with equivalent arguments.

[4] An expression A is a constituent of an expression B if it is a constituent of any order of B: of zero order if A is the same as B, of first order if A is the main operator in B or if A is an argument of the main operator, and so on. The constituents of an expression occupy a syntactic position for which Ajdukiewicz uses the follow particular notation:

2	+	3	=	6	-	1
(1,1,1)	(1,1,0)	(1,1,2)	(1,2,1)	(1,2,0)	(1,2,2)	
(1,1)		(1,0)		(1,2)		
			1			

The concept of being a constituent of an expression is a very important one, because an expression can be considered intensional only if the proof of the substitution applies to constituents, not to parts which do not form constituents. For example, if we change *passed* with the equivalent *crossed* in:

(i) *They passed over the obstacle*

we obtain:

(ii) *They crossed over the obstacle*

but we do not have to do with an intensional expression, because here *passed* is not a constituent, but a part of the constituent *passed over*.

Examples like this one show that the identification of intensional expressions depends on the syntactic analysis of the expression.

(2) *Newton knew that the atomic number of oxygen > 5*

which is false.

B) expressions which contain one or more free variables such that, by replacing one free variable by two different but equivalent constant expressions, we obtain two expressions which are not equivalent. For example, in the formula:

(3) *Newton knew that x > 5*

if we replace *x* by two equivalent expressions, *8* and *the atomic number of oxygen*, we obtain two sentences with different truth values.

Ajdukiewicz 's definition of intensionality is general and it applies to different expressions such as sentences, predicates, operators and sentential formulas; nevertheless, in this work he limits the discussion to sentences, in particular, to a kind of intensional sentences which contain indirect speech introduced by verbs as *to say*.[5]

The author points to the fact that intensional expressions represent a problem and that it is desirable to free language from them.

Why are they a problem? First of all because intensionality does not allow to adopt Leibniz's definition of identity, in account of which two objects are the same object if they can't be distinguished. If we apply this principle to the analysis of sentence, two entities are the same entity if each one can be substituted by the other one everywhere without a change of the truth value. Intensional expressions, as we have seen, violate this principle.

The second reason that makes problematic the existence of intensionality is the fact that it prevents a sentential formula which contains one variable to establish a functional relationship between the values of the variable and the logical values of the formula: truth, when the formula is satisfied; falsity, when it is not. In opposition to extensional sentential formula, an intensional one is not capable of determining any class of values of the variables which satisfy it. So, as we have seen, truth or falsity of the formula:

(4) *Newton knew that x > 5*

will depend on the name of the number 8, not on its denotation.

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[5]   The semantic class of verbs which, with their subordinate, form an intensional sentence, is heterogenous and it includes verbs as *to say, to replay, to believe*, *to know, to doubt, to wonder, to intend, to want*; modal expressions as *to be necessary that*, *to be possible that*, etc.

Finally, intensional epressions represent a problem with respect to the principle of compositionality, which establishes that the denotation of the whole expression is a function of the denotations of its parts. If an expression is formed by constituents of different orders, its denotation is unambiguously determined by the denotation of its constituents, from lower order to higher one. Buttom-up compositionality makes impossible that a change in the denotation of a constituent can change the denotation of some other constituent of higher order without changing the denotation of all the intermediate constituents which separate them. Nevertheless, it seems that in intensional expressions there is a kind of action at a distance such that the denotation of the whole expression is changed by the substitution of a constituent of a lower order without a change of the denotation of the intermediate constituents. For example, replacing *8* in example (1) by *the atomic number of oxygen* does not change the denotation of the intermediate constituent:

(5) *the atomic number of oxygen > 5*

but it does change the denotation of the whole expression, as it is evident in example (2), repeated below:

(2) *Newton knew that the atomic number of oxygen > 5*

On the bases of these considerations and in order to preserve the principle of compositionality and the principle of identity, Ajdukiewicz looks for a way of eliminating intensional expressions from language. One possibility is to avoid them, as does mathematics, but it does not seem a reasonable solution for natural language: how (and why) to eliminate a very great number of verbs and expressions?

The solution that Ajdukiewicz discusses in his article is a radical one; on the base of a different interpretation of the syntactic structure of the sentence, the author avoids intensional expressions by preventing the rising of the problem itself, the springing up of intensionality, without betraying the sentential meaning.

How does the author procede in his argumentation? He starts with an example of intensional expression:

(6) *Caesar believed that Rome lies on the Tiber.*

This is an intensional sentence because the substitution of the constituent *Rome* by, for example, *the capital of the Popes*, changes the logical value of the whole sentence from truth to falsity:

(7) *Caesar believed that the capital of the Popes lies on the Tiber.*

According to Carnap, the intensionality of (6) desappears if we interpret it as a metalinguistic sentence expressing Caesar's attitude towards a linguistic entity rather than towards a state of affairs:

(8) *Caesar believed in the sentence 'Rome lies on the Tiber'*

In Ajdukiewicz's opinion, this sentence need to be reformulated as:

(9) *Caesar believed in a sentence which is the translation of the English sentence 'Rome lies on the Tiber' into some other language.*

This is necessary to avoid falsity of (8), because Caesar did not know English.

Nevertheless, the interpretation of an intensional sentence proposed by (8) and (9) is not satisfactory for Ajdukiewicz because it changes a sentence in object language like (4) into a metalinguistic sentence like (8) or (9). In fact, Caesar's attitude is not towards a verbal entity, as it is stated in these sentences, but towards a situation in the world, as it is stated in (6), in which the entity Rome establishes a relation of lying on with respect to a second entity, the Tiber. Ajdukiewicz's goal is to give an interpretation of sentence (6), such that it accounts of its caracter of being a sentence in object language and, at the same time, being free from intensionality.

To get his goal the author makes use of the concepts of connotation and translation. The connotation of a sentence, as he defines it in "Proposition as the connotation of a sentence" in the same work, is a function which establishes a one-to-one correspondence between the syntactic position of each one of the ultimate constituents of the sentence and the object denoted by the expression occupying this position. The correspondence is called the connotation, or the proposition, or the basic content of the sentence.[6]

On the base of the concept of connotation the author constructs the notion of literal translation: an expression A is a literal translation of an expression B from the language L1 into the language L2 if and only if:

a) there is a one-to-one correspondence between each one of the ultimate constituents of one expression and of the other one

b) the constituents occupy in A and B the same syntactic positions

c) they denote the same object.

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[6]   The author distinguishes between the basic content of the sentence and the full content, which is compositionally determined by the basic content.

Then, a literal translation[7] of a sentence A is a sentence B which has the same basic content than A.

If we translate the sentence *Rome lies on the Tiber* (RlT) in a sentence with the same basic content, formed by the set of ordered pairs of syntactic positions occupied by certain words and the objects denoted by them, we obtain:

(10) [(1,1)-R, (1,0)-l, (1,2)-T]

So, instead of:

(11) *Caesar believed in a sentence which is the literal translation of the English sentence 'RlT' into some other language.*

we have:

(12) *Caesar believed in a sentence with the basic content [(1,1)-R, (1,0)-l, (1,2)-T]*

The sentence (12) is an extensional one because its truth value does not change if we replace anyone of its constituents by an equivalent expression. We must not forget that the basic content of a sentence is the correspondence between the syntactic position of each one of its ultimate constituents and the object denoted by the expression filling this position, not between the syntactic position and the word which occupies it. Then, if we sustitute, for example, the constituent *Rome* by its equivalent expression *the capital of the Popes* we obtain:

(13) *Caesar believed in a sentence with the basic content [(1,1)- c(p), (1,0)-l, (1,2)-T]*

The two sentences (12) and (13) have the same basic content and the same truth value because the object denoted by *R* in (12) and by *c(p)* in (13), as well as the syntactic position of these constituents, are the same.

To sum up Ajdukievicz's argumentation till now, the sentence:

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7   Translations are not always literal, but they can be of different degrees of precision: an expression A is a translation of nth degree of an expression B if A and B are reciprocal literal translations provided their constituents of orders higher than nth are disregarded. So a literal translation of an expression A is the same as its translation of the highest possible degree of precision, which corresponds to the highest order shared by the constituents of the expression A. In the analysis of intensional expressions it is convenient to use the concept of literal translation and disregard translations of lower degree of precision.

(14) *Caesar believed that (RlT)*

is interpreted, following Carnap, as:

(15) *Caesar believed in the sentence 'RlT'*

which is reformulated as:

(16) *Caesar believed in a sentence which is the translation of the English sentence 'RlT' into some other language*

This sentence can be reformulated as:

(17) *Caesar believed in a sentence which is the literal translation of the sentence 'RlT'*

which, on the base of the notion of literal translation, is the same as:

(18) *Caesar believed in a sentence with the basic content [(1,1)-R, (1,0)-l, (1,2)-T]*

There is an important difference between (17) and (18): the first sentence is in metalanguage, because of the expression in quotation marks, and must be considered as an abbreviation of an expression containing a basic description, a concept which refers to the correspondence between syntactic positions and the names of the words which occupy them. We can express this in the following way:

(19) *Caesar believed in a sentence which is the literal translation of the English sentence with the basic description [(1,1)-'Rome', (1,0)-'lies on', (1,2)-'the Tiber']*

On the contrary, (18) is in object language because it does not contain quoting expressions but only syntactic positions related to referents.

It is true that (18) still retains a certain metalinguistic aspect: it refers to the fact that Caesar recognizes a certain sentence and that he believes in it; however, this metalinguistic component, as we will see later, will be easily eliminated.

It is the sentence (18) the one that better suits Ajdukiewicz's purpose of eliminating intensionality[8] without changing the meaning of a sentence in object

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[8] Although the sentences (19) is not intensional, because it is not possible to substitute one of the names in quotation marks by a phonological equivalent expression, with respect to his goal

language; in fact, its constituents are not words but extensional expressions which refer to Rome and the Tiber, as well as to the relation of lying on.

The basic idea of Ajdukiewicz's analysis of intensional expressions like (6), repeated below:

(6) *Caesar believed that Rome lies on the Tiber.*

consists in considering:

> the intensional operator, e.g., 'believes that...' as an analyser which breaks the syntactic structure of the subordinate clause into separate simple words, by considering the original syntactic role they played in that subordinate clause (Ajdukievicz, 1974: 338).

In other words, the intensional verb is the main operator which destroys the structure of the simple clause when this one comes to form a compound sentence; the constituents of this one are the simple words of the subordinate clause, with their syntactic positions and denoting certain objects. So, in Ajdukiewicz's interpretation the arguments of the operator *believes that* are not *Caesar* and all the subordinate clause, but *Caesar* and the separate words which constitute the second, third, etc. argument of the operator, as we can see in:

(20) *Caesar believed that Rome lies on the Tiber.*
   (1,1)   (1,0)   (1,2) (1,3) (1,4)

By means of this syntactic analysis intensionality desappears from the sentence because, if we want to use the proof of substitution, traditionally reserved to identify opac contexts, we are obliged to apply it only to simple words, which are extensional expressions with a syntactic position in the compound sentence, not to expressions considered as constituents in the subordinate clause.

In other words, if we examine one more intensional sentence:

(21) *Caesar believes that the capital of the Repubblic lies on the Tiber.*

it is not possible to replace *the capital of the Repubblic* with *the capital of the Popes* because the first expression is not a constituent, and the proof can apply only to separate words. As constituents of the compound sentence, those can be

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Ajdukiewicz does not take it into account because of its metalinguistic caracter. He points out that the elimination of intensionality must respect the object language nature of the sentence and its meaning.

substituted either by a complex expression, as we have seen till now, or by simples words, as in the following sentence:

(22) *John believed that Dr Jekyll was a gentleman.*
(23) *John believed that Mr Hyde was a gentleman.*

Ajdukievicz's interpretation allows that by replacing a word, which is no more a constituent of the subordinate clause, by an equivalent one, the problem of intensionality does not rise. In fact, the concept of basic content, or connotation of the sentence, as we have seen, makes that the proof of substitution applies to ordered pairs of syntactic positions and referents. Being the same the syntactic position and the object denoted by two equivalent expressions as *Dr Jekyll* and *Mr Hyde*, the logical values of (22) and (23) is the same, indipendently from the fact that John knows or does not know that they are two names for the same person.

Then, the concepts of connotation of the sentence and the kind of syntactic analysis which breaks a sentence with an intensional operator into isolated parts which do not integrate constituents of higher order, limit the proof of substitution to the ordered pairs of syntactic positions and referents.

Intensionality rises if we understand that sentence (6), repeated below:

(6) *Caesar believed that Rome lies on the Tiber.*

states a relation between Caesar and certain words. The interpretation which prevents the rising of intensionality lies in considering that the sentence states a relation between Caesar and the city named Rome, which lies on a river named Tiber; in other words, the sentence states a relationship between Caesar and a state of affairs. Intensionality rises up if we understand a sentence like (6) in a metalinguistic way, but it can be eliminated if we consider the relationship between the subject and the object of the belief, not between the subject of the belief and some words which denote the object. Intensionality rises from the sense (Frege), not from the denotation, so it can be eliminated pointing to the denotation and disregarding the sense. Intensionality desappears if we do not consider a metalinguistic relation and we point only to the denotation of the words.

Nevertheless, if we interpret a sentence of the type *x believes that...* as *x believes in a sentence with the basic content [...]*, there is still some metalinguistic residue in Ajdukiewicz's interpretation. In fact, the schema refers to an assertive attitude of a given person towards a certain sentence, a linguistic entity, and this element does not appear in the original sentence in object language.

So, the following stage in the author's argumentation is to eliminate this metalinguistic residue once more on the base of the notion of basic content. What a sentence states, its basic content or connotation, refers to something existing in the world; so it is possible to set the following equivalence:

(24) *What is stated by a sentence A = the basic content of A*

The basic content of a sentence A is what a literal translation of A contains, then:

(25) *x believes in what is stated by a sentence A = x believes in a literal translation of A = x believes in a sentence with the basic content [...] = x believes that [basic content]*

So, operating with these equivalences it is possible to transform the metalinguistic interpretation of an intensional sentence proposed by Carnap, and which was used by Ajdukiewicz to reveal the extensional caracter of its constituents, back to its object language caracter. To conclude, the schema that the author adopts for the interpretation of intensional expressions and which allows to express its basic content in object language is the following:

(26) *x believes that...[basic content]*

Then, in the case of the example used in the argumentation, it can be reformulated as:

(27) *Caesar believed that [(1,1)-R, (1,0)-l, (1,2)-T]*

Finally, Ajdukiewicz eliminates the last unsatisfactory detail in his analysis: the presence in the notation of the ordered pairs formed by a syntactic position and a word. He points out the ambiguity of the term *word* which can refer to a word *in concreto* (muestra), to a word *in specie* (tipo) or to a word *in specie* determined as to its syntactic position (for instance, a word with a case suffix as it appears in latin). This kind of word is characterized by two coordinates: a definite word *in specie* and a definite syntactic position. If the sentence becomes a syntactic part of another sentence with an intensional operator like *to believe that*, the constituents of the compound sentence must be considered as words *in specie* not determined as to their syntactic position in the indipendent clause.

Ajdukiewicz's proposal to eliminate intensionality is interesting for different reasons.First of all, he points to the fact that intensionality is a problem with

respect to formal language, not to object language. An evidence of this fact is that all the natural languages can be considered "intensional"; another evidence is the fact that Leibniz's definition, which is formulated exclusively in the object language and applies only to it, not to sentential formulas in a formal language, presents problems in formal language. Then a name A may denote the same object as the name B; in other words, it does exist identity between A and B, in spite of the existence of intensional formulas because these ones do not introduce new classes or new properties in order to consider the denotation. So, the problem rises not from the relation between natural language and world, but from the relation between natural language, world and formal language.

The problem rises when the logical language inspirates on natural language taking in account principles of its working and then, through a process of abstraction of containing and of consideration of form exclusively, looks at natural language regressively and founds it insatisfactory. It becames a circular process.

It seems that is important to separate the goals and the tasks of logical language from those of natural languages, because there are no reasons for considering them as mirrors of one another, without reducing one of them to the other one.

For this reason, Ajdukiewicz considers that a way of eliminating intensionality is by means of paying attention to denotation, not to sense. He is convinced that we do not believe in linguistic entities as sentences, but in state of affairs which are stated by them. So, denotation seems to be central in Ajdukiewicz's point of view. Sentences, as in Wittgenstein, are proyects of reality. From his point of view, intensionality rises if we stop in the sense and we do not walk along till the referent; so, if we take in account the referent, does not matter with its name, intensionality desappears. So, he is suggesting that intensionality rises from the sense, and that it can be eliminated if we consider denotation.

The author does not claim that the syntactic interpretation that he proposes is the only correct one, because of the plurality of syntactic interpretations that a natural language leaves room for, but only the most convenient for his aim, the elimination of intensionality. Nevertheless, it seems to be necessary that the syntactic analysis that he proposes must be justified with respect to a linguistic theory, to avoid the impression of ad hoc analysis. It would be necessary to find linguistic evidences, syntactic proofs, for instance, that the subordinate clause of an intensional verb does not function as a whole and has not an internal structure of constituents

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