PROPOSITIONAL LOGICALITY OF LANGUAGE

ABSTRACT. In this paper we focus on the logicality of language, i.e. the idea that the language system contains a deductive device to exclude analytic constructions. Puzzling evidence for the logicality of language comes from acceptable contradictions and tautologies. In the literature, the standard response to this puzzling evidence involves assuming that only functional analyticities, i.e. analyticities that are due to the functional vocabulary of the language, can be accessed by the device and consequently be excluded from the language.

In this paper we especially focus on the proposed conjencture that the functional vocabolary paired with logicality only includes nonpropositional operators. We first observe that propositionally one can derive adequate variants of relevant analytic cases whose logical status is an effect of the very same principle. Note that this may be surprising as one might expect that logicality works on different logical principles. In addition, we observe that natural language translations of such propositional variants appear to be acceptable. Our discussion then shows that grammaticality is restored at the propositional level, in crucial accordance with expectations built on the conjecture, and confirms that this is due to a limitation in the vocabulary accessed by the deductive device.

KEYWORDS: Logicality of Language; Triviality; Acceptable Analyticities; Functional Vocabulary; Propositional Logic

1. INTRODUCTION

In this paper we focus on the logicality of language. This is the idea that the language system contains a deductive device to exclude analyticities (Gajewski [5, 7]; Fox and Hackl [4]; Chierchia [2]). Standard evidence for the logicality of language comes from the distribution of exceptive phrases (von Fintel [8]; Gajewski [6]). In particular, the construction in (1a) is said to be associated with a contradictory content such as that reported in (1b). In essence, this is due to a conflict between the exceptive ("but") and the existential quantifier ("some"). Denote by $\texttt{student}$ and $\texttt{smoke}$ respectively the collection of all students and all smokers, and by the constant j John. On the one hand, the exceptive should make the quantified formula "some students smoke" false on $\texttt{student}$, but true with respect to a relevant subset X of $\texttt{student}$ (e.g., X can be taken as $\texttt{student} \setminus \{j\}$); yet, on the other hand, the existential quantifier is *upward monotone*, i.e., if the quantified formula is true over X, then it should be true over all supersets of X, including $\texttt{student}$. Hence, we have a contradiction, and (1b) provides the logical reason why the language system excludes (1a). Note that exceptives are naturally usable in universal quantification, i.e. in (2a), where the associated content is clearly informative.

(1) a. *Some students but John smoke.

b. $(\texttt{student} \setminus \{j\} \cap \texttt{smoke} \neq \emptyset) \wedge (\texttt{student} \cap \texttt{smoke} = \emptyset)$

(2) a. Every student but John smoke.

b. $(\texttt{student} \setminus \{j\} \subseteq \texttt{smoke}) \wedge (\texttt{student} \nsubseteq \texttt{smoke})$

Since acceptable analyticities are also observed, as is illustrated by the familiar contradiction and tautology respectively in (3a) and (4a), the literature generally assumes that the logicality of language hypothesis cannot hold unrestrictedly and that additional properties of the deductive device are needed to explain why some analyticities are excluded from the language.

(3) a. It is raining and it is not raining.

b. $\texttt{rain} \wedge \neg\texttt{rain}$

(4) a. War is war.

b. `war=war`

The standard response involves distinguishing two types of vocabulary, functional and non-functional, and assuming that only functional, i.e. permutation invariant, analyticities can be accessed by the device and consequently be excluded from the language (Gajewski [5], Fox and Hackl [4], Chierchia [2], Del Pinal [3]). In his discussion, Chierchia [2, p. 53] takes a further step in conjecturing that the deductive device may only involve monadic and perhaps polyadic but nonpropositional operators (like quantifiers). According to him, assuming this limitation gives the following reason why only some analyticities result in ungrammaticality: propositional operators are easier to access than nonpropositional ones. Moreover, observe that (1b), being about sets, apparently requires second-order logic to be properly formulated, and this might be an hint that a certain logical complexity is indeed needed to induce a failure of grammaticality.

In the remainder of this note we focus on Chierchia's conjecture. We first derive an adequate propositional variant of (1b) showing that the logical principle that speakers assume in excluding (1a) from the language is already available propositionally. In addition, we provide a natural language translation of the propositional variant. In accordance with Chierchia's prediction, according to which the deductive device is expected not to access propositional contradictions, the natural language translation appears to be acceptable.

2. Grammaticality through propositional lens

2.1. **First example.** For the sake of exposition, let us begin from the analysis of the acceptable sentence (2a). Let us denote by P the unary predicate of smoking (obviously we have that $x \in \texttt{smoke}$ if and only $P(x)$ holds). We submit that the formula in (†) is an adequate propositional variant of (2b). Note, in particular, that what this propositional variant expresses is that any collection of students such that they all smoke must necessarily exclude John – hence, capturing the content of (2b).

(†)
$$\left(\bigwedge_{x\in\texttt{student}\smallsetminus\{j\}} P(x)\right) \wedge \neg \left(\bigwedge_{x\in\texttt{student}} P(x)\right).$$

Let us now provide in (5) a natural language translation of the submitted propositional variant. For concreteness, in order to translate (†) into natural language, we assume that the domain D consists of three students: say Alice, Bob, and John. Note that this assumption is for the sake of simplicity: our understanding is that the cardinality of D should not affect any grammaticality issue. Under this assumption, then, our translation appears straightforward.

(5) Alice and Bob smoke, and it is not the case that Alice, Bob, and John smoke.

Clearly, this natural language translation is perfectly acceptable. As the original sentence (2a) was also acceptable, with this we observe that moving to the propositional level does not decrease the acceptability of linguistic constructions. But let us now now turn to our more relevant example in which grammaticality is actually expected to disappear at the propositional level, if Chierchia's conjecture is on the right track.

2.2. **Second example.** Let us then turn to the analysis of (1a). Here we submit that the formula in (‡), which is somehow dual to (†), constitutes an adequate propositional variant of the nonpropositional formula in (1b).

(‡)
$$\left(\bigvee_{x\in\texttt{student}\setminus\{j\}} P(x)\right) \wedge \neg \left(\bigvee_{x\in\texttt{student}} P(x)\right).$$

As it is is easy to check, the propositional formula now under consideration constitutes a contradiction. A crucial observation in this respect is that the source of contradictoriness in this case coincides with the source of contradictoriness of the nonpropositional variant. Note that such an analogy between (‡) and (1b) is not a mere superficial resemblance. In fact, it is obviously a principle of classical logic that the disjunction satisfies the following *weakening* principle, which is analogous to the upward monotonicity of the existential quantifier: if ϕ holds, then $\phi \vee \psi$ hols for any choice of ψ. More generally, if a disjunction holds (resp., if an existential formula is true over a certain domain), there is no way to make it false by adding other disjuncts (resp., by expanding the domain).

Let us now consider a natural language translation of the propositional variant. Consider the construction in (6), assuming as above that $|D| = 3$. Our take is that this structure is acceptable, certainly less deviant than standard nonpropositional examples with exceptives and existentials such as (1a). In order to realize this, just consider a context in which the speaker wants to convey that adding John to the relevant group of people actually changes something with respect to what counts as smoking. This makes the sentence actually informative by preventing the realization of the contradiction via modulation of the meaning of the predicate.

(6) Alice or Bob smoke, and it is not the case that Alice or Bob or John smoke.

Note that this possibility immediately follows from versions of the logicality appraoch such as that provided by Del Pinal [3]. According to Del Pinal, when an analytic interpretation is due to the nonfunctional vocabulary, a pragmatic repair strategy, e.g. *rescale* or $\mathfrak{R}$ in symbols, applies to modulate the meaning of the predicates thus removing the contradictory or tautologial interpretation. Such a pragmatic strategy is assumed to be ineffective in case the analyticity is due to the functional vocabulary like in the case of (1a). But if we focus on our natural language translation, we immediately realize that the strategy would indeed remove the contradiction that is literally expressed in this case. In particular, this would be obtained by specializing (since $\{x : \mathfrak{R}_c(P(x))\} \subseteq \{x : (P(x)\}$) the meaning of the second occurrence of the predicate. But then the acceptability of (6) is the clearly expected.

(7) Alice or Bob smoke, and it is not the case that Alice or Bob or John $\mathfrak{R}$(smoke).

3. Conclusion

We take stock. Based on unacceptable analyticities, the logicality of language hypothesis recently assumes a strict interaction between logic and grammar to the point that some constructions are excluded from the language on account of their logical status. Since acceptable contradictions and tautologies are also observed, the logicality of language hypothesis is paired with an assumption that the deductive device only detects functional analyticities, i.e. analyticities due to the functional vocabulary. This of course relates to the idea of a natural logic, i.e. a deductive device which is linguistically motivated (and so appears to require a *substantive* account of logical principles) and that then appears to be somewhat exotic, as is commonly observed in the literature, from the perspective of classical logic ([1], [3]).

In this paper we considered Chierchia's conjecture that the functional vocabulary may only include nonpropositional operators. In particular, we provided the following two contributions. To begin with, we observed that propositionally one can derive adequate variants of relevant analytic cases whose logical status is an effect of the very same principle.

Note that this may be surprising as one might expect that logicality works on different logical principles. In addition, we observed that natural language translations of such propositional variants are acceptable, in accordance with expectations built on the conjecture. So the result of our discussion shows that the logical principle that justifies the ungrammaticality of constructions like (1a) already arises at the propositional level but here the principle does not have effects with respect to the grammaticality of constructions given the limitation, that turns out to be empirically justified, to nonpropositional operators.

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