QUANTIFIERS AND *IF*-CLAUSES

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ABSTRACT. Stephen Barker has presented a new argument for a pure material implication analysis of indicative conditionals. His argument relies crucially on the assumption that *general indicatives* such as “Every girl, if she gets a chance, bungee-jumps” are correctly analysed as having the formal structure (*x*) (if *x* gets a chance, *x* bungee-jumps). The present paper shows that an approach first proposed by David Lewis must be pursued: the *if*-clause in these sentences restricts the quantifier. Only the Lewis-style analysis can deal with sentences involving non-universal quantifiers such as “Most letters are answered if they are shorter than 5 pages”. It is shown that Barker’s reasons for rejecting the restrictor analysis are not cogent. The restrictor analysis is further shown to connect widely with recent work in natural language semantics.

Stephen Barker has presented a new argument for a pure material implication analysis of indicative conditionals.[1] I will not rehearse the details of the argument but attack one of its premises. Barker assumes that sentences like

1. If a girl gets a chance, she bungee-jumps
2. Every girl, if she gets a chance, bungee-jumps

which he calls *general indicatives*, are correctly analysed as open indicative conditionals prefixed by universal quantifiers. So they are both analysed as (*x*) (if *x* gets a chance, *x* bungee-jumps), where *x* ranges over girls. This analysis is attributed to Geach.[2] Barker then shows that this syntactic analysis together with other premises entails that the open conditional occurring under the universal quantifier has to be analysed as having the import of material implication.

Barker considers and rejects the possibility that the Geachian analysis of the logical form of general indicatives is mistaken. The most promising alternative analysis is that general indicatives are *adverbial generalities*, i.e. sentences modified by adverbs of quantification like *always*, *invariably*, etc.[3] Lewis would give (1) the form:

3. (Always: if *x* is a girl & *x* gets a chance) (*x* bungee-jumps)

The *if*-clause here serves as a quantifier-restrictor and not as part of a conditional sentence at all. In the case of (1), the adverbial quantifier would be implicit, but it can of course appear explicitly:

[1] S. Barker, ‘Material Implication and General Indicative Conditionals’, *The Philosophical Quarterly*, 47 (1997), pp. 195-211.

[2] P. Geach, *Reference and Generality* (Cornell UP, 1962).

[3] D. Lewis, ‘Adverbs of Quantification’, in E. Keenan (ed.), *Formal Semantics of Natural Language* (Cambridge UP, 1975), pp. 3-15.

'Invariably, if a girl gets a chance, she bungee-jumps'. Kratzer has proposed to generalize Lewis' analysis and to treat all *if*-clauses as restricting some quantifier or other. She writes: 'the history of the conditional is the story of a syntactic mistake. There is no two-place *if…then* connective in the logical forms of natural languages. *If*-clauses are devices for restricting the domains of various operators'.[4] The Lewis-Kratzer approach to the role of *if*-clauses, especially as elaborated by Heim, has been adopted widely in recent work in natural language semantics on *donkey-sentences* such as (1).[5] Barker grants that the analysis may be appropriate for (1) but he rejects it for (2), which he calls a *universal noun phrase indicative*. I will consider Barker's reasons for rejecting the analysis in a little while, but first I will present some powerful reasons in favor of adopting the analysis for *noun phrase indicatives* in general.

Lewis' main argument for the restrictor analysis of *if*-clauses rested on the challenge posed by the following kinds of examples:

4. Sometimes, if a girl gets a chance, she bungee-jumps.
5. Never, if a girl gets a chance, does she bungee-jump.
6. Usually, if a girl gets a chance, she bungee-jumps.

Assume that we tried to replace Lewis' analysis of (4)-(6) with one according to which the adverb of quantification combines with an open sentence of the form 'if p, q'. Clearly, (4) cannot be analysed as (*x*) (*x* gets chance   *x* bungee-jumps), since this would be almost trivially verified by any girl who doesn't get a chance. Instead, (4) appears to require an analysis as (*x*) (*x* gets chance & *x* bungee-jumps). The same must be said about (5). In the case of (6), there is no natural interpretation that works. Assuming that (6) means something like 'Most girls who get a chance bungee-jump', we can appeal to a well-known result that the truth-conditions of sentences involving the quantifier *most* cannot be given by a first-order formula.[6] To get a feel for the problem, one can convince oneself that (Most *x*) (*x* gets a chance & *x* bungee-jumps) would be too hard to make true, while (Most *x*) (*x* gets a chance   *x* bungee-jumps) would be too easy to make true. It is sentences like (6) then which present the best argument for Lewis' analysis, since they are perfectly well captured by treating *usually* as a restricted quantifier:

7. (Usually: if *x* is a girl & *x* gets a chance) (*x* bungee-jumps)

Apart from Lewis' paper, the essentially dyadic nature of *most* was recognized many times in the logico-philosophical literature.[7] Geach tries to convey a sense that the implications for the study of semantics are minimal.[8] He relegates the issue to 'a rather outlying field of logic, pleonotetic logic, as it might be called, the logic of majorities' (p. 125). Not so, one will have to say: if the proper analysis of sentences like (1) and (2) is supposed to help determine the proper analysis of indicative conditionals in general, it would be important to know that one's favored analysis does not extend to the parallel case in (6).

[4] A. Kratzer, 'Conditionals', in A. von Stechow and D. Wunderlich (eds.), *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung* (de Gruyter, 1991), pp. 651-656.

[5] I. Heim, *The Semantics of Definite and Indefinite Noun Phrases* (Garland, 1988).

[6] For a proof, see for example J. Barwise and R. Cooper, 'Generalized Quantifiers and Natural Language', *Linguistics and Philosophy*, 4 (1981), pp. 159-219.

[7] A. Mostowski, 'On a Generalisation of Quantifiers', *Fundamenta Mathematica*, 44 (1957), pp. 12-36; N. Rescher, 'Plurality-Quantification', *Journal of Symbolic Logic*, 27 (1962), p. 374; J. Altmann and N. Tennant, 'Sortal Quantification', in E. Keenan (ed.), *Formal Semantics of Natural Language* (Cambridge UP, 1975); G. Evans, 'Pronouns, Quantifiers, and Relative Clauses (II)', *Canadian Journal of Philosophy*, 7 (1977), pp. 777-798.

[8] P. Geach, 'Quine's Syntactical Insights', in P. Geach, *Logic Matters* (Blackwell, 1972).

Since Barker grants the possibility that Lewis is correct for sentences like (1), why should we care about the points made by (4)-(6)? The crux of the matter is that there are noun phrase indicatives that raise the same problem. Read has recently brought to light a puzzle noted by Peirce, posed by the pairs of sentences such as the following:[9]

8. Someone will win £1,000 if everyone takes part.
9. Someone will win £1,000 if he takes part.

While (8) can be symbolized as (*x*) (p(*x*)) (*x*) (q(*x*)), it would be disastrous to symbolize (9) as (*x*) (p(*x*) q(*x*)), since the latter is provably equivalent to the former. But (8) and (9) are surely not equivalent. Read uses this argument to support the claim that conditionals are not truth-functional. Gillon tries to defuse the argument by proposing an analysis in which the pronoun in (9) is treated as a disguised definite description.[10] The sentence would be analysed as something like ‘Someone will win £1,000 if the winner takes part’. I’m not sure whether this is an adequate analysis for (9), but it cannot carry over to other examples involving quantifiers other than *some*. Instead, we should see Peirce’s puzzle as an instance of a wider range of cases, ultimately supporting the non-Geachian analysis which treats the *if*-clause as restricting the quantifier *someone*.

The next example involves the quantifier *no*:

10. No student will succeed if he goofs off.

As discussed by Higginbotham, within a strictly first-order system, (10) must be analysed as ¬ (*x*) (*x* succeeds & *x* goofs off).[11] Again, we see that quite surprisingly one would have to treat a conditional as expressing conjunction! Higginbotham presents sentences like (10) as a problem for something like the principle of compositionality. In his view, *if*-clauses do not contribute a constant meaning ingredient but vary in their contribution depending on the surrounding environment. Pelletier and Janssen have echoed Higginbotham’s considerations.[12] None of these authors nor Bosch, who independently discussed such sentences,[13] consider a Lewis-style analysis. But surely they should have. The problem is exacerbated by examples with *most* and *few*:

11. Most letters are answered if they are shorter than 5 pages.
Few people like New York if they didn’t grow up there.

(These examples are due to Heim.) Again, the fact is that if there is an open conditional under *most* or *few* it cannot be given a truth-functional analysis. The Lewis-style analysis on the other hand works like a charm:

12. (Most letters x: if *x* is shorter than 5 pages) (*x* is answered)
(Few people x: if *x* didn’t grow up in New York) (*x* likes New York)

Thus there are good reasons to adopt the restrictor analysis for noun phrase indicatives and not just for sentences involving adverbial quantifiers.

[9]S. Read, ‘Conditionals Are Not Truth-Functional: An Argument from Peirce’, *Analysis*, 51 (1992), pp. 5-12. See C. Peirce, *Collected Papers* (ed. by Hartshorne and Weiss), v. 4, §546 and §580.

[10]B. Gillon, ‘Peirce’s Challenge to Material Implication as a Model of *If*’, *Analysis*, 55 (1995), pp. 280-282.

[11]J. Higginbotham, ‘Linguistic Theory and Davidson’s Program in Semantics’, in E. LePore (ed.), *Truth and Interpretation: Perspectives on the Philosophy of Donald Davidson*, (Blackwell, 1986), pp. 29-48.

[12]J. Pelletier, ‘On an Argument Against Semantic Compositionality’, in D. Westerståhl (ed.), *Logic, Methodology and Philosophy of Science* (Kluwer, 1994), pp. 599-610; T. Janssen, ‘Compositionality’, in. J. van Benthem and A. ter Meulen (eds.), *Handbook of Logic and Language* (Elsevier, 1997), pp. 417-473.

[13]P. Bosch, *Agreement and Anaphora: A Study of the Role of Pronouns in Syntax and Discourse* (Academic Press, 1983), esp. pp. 133-141.

It should be noted that the Geachian analysis may be pursued even for non-universal quantifiers if one adopts Belnap's analysis of how conditionals interact with noun-phrase quantifiers (this possibility is noted by Lewis in a footnote). Belnap's analysis gives *if p, q* the same truth-value as *q* if *p* is true, but give it a third truth-value if *p* is false.[14] I do not know whether the other ingredients of Barker's argument would successfully exclude Belnap's analysis. I will continue arguing that at least Barker's rejection of the restrictor analysis is untenable.

Having encountered strong reasons for the restrictor analysis, we still need to deal with Barker's argument against it. He discusses the following example:

13. Every girl bought a donkey first and then, if she was happy, she bought a llama.

As Barker shows, it is not immediately obvious how to analyse this sentence within the restrictor analysis. One cannot say that the *if*-clause restricts the top quantifier and that thus the sentence is equivalent to 'Every girl if she was a happy bought a donkey first and then bought a llama', since it obviously isn't. Barker also rejects an analysis where the universal quantifier is repeated, so that the sentence would be equivalent to 'Every girl bought a donkey first and then, if she was happy, every girl bought a llama' or 'Every girl bought a donkey first and then every girl, if she was happy, bought a llama'. One reason is that the analysis would seem to predict incorrectly that (13) implies that all the donkeys were bought before all the llamas were bought. Another reason is that it would be mysterious how to justify compositionally the second occurrence of the universal quantifier: one can hardly claim that the last pronoun in (13) is some kind of universal quantifier.

To answer these worries, note that we can cast (13) equivalently as follows:

14. Every girl bought a donkey. Then, if she was happy, she bought a llama.

The possibility of (14) is puzzling at first glance, since quantifiers do not in general seem to have the option of taking scope over a succeeding independent clause:

15. Every soldier is armed, but will he shoot?
16. Every congressman came to the party and he had a marvelous time.

Neither (15), due to Chomsky, nor (16), due to Evans, can be read as having the quantifier bind the pronoun as a variable.[15] But there is a class of exceptional cases to which (14) belongs. Other examples include the following one due to Partee:

17. Each degree candidate walked to the stage. He then took his diploma from the Dean and returned to his seat.

Roberts called this phenomenon *telescoping*: from a discussion of the general case, we zoom in to examine a particular representative case.[16] An analysis might allow, in certain cases, to posit an implicit adverbial quantifier *always* or *in all cases*, so that (17) would mean something like 'Each degree candidate walked to the stage. In all cases, he took his diploma from the Dean and returned to his seat'.[17] Barker's first worry is thus answered: it is not the pronoun that is interpreted as the second occurrence of a universal quantifier, instead an adverbial quantifier is assumed. It is not

[14] N. Belnap, 'Conditional Assertion and Restricted Quantification', *Noûs*, 4 (1970), pp. 1-12, and 'Restricted Quantification and Conditional Assertion', in H. Leblanc (ed.), *Truth, Syntax and Modality: Proceedings of the Temple University Conference on Alternative Semantics* (North-Holland, 1973), pp. 48-75.

[15] N. Chomsky, 'Conditions on Rules of Grammar', *Linguistic Analysis*, 2 (1976), pp. 303-351; G. Evans, 'Pronouns', *Linguistic Inquiry*, 11 (1980), pp. 337-362.

[16] C. Roberts, 'Modal Subordination and Pronominal Anaphora in Discourse', *Linguistics and Philosophy*, 12 (1989), pp. 683-721.

[17] See for such an analysis M. Poesio and A. Zucchi, 'On Telescoping', *SALT II: Proceedings of the Second Conference on Semantics and Linguistic Theory* (Ohio State University Department of Linguistics, 1992), pp. 347-366.

simply that the universal quantifier is repeated, as shown by the following case, cited by Poesio and Zucchi:

18. No story pleases these children. If it is about animals they yawn. If it is about witches they frown. If it is about people they fall asleep.

Here, as well, we have an implicit universal quantification following the initial generalization. But since the initial quantifier is *no* and the succeeding sentences are interpreted as quantifying universally over stories (read to the children), we clearly need to have the freedom of assuming an implicit *always*.

Barker's second worry was that one has to get the temporal relations right. It should not follow from the analysis of (17) that first all candidates walked to the stage, and that then all of them received their diplomas. The answer must be that *then* does not have scope over the second universal quantifier, but instead has scope under it. (17) is interpreted as 'Every candidate walked to the stage. In all cases, he then (after he walked to the stage) took his diploma from the Dean and returned to his seat'. Similarly, (13) and (14) mean the same as 'Every girl first bought a donkey. In all cases, if she was happy, she then bought a llama'.

A problem remains:

19. No girl bought a donkey and then, if she was happy, bought a llama.

Barker cannot take heart from such an example, since it clearly cannot be treated as involving material implication. (19) cannot be symbolized as ¬ (*x*) (*x* bought a donkey & (*x* was happy *x* bought a llama)), because this would be almost trivially falsified by the existence of one girl who bought a donkey but was not happy. What (19) means is that there is no girl who bought a donkey, and then was happy and bought a llama. Again, it seems that *if* might have to be treated as expressing conjunction under *no*. What is the Lewis-style alternative, though? Perhaps, the most plausible analysis would be:

20. (No *x*: *x* is a girl & *x* bought a donkey & *x* was happy) (*x* bought a llama)

But what would be a reasonable procedure that would get us to (20)? It would have to be prohibited from applying to a universal analogue of (19):

21. Every girl bought a donkey and then, if she was happy, bought a llama.

This does not mean the same as 'Every girl who bought a donkey and was happy bought a llama', although it entails it.

In conclusion, although there remain issues to sort out, the non-Geachian analysis of general indicatives rejected by Barker is in fact a vibrant alternative. It is supported by powerful considerations from non-universal quantifiers. It connects widely with other work in natural language semantics.

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