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Redefining logical constants as inference markers[1]

Abstract: There is currently no universally accepted general definition of logical constanthood. With a view to addressing this issue, we follow a pragmatist rationale, according to which, some notion can be identified as a logical constant by considering the way in which it is used in our everyday reasoning practices, and argue that a logical constant has to be seen as encoding some kind of dynamic meaning, which marks the presence of an inferential transition among propositional contents. We then put forth a characterisation of logical constants that takes into account their syntactic, semantic and pragmatic roles. What follows from our proposal is that logical constanthood can be best understood as a functional property that is satisfied only by certain uses of the relevant notions.

Keywords: logical constants; pragmatism; expressivism

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1 Introduction

Fundamental though it may be in the study of semantics, the property that enables us to classify some expression as a 'logical constant' has proven particularly difficult to pinpoint with precision. And even though it is generally agreed

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that the set of logical constants includes at least negation, conjunction, disjunction, the conditional, the universal quantifier and the existential quantifier,[2] the reasons for taking some notion to be included in this set are hardly ever debated by the contemporary semanticist who is in most cases trained to treat this set as pre-theoretically given, no questions asked.[3] It therefore falls to the philosopher of logic to provide a clear-cut definition of logical constanthood, but again even in this domain of enquiry the situation is not as straightforward as one would have hoped, with various accounts approaching the issue from distinct viewpoints. From all of these, invariantist definitions, of the type that Tarski (1986 [1966]) had originally suggested and Sher (1991, 2003) currently defends, have attracted broad agreement among specialists. But apart from them, a number of semantic and functional accounts have also appeared in the relevant literature; Gentzen (1935), for example, and following him Hacking (1979), Peacocke (1987) and Dummett (1991) have put forward inferential proposals that take a semantic stance on the meaning of logical constants, while Warmbrod (1999: 516) has identified them by means of their role in systematising scientific theories and Gómez-Torrente (2002, 2007) has emphasised some aspects that a pragmatic characterisation should cover. In spite of all this theoretical activity, however, it still seems that "there is as yet no settled consensus as to what makes a term a logical constant or even as to which terms should be recognized as having this status" (Warmbrod 1999: 503).[4]

A common characteristic of previous attempts to provide a definition of logical constanthood is that they are usually strongly *ad hoc*: the intuitive set of logical constants precedes its theoretical characterisation, and any proposal made to this effect has to be tested against the original intuitions about which notions are 'logical' in the first place. Clearly, this methodology has generated a substantial

2 For some, this list goes on to contain identity, membership, the lambda operator, non-standard quantifiers, tense, modal and epistemic operators and so on. Again, if anything, the lack of agreement across researchers on the members of the set of logical constants shows that the notion of logical constanthood has until now eluded the different attempts to characterise it.

3 A clear example of this attitude can be found in such influential theories as Montague Grammar, which incorporated in its premises "all the usual notions of propositional, quantificational, and modal logic" (Montague 1974 [1970]: 235) assuming *a priori* their constanthood.

4 Due to space limitations, we will not go through the different available definitions of logical constanthood in any detail. There are several out there, but they have all been considered more or less defective on various grounds. The criticisms that can be addressed against them should be well known to specialists, but for representative discussions see Haack (1978: 3–10); Feferman (1999); Warmbrod (1999) and Gómez-Torrente (2002, 2007).

amount of ground-breaking research, at least in relation to the formal artifacts that logicians customarily posit. However, when one enters the domain of natural language, with its well-known ambiguities and 'imperfections', the extent to which mathematical logic can be used as the irreducible basis of natural-language semantics is itself debatable. As Seuren has argued,

> logic cannot be the foundation of semantics, but semantics is the proper foundation of logic. The logical properties of the sentences of natural languages are best seen as epiphenomenal on the semantic and cognitive processing of the sentences in question. They emerge when semantic processes and properties are looked at from the point of view of preservation of truth through sequences of sentences, which is the defining question of logic, not of semantics. (2000: 289)

Against this background, we wish to explore in this paper an alternative way of dealing with the problem of logical constants: instead of attending to the pre-selected group of abstract notions, we will focus on the *function* that logical constants are expected to perform in inferences, and then investigate which expressions match this logical profile. Even though this suggested methodology might appear to be unconventional at first sight, it squarely belongs to the pragmatist philosophical tradition, which seeks to connect theory and practice:

> Reasoning cannot possibly be divorced from logic; because whenever a man reasons he thinks that he is drawing a conclusion such as would be justified in every analogous case. He therefore cannot really infer without having a notion of a class of possible inferences, all of which are logically good. (Peirce 1998 [1903]: 188)

As we will turn to discuss in the following section, the intuition that we wish to vindicate is that by focusing too much on structural features, we have forgotten central aspects of the original motivation that gave rise to the modern study of logic, and the connection of logic with the actual reasoning practices that agents typically engage in is a case in point. The account we will be offering is neither radical nor revisionist; it is what one should expect if the conception of logic that begins independently with Peirce and Frege is taken seriously. All too briefly, the general conclusion we will argue for is that, if logical constanthood is seen as a functional property, it is not a property of types of expressions, but of tokens. In this picture, the distinct terms usually discussed under the heading of 'logical constants' do not form a natural kind, i.e., there is no logically significant feature, from the point of view of their overall meaning, that all of them share. Even so, most of them have specific, inferentially valuable roles that justify their inclusion in a general set of 'aids for drawing inferences'.

2 Logic and logics

Logic is customarily defined as "the most general theory of the true and the false" (Higginbotham 2000: 79). Nevertheless, particular aspects of what logical enquiry effectively involves can be found to vary from author to author, even when the authors in question are admittedly among the discipline's founding fathers.

Tarski, for example, described logic as the science of a *highly abstract kind of truths* (logical truths), whereby "one aims to establish the precise meaning of [logical] terms [such as 'not', 'and', 'or', 'is', 'every', 'some'] and to determine the most general laws which govern them" (1994 [1936]: 17). From this perspective, the difference between logic and the rest of the sciences, formal or not, rests on its degree of generality, but apart from that, logic possesses all the features that characterise a scientific theory. This much should be obvious from the way in which Tarski eventually connected his proposal on logical constants with the method used by Felix Klein to distinguish between geometrical theories, and further suggested that the very same method could be extended to cover non-formal realms, such as biology, physics and chemistry (1986 [1966]: 145–146).

Frege, on the other hand, may have also noted that "just as 'beautiful' points the way for aesthetics and 'good' for ethics, so do words like 'true' for logic" (1997 [1918–1919]: 325), but he had already clarified in earlier writings that " 'true' only makes an abortive attempt to indicate the essence of logic, since what logic is really concerned with is not contained in the word 'true' at all but in the assertoric force with which a sentence is uttered" (1997 [1915]: 323). From this viewpoint, logic is not so much of a theory like other scientific theories, but a language (a 'formula language for pure thought', as the title of his *Begriffsschrift* has it) and essentially a method of discovery, which seeks to identify safe transitions from the point of view of *truth-preservation* and bring into the open all the information needed to draw inferences safely.

The distinction between these two conceptions of logic, which, for ease of exposition, we will call 'T-Logic' (for 'Tarski') and 'F-Logic' (for 'Frege'), can become clearer, once their connection to mathematics is contrasted. T-Logic can be considered without risk a mathematical discipline, concerned with structural properties and relations; a discipline of the same kind as geometrical theories, but of a much more abstract nature. F-Logic, on the other hand, is no closer to mathematics than it is to any other discipline, since it is essentially a deductive tool; a system for the representation and evaluation of inferences that has universal applicability. To put it more simply, T-Logic is a system of truths, whereas F-Logic is an auxiliary system that does not produce truths on its own, but rather allows us to represent all kinds of arguments and assess them from the point of view of their validity.

When we turn to particular calculi, the differences between F-Logic and T-Logic affect the class of systems that are correspondingly considered to be logical calculi. The two options are to consider a calculus a logic either by attending to its structure or by focusing on its intended aim. As Haack discusses,

> It is relevant to distinguish, at the outset, between interpreted and uninterpreted formal systems: uninterpreted, a formal system is just a collection of marks, and cannot, therefore, be identified as a formal logic rather than, say, a formalization of a mathematical or physical theory. The claim of a formal system to be a logic depends, I think, upon its having *an interpretation according to which it can be seen as aspiring to embody canons of valid arguments*. (1978: 3, emphasis ours)

Mathematical methods focus on formal aspects, and this focus can make it easy to forget that in logic the items that bear logical properties are propositions, i.e. what is said by speakers in successful speech acts with assertive character, and not strings of uninterpreted signs. It is of course undeniable that the discipline of modern logic was born from the previous enterprise of applying algebra to the study of natural language, thanks to the work of mathematicians, such as Jevons, Boole, Peano, De Morgan, Schröder and Frege (see for example Kneale and Kneale, 1962), but it is also true that it became the independent science it is today when logicians understood the previous algebraic relations not as relations between sets but as relations between truth-bearers. This step was first taken by Bolzano, who placed the focus of logical relations on *Sätze an sich* (see Sundholm 2009), and then by Frege who placed it on judgments (see, for instance, 1967 [1879]: 12). In fact, Frege insisted that the only relevant feature shared by his ideography and arithmetic was the use of variables (Frege 1967 [1879]: 6), and continued, for several years after the publication of *Begriffsschrift*, to underline the crucial differences between his system and that of Boole (see Sluga 1987). In this picture, algebra represents relations between sets, which in the case of the algebra of logic are seen as extensions of concepts, while logic is concerned with relations between truth bearers, which are complete judgeable contents, that is, propositions.

Following this rationale, which, apart from the *Begriffsschrift* and Haack (1978), can be also found in Peirce's writings and in the work of a substantial number of logicians from Gentzen (1935) till today (e.g. Read 2003), we also maintain that, if mathematically-oriented approaches aim to be logically relevant at all and not only mathematically interesting, they need to provide scientific models, with their fully heuristic power, of the inferential patterns that connect concepts and conceptual contents as they are used in run-of-the-mill arguments. In this respect, the contrast between T-Logic and F-Logic becomes enormously relevant for the purpose of defining logical constants, which thus varies from the task of characterising some maximally abstract *objects* in the type hierarchy to that of characterising truth-preserving *links* among conceptual contents. These two tasks are independent of each other, and so, strictly speaking, determine two independent theoretical enterprises. One of these enterprises aims at obtaining maximally abstract formal structures, axiomatically organised; the relevant axioms being some kind of formal skeletons, 'logical truths', which deal with sets of highly abstract formal objects, 'logical constants'. This enterprise surely belongs to mathematics and its objects can be safely defined by mathematical methods. The second enterprise, however, has a different goal: it attempts to represent valid modes of reasoning, with *validity* rather than truth being its basic notion. It does not purport to identify sets of axioms but rather those transitions between propositional contents that are safe from the point of view of truth preservation. Therefore, in contrast to what happens in T-Logic, in which logical systems are free-standing mathematical theories, in F-Logic systems of logic are representations of ordinary reasoning on propositions or, in alternative terminologies, *Sätze an sich*, judgeable contents, what is said, judgments, thoughts, and it is such propositions that are the items related in valid inferences, and the arguments of logical constants.

3 Characterising logical constanthood

Having justified why we take the way in which agents *use* relevant expressions in explicit arguments to be fundamental in the account of logical constanthood we are currently pursuing,[5] we are now in a position to propose a general definition of logical constants that does not only take into account their well-established logico-syntactic and semantic status, but also their functional role as truth-preserving links between truth-bearers.

> [LC]: *Logical constants are higher-order predicables whose arguments are n-adic predicables ($n \geq 0$), i.e. concepts and propositions. They cannot be individuated by reference to extralinguistic entities, concepts or objects, but through the function they perform in representing truth-preserving inferential relations among concepts and propositional contents.*

[LC] can be seen as a formulation of what we should expect a logical constant to be, if our preferred sense of 'logic' goes along the lines of F-Logic.

To possess a higher-order predicative status is what is required for an expression to be able to represent properties of and relations between concepts and

5 For a more detailed exposition of our rationale, see Frápolli (in press).

propositions. Familiar intuitions around logical constants, i.e. that they are syncategorematic and topic-neutral expressions, have a syntactic interpretation that is answered for by this part of [LC]. The items that carry a discourse's propositional content are, by definition, its propositions and the concepts they include, that is, the items that have a truth conditional effect, whereas higher-order functions stand at a different level; they play their role regardless of the actual content of the items which are their arguments. Along these lines, the syntactic claim of [LC] also explains one of the basic intuitions behind invariantist approaches: that logical constants cannot be used to discriminate between individuals.

This widely held assumption is further captured by the semantic part of [LC], according to which logical constants are not referential devices, that is, they do not name, hence their Tractarian analysis as *rules* (Wittgenstein 1922: §5.2341) that *do not represent* (Wittgenstein 1922: §4.0312) and their treatment by Grice as expressions that carry non-truth conditional meaning.[6] Building upon such intuitions, it seems necessary to clarify in which sense we maintain that logical constants do not have a truth-conditional import to the propositional complex that they are part of. As it is widely held, the semantic contribution of an expression to the whole in which it is inserted is the effect it has on the truth-conditions of the whole, but in order to evaluate the relevant contribution of logical constants, we still need to make clear how big we take the 'whole' to be and how we interpret what it is to 'have an effect on truth-conditions'. There are currently two prominent ways of construing the notion of truth conditions. According to the first of them, the truth conditions of a sentence, as uttered in a suitable context, refer to the whole characterisation that follows:

[[s]]w, t, s. . . = 1 iff s is true in w, t, s. . .

According to the second one, the truth conditions of a sentence, as uttered in a suitable context, refer only to the explicitly represented content s, that is, whatever one has to check with respect to the indices to see whether what is said is true or false.[7] For our present purposes, logical constants can be taken to affect truth conditions in the first sense, but not in the second.

Up to this point, [LC] provides some information regarding the meaning that a logical constant should encode, but it does so by stressing what the relevant expressions do not do. Its last part aims at providing a positive answer to the same question by emphasising that the role of logical constants as links or

6 For a discussion of Grice's views on this kind of expressions, see Frápolli and Villanueva (2007).

7 For an illuminating discussion on this issue, see Recanati (2007: ch. 3).

inferential transition markers has to be somehow reflected in their conventional meaning. Naturally, the inferential links that logic is concerned with rest on the relation of logical consequence, and even though each logical constant has a specific function that makes it the constant it is, if logical constants are to be thought of as inference markers, they all have to possess some kind of dynamic meaning; they all have to encode some kind of rule that invites agents to treat the surrounding propositions as sustaining a truth-preserving inference.[8]

To this effect, we can implement in our account the logical notion of implication. Implication and inference are two sides of the same coin, since by definition implication is the relation that holds between the premises and conclusion in valid arguments. From *Begriffsschrift* onwards, we represent it as '$\vdash$' and with the development of formal semantics, as '$\vDash$'. In this respect, it roughly corresponds to the natural language words 'so', 'therefore', 'thus', 'then' and the Latin 'ergo', possibly among others. The deduction theorem of first order logic [DT] shows that valid inferences can be represented as the validity of the corresponding material conditional: Be $\mathbf{\Gamma}$ the set of sentences $\{\boldsymbol{\gamma}1, \boldsymbol{\gamma}2, \ldots, \boldsymbol{\gamma}n\}$, [DT] states that if a formula $\boldsymbol{\delta}$ follows from a set of formulae $\mathbf{\Gamma}$, then the conditional that has a conjunction of the formulae $\boldsymbol{\gamma}$ in $\mathbf{\Gamma}$ as its antecedent, and the formula $\boldsymbol{\delta}$ as the consequent is valid:

[DT]: If $\mathbf{\Gamma} \vdash \boldsymbol{\delta}$, then $\vdash (\boldsymbol{\gamma}1 \,\&\, \boldsymbol{\gamma}2 \,\&\, \ldots \,\&\, \boldsymbol{\gamma}n) \rightarrow \boldsymbol{\delta}$.

In this respect, the possibility of converting inferences into conditionals and vice versa appears to be all that is needed in order to maintain that the particular uses of the conditional that give support to [DT] mark ongoing truth-preserving inferences. This comes as no surprise, since the conditional is recognised as a logical constant, and Modus Ponens as a rule of inference, in every logical calculus that has ever enjoyed any success, a point emphasised by both Frege (1967 [1879]: 7–8) and Peirce (1998 [1896]: 279).

From our current perspective then, it seems that the material conditional is a perfect candidate for logical constanthood, since it fits [LC] seamlessly; it is a

8 The characterisation of logical constants as rules should be familiar from other philosophical discussions as well. Apart from Wittgenstein, whom we have already mentioned above, Ramsey also contended that variable hypotheticals, i.e. universally quantified conditionals, "are not judgements but rules for judging "If I meet a φ, I shall regard it as a ψ" (1990 [1929]: 149) and Ryle understood law-like generalisations as types of "an inference ticket (a season ticket) which licenses its possessors . . . to move from one assertion to another, to provide explanations of given facts, and to bring about desired states of affairs by manipulating what is found existing or happening" (1949: 117).

higher-order,[9] relational notion, it does not represent truth-conditionally relevant concepts, that is, it does not add a substantive component to what is said in the sense discussed above, and it indicates a truth-preserving inferential transition.

4 Truth-preserving logical constants: a preliminary analysis

As we have argued so far, [LC] assembles three aspects that are individually necessary and jointly sufficient for characterising logical constants from the point of view of F-Logic. Removing some aspects of [LC] while maintaining others, we obtain broader sets of expressions related to logical practice, which have higher or lower degrees of closeness to logical constanthood. Indeed, most expressions that have at times been considered logical constants have features also possessed by genuine logical constants, but most of them fall short of having them all together. Up to this point, we have argued that only the conditional (singular or quantified), and its meta-linguistic counterpart of implication, are clearly logical constants. Let's now turn to see how the rest of the usual candidates of logical constanthood pan out in our account, in an inevitably brief and preliminary analysis.

As [LC] dictates, logical constants have to be functions; this feature rules out truth-values, and the universal and empty classes, which have been treasured by invariantists. The status of expressions as inference markers requires them to be higher-order; this rules out the membership relation as well as first-order identity. The function of logical constants as markers of inferential links between (potential) truth bearers also rules out monadic predicables, and among them, monadic sentential functions that act as circumstance-shifting operators, such as modal, epistemic and temporal operators, as well as monadic sentence-formers, such as monadic quantifiers.

When it comes to negation, however, it seems that, appearances aside, its case deserves some further thought. From a logico-syntactic point of view, negation is also either a monadic sentential operator (wide scope) or a monadic predicable-former (narrow scope), i.e., a function from predicables to

9 In the Fregean universe, logical constants are not higher order, for propositions are saturated objects and properties and relations of objects are first order. But this is a technical feature of Frege's logic and semantics. Today, we understand that properties and relations of concepts or concepts-plus-their-arguments are higher order or, to unify the treatment that [LC] proposes, n-adic predicables ($n \geq 0$). In this sense, we follow the Peircean practice of understanding propositions as 0-adic predicables.

predicables.[10] But there is still another logically important function that negation has: that of expressing propositional incompatibility. Given two propositions, one of the three following possibilities hold: either one of them entails the other or they are merely compatible or else they are incompatible. In this sense, propositional incompatibility can be seen as a logical relation which can be given in an inferential form, through the use of the conditional (or implication) and negation; assuming that *p* and *q* are incompatible contents, this circumstance can be expressed by *if p, then not q*. In this respect, incompatibility is an irreducible logical relation, whose expression requires the use of negation. So, even though negation is a monadic operator from a syntactic point of view, it is sometimes used to express an inferential relation, one of the arguments of which is implicit.[11] In these cases, negation appears to be a logical constant in [LC]'s terms.

Turning to quantifiers, their standard understanding in logical theory is that they are higher-order operators that have concepts as their arguments. A sentence such as

(1) a. All Germans eat sausages.

is translated into predicate logic by means of the universal quantifier and the conditional:

(1) b. $\forall$x (x is German $\rightarrow$ x eats sausages).

This suggests that in cases like (1a) there is an implicit conditional that the logical translation brings into the open. This standard translation is based on the two following assumptions: (i) that in standard calculi quantifiers are monadic operators and (ii) that, most of the time, general thoughts of the kind encoded in universal sentences include at least two concepts. An alternative interpretation is to understand quantifiers as being binary operators themselves, representing some kind of link between the concepts involved.[12] Viewed in this way, binary quanti-

10 These two options can be illustrated as follows: (a) from "John is happy" to "It is not the case that John is happy", and (b) from "happy" to "unhappy". Recall Russell's treatment of 'The present King of France is bald' (1905).

11 Implementing the Wittgensteinian distinction between saying and showing, it should be evident that it is possible to *see* and also to *show* that two contents are incompatible without using higher-order notions, but to *say* it requires the use of negation (as well as the conditional).

12 Both interpretations can be located in Frege's writings. In (1980 [1884]), Frege treats quantifiers as higher order functions that represent the size of a concept's extension. In this case, their arguments are the concepts, the size of which is represented, and they are thus fiers also clearly qualify as logical constants according to [LC]. Still, even if the preferred interpretation is the classical one, which takes quantifiers to be monadic higher-order operators, then their standing relative to [LC] would be similar to that of negation; they have uses in which they indicate the presence of an inferential link, which can be represented by the (implicit) conditional.

With respect to more straightforwardly binary operators now, it seems that apart from the conditional, conjunction and disjunction are also standardly included in the traditional lists of logical constants. Let us now briefly turn to them.

Conjunction[13] is indeed a higher-order binary operator, whose arguments can be either n-adic predicables (n > 0) or propositions (i.e. 0-adic predicables), satisfying in this way the logico-syntactic claim of [LC]. However, when it comes to the semantic and pragmatic conditions of [LC], it seems to be running into problems. According to the recent treatment of and-conjunction within Relevance Theory (Carston 2002: ch. 3; Blakemore and Carston 2005), if its truth table exhausted its meaning, the replacement of the whole conjunctive complex with a mere juxtaposition of the sentences it contains would not affect the information explicitly expressed by it. However, this is not the case, which means that the presence of conjunction does not only affect the truth conditions of what is said, but also crucially restricts the range of available interpretations. Consider the following examples (adapted from Carston 2002: 236):

(2) a. Mary didn't finish her homework. She got sick.
b. Mary didn't finish her homework and she got sick.

(3) a. John fell. He slipped on the wet pavement.
b. John fell and he slipped on the wet pavement.

It is clear in these examples that the juxtaposed sentences communicate essentially different information from the conjoined ones. The explanation that relevance theorists offer for this phenomenon is that the use of conjunction forces

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monadic functions. However, in (1997 [1892]), he also offers a different approach: "In universal and particular affirmative and negative sentences, we are expressing relations between concepts, we use these words [i.e. quantifiers] to indicate the special kind of relation" (Frege 1997 [1892]: 187).

13 We are concerned here with the paradigm case which involves sentential coordination with 'and'. This argument could be expanded to include most cases of sub-sentential coordination too, as is obvious in cases like "John and Bill love Mary", which can be taken to be equivalent to "John loves Mary and Bill loves Mary", but it certainly does not generalise across all cases. For example, the utterance "John and Bill are colleagues" cannot be taken to mean John is a colleague and Bill is a colleague.

two conjoined propositions to be processed as a single unit for interpretation. In other words, propositions connected by conjunction stop being independent pieces of information and become a single complex piece. Therefore, when the two sentences in (2a) and (3a) are juxtaposed, the second sentence is naturally interpreted as an explanation of the former, whereas when they are conjoined with ‘and’, as in (2b) and (3b), this interpretation is no longer available, and the hearer has to reach for an alternative one. The reason for this appears to be that explanations and explananda cannot be built into a unity; to perform their job they have to remain separate items. As Carston further discusses, the same applies to a question and its answer, a claim and its exemplifications, a piece of information and the evidence for it, as well as a claim and any of its consequences. In light of this argument then, Relevance Theory offers a genuine reason to exclude conjunction from the list of logical constants in the sense favored here. According to [LC], in order to be able to characterise an expression as a logical constant, it has to be used by speakers to mark an inferential link between two truth-bearers. In this respect, there need to be two independent information units between which truth is preserved (in the positive or in the negative), and, as relevance-theoretic account shows, the presence of ‘and’ specifically excludes any interpretation in which the two conjoined propositions can be said to stand in any kind of relation. Therefore, a fortiori, ‘and’ cannot be seen as marking any kind of transition between the conjuncts, let alone a truth-preserving one.

Interestingly enough, even classical logic offers arguments in the same direction. In logical calculi, the role of conjunction is purely syntactic: it converts two predicables into a single conjunctive one and two sentences into a single conjunctive one. Its role cannot be dispensed with, since it is sometimes needed to make a conjunctive predicable the argument of a monadic higher order operator, as in (4a), translated into predicate logic in (4b):

(4) a. There are honest politicians.
b. $\exists x\ (Px\ \&\ Hx)$.

Along similar lines, conjunctive sentences can also be the arguments of higher-order operators, such as the conditional, in a sense in which the juxtaposition of the conjunctive parts cannot be. Even in this case, however, both the logical function of combining different predicables and sentences into single syntactic items and the pragmatic function that relevance theorists discuss block the reading of conjunction as a marker of any sort of transition or movement between two semantic items.

Concluding our rapid overview of the way in which the traditional list of logical constants behaves in our account, we turn to disjunction. Logicians have traditionally considered disjunction and conjunction to be similar in many respects, but when looked at from our present perspective, this turns out to be an illusion. As Schiffrin discusses, contrasting disjunction and conjunction,

> *or* is an inclusive option marker in discourse: it provides hearers with a choice between accepting only one member of a disjunct, or both members of a disjunct. Thus, *or* is fundamentally different from *and* and *but* because it is not a marker of a speaker's action toward his own talk, but of a speaker's desire for a hearer to take action. More specifically, *or* represents a speaker's effort to elicit from a hearer a stance toward an idea unit, or to gain a response of some kind. *Or* thus prompts the exchange of responsibility for the maintenance of conversation, whereas *and* maintains the status quo, and *but* returns it to a prior state. (1987: 181)

In line with the received view, Schiffrin considers the inclusive sense of disjunction as basic, with its exclusive use being derived from the context and the content of the disjuncts at hand. She stresses that *or* is a means of presenting the hearer with two possible lines of inference. An assertion can be seen as presenting information as a possible premise in further inferential moves; when two propositions are connected by disjunction, none of them is genuinely asserted, but the speaker invites the hearer to choose any one and explore what happens. For this reason, Schiffrin contrasts the import of conjunction, which conveys some information on the part of the speaker, to that of disjunction, which asks for a move on the part of the hearer. In both cases, and concerning their connection to truth-preserving inference, the speaker is presenting premises at most, not inferential moves. In this respect, when disjunction works as Schiffrin explains, it is not a logical constant according to [LC], nor would it be if it worked as a means of building complex disjunctive predicables.

However, there is a sense in which disjunction presents clear connections to the conditional. Classical logic defines conditionals in terms of disjunction: '$\alpha \rightarrow \beta$' is treated as equivalent to '$\neg\alpha \vee \beta$'. Even though we have not, up to this point, given too much weight to the interdefinibility of the classical connectives, since it is only informative when restricted to the truth-functional import of complex sentences and says nothing about the speaker's meaning, in this particular case, the interdefinibility of disjunction and the conditional touches upon a phenomenon that has pragmatic roots. Theorists on conditionals have noticed this as well. According to Jackson, for example, "the circumstances in which it is natural to assert the ordinary indicative conditional 'if P, then Q' are those in which it is natural to assert 'either not P, or P and Q' " (1998: 3). Therefore, a sentence such as (5):

(5) Victoria is either in the kitchen or in her bedroom.

can be used with an inferential import that is equivalent to (6):

(6) If she is not in the kitchen, she must be in her bedroom.

A further example is (7):

(7) All integers are either even or odd.

If (7) can be asserted, then the two conditionals, (8) and (9), can be deployed:

(8) If x is not even, then it is odd.

(9) If x is even, then it is not odd.

Here, the relevant aspect is still the intentions of the speaker, which the meaning of disjunction allows to be used as an alternative to the compound of the conditional and negation. Therefore, when the intention is stressing a truth-preserving inferential relation, the disjunction token is a logical constant.

5 Concluding remarks

It seems that by taking logical constants to mark inferential relations and represent non-truth-conditional links between (potential) truth bearers, we have come up with four candidates that pass [LC]'s tests: conditional (and its meta-linguistic counterpart, implication), some uses of the compound of conditional-plus-quantifiers, of disjunction and of negation. Clearly the analysis of each type of notion we have touched upon has hardly been exhaustive, but we hope that it has made clear the underlying argument that motivates our present proposal: Trying to organise all the expressions selected by logicians at one time or another as constants under a single general view has taken us to a theoretical *cul-de-sac*. A fresh look at what all of us know about logic, and at the way in which we, as ordinary speakers, use logical terms can open the door to the solution of a question, that of the meaning of logical constants, which has until now proven to be analysis-resistant. In this regard, the account we have presented here can be best seen as an effort to understand what we do when we draw logical inferences as well as how we use the conceptual and linguistic tools involved in these practices. This enterprise, however, is only feasible if we pursue it on the basis of understanding logic as the science of truth preservation rather than as a mathematical, purely formal science.

Wrapping up this paper, we would like to add a comment regarding the linguistically-encoded meaning of logical terms, which we did not have the space to deal with here. Browsing through the relevant literature, there is an overwhelming tendency, which certainly owes a lot to Grice's seminal argumentation (1989), to accept the Boolean truth-based approach as the one capturing the encoded meaning of expressions such as 'and', 'or', 'if', 'not', etc. The same seems to apply even within the cognitive account that relevance theorists propose,[14] despite their contention that it is not important "whether a linguistic expression contributes to something with truth conditions, but rather what kind of cognitive information it encodes" (Blakemore 2000: 464). We feel that truth tables offer little input by way of this aim, and much more can be accomplished if a methodology like the one we have used in this paper is implemented; that is, if the meaning of each term under question is approached functionally rather than formally. After all, as Carston has suggested, from a cognitive perspective, "there is no obvious reason to suppose, or to consider it desirable, that what natural language connectives and determiners encode is identical to the context-free, truth based properties of logical operators; rather, there is some reason to expect differences in at least some cases" (2002: 257). Still, this is an insight that we can only hope to pursue in future research, that we will undertake alongside the more thorough exposition of the present proposal.

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14 In all fairness, relevance theorists have not made any explicit commitments with respect to the preferred treatment of logical terms as a group within their framework, but all the experimental work that appears to vindicate their position against Levinson's neo-Gricean one (for a representative overview see Noveck and Sperber 2007), does so on the assumption that the relevant expressions linguistically encode their context-free logical meaning, which needs to be effortfully enriched in order to communicate speaker-intended inferences that are over and above this meaning (be they part of the utterance's explicature or implicature(s)).

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