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If a man buys a horse, … you have no argument against material implication: On a flaw in the foundations of the restrictor approach to conditionals

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Abstract

The paper discusses a prominent one of Kratzer's (1986, 1991, 2012) arguments against material implication analyses of the denotation of (indicative) conditional sentences. This is the argument based on the sentence *Most of the time, if a man buys a horse, he pays cash for it*. It is shown that material implication makes a prediction that does conform to speakers' intuitions, contrary to Kratzer's claim. The paper also argues that Lewis's (1975) attack on material implication analyses of conditional sentences based on examples where the conditional is embedded under the adverbials *sometimes* and *never* does not have much force given that the interpretation of such sentences is subject to inferential pragmatic operations in addition to the recovery of their denotation.

Keywords

conditional sentence, restrictor approach, material implication approach

1 The restrictor approach to conditionals and Kratzer's horse sale argument

The restrictor approach to (or restrictor view / analysis / theory of) natural language conditional sentences represents a very prominent and influential theoretical framework for the analysis of the meaning of such sentences in linguistic semantics and pragmatics as well as the philosophy of language (see e.g. Edgington 2001/2014: section 4.3, Kaufmann & Kaufmann 2015: 246, 254-255, Liu 2019: 2). It is presented as the "dominant approach" to conditionals in linguistics by von Fintel (2011: 1524; likewise Cantwell 2018: 139), who points out that

> [f]ollowing Partee (1991), the restrictor theory of *if*-clauses is sometimes called the "Lewis/Kratzer/Heim" analysis (henceforth restrictor), because after the initial idea of Lewis and the generalization by Kratzer, the application of the story to the analysis of donkey anaphora by Heim (1982) played a large role in the triumph of the theory in linguistic circles. (von Fintel 2011: 1526)

The reference to Lewis here is Lewis (1975), in which it is argued that in sentences of the form *{Always / Sometimes / Never}, if P (then) Q*, "the *if* of our restrictive if-clauses should not be regarded as a sentential connective. It has no meaning apart from the adverb it restricts" (Lewis 1975: 11). This idea is taken up by Kratzer (1986, 1991, 2012).[1] After diagnosing a "steady decline of the material conditional" in the "recent history of semantics" (Kratzer 2012: 88), she characterises Lewis's argument as a "more direct attack" (Kratzer 2012: 89) on an analysis of conditionals as denoting material implication. For Kratzer, Lewis (1975) shows that "there are indicative conditionals that cannot be analyzed as material conditionals" (Kratzer 2012: 91). The generalisation that von Fintel (see above) refers to consists in Kratzer's conclusion that clauses complementing *if* generally do not play the role of an antecedent in material implication. Rather, "[*i*]*f*-clauses need to be parsed as adverbial modifiers that restrict operators that might be silent and a distance away. This is what we might call 'the restrictor view' of *if*-clauses" (Kratzer 2012: 107). That is, according to this view, it is *generally* inadequate to analyse an (English) indicative conditional as denoting a material implication relation between the *if*-clause and its matrix clause.

Kratzer summarises the gist of Lewis (1975) by way of the following argument, containing what is considered to be a refutation of the material implication approach ('→' symbolising material implication):[2]

> [s]uppose the logical form of [(1a)] were [(1b)]:
>
> [(1)] a. Most of the time, if a man buys a horse, he pays cash for it.
> b. For most events e ((e is an event where a man buys a horse) → (e is part of an event where the man in e pays cash for the horse in e)).
>
> If formalized as [(1b)], [(1a)] should be true on a scenario where, say, out of a million events of some kind or other, 2000 are events where a man buys a horse, and, out of those, 1990 are sales that are settled by check. [(1a)] is intuitively false on such a scenario, since most of the horse sales are not settled by cash. [(1b)] comes out true, however, since most of the one million events that make up the domain of quantification are not events where a man buys a horse to begin with.
>
> The problem can be solved by adopting restricted quantification structures for adverbial quantifiers, too.
>
> [(2)] (Most e: e is an event where a man buys a horse) (e is part of an event where the man in e pays cash for the horse in e).
>
> […] [(2)] is true just in case most events that satisfy the quantifier restriction also satisfy the nuclear scope. (Kratzer 2012: 90)

This reasoning, which has never been convincingly refuted (but see Smith & Smith 1988: 338-339 for a decidedly skeptical attitude towards it), distorts to a contradictory degree what the material implication approach to conditionals predicts about a sentence like (1a) and thus does not constitute a piece of evidence against this approach, as will now be shown.

[1] Kratzer (2012) is a revised and expanded version of Kratzer (1991), which is a reprint of Kratzer (1986). I quote from Kratzer (2012).
[2] The argument is explicitly endorsed by Reed (1999: 313).

2 A refutation of the horse sale argument

(3) below is the material implication in the scope of the quantifier *for most events e* in Kratzer's representation (1b) of the material implication analysis of the conditional in (1a).

(3) (e is an event where a man buys a horse) → (e is part of an event where the man in e pays cash for the horse in e)

Let us consider how many events exactly render (3) true in Kratzer's horse sale scenario. Material implication predicts that (3) is false if the antecedent is true and the consequent is false; otherwise (3) is true. That is, in this scenario, (3) is false for 1990 events – these are the events where a man buys a horse and does not pay cash – and thus is true for 1000000 - 1990 = 998010 events.

Kratzer's argument is this: the material implication analysis makes a false prediction; it predicts that (1a) is true since the number of events for which (3) is true is 998010, which is more than the number of "horse sales […] not settled by cash" (see quotation above), i.e. the number of horse sales settled by cheque, namely 1990. This argument is wrong. In a material implication analysis of conditionals in the scope of the adverbial *most of the time* (rendered as *for most events e* in Kratzer's logical form; see quotation above), it is wrong to compare the number of events for which the conditional is true with the number of events for which the consequent of the conditional is false. What has to be compared is the number of events for which the conditional is true and the number of events for which the contextually relevant alternative conditionals are true.[3] Since there is only one contextually relevant alternative conditional in Kratzer's scenario, namely *If a man buys a horse, he pays for it by cheque*, the number of events for which (3) is true has to be compared with the number of events for which (4) is true.

(4) (e is an event where a man buys a horse) → (e is part of an event where the man in e pays for the horse in e by cheque)

Again, of course, material implication predicts that (4) is false if the antecedent is true and the consequent is false; otherwise (4) is true. That is, in Kratzer's scenario, (4) is false for 10 events – these are the events where a man buys a horse and does not pay by cheque – and thus is true for 1000000 - 10 = 999990 events. These are more events than those for which (3) is true, i.e. 998010.[4] That is, the material implication analysis (1b)

[3] On the role of contextually relevant alternatives for the evaluation of expressions in the scope of superlatives see Hackl (2009), Heim (1999), Kotek & Sudo & Howard & Hackl (2011), Krifka (1992) among others.

[4] Note also that (1b) above is equivalent to (i):

(i) For most events e ((e is not an event where a man buys a horse) ∨ (e is part of an event where the man in e pays cash for the horse in e))

Obviously, in order to evaluate whether this is true in Kratzer's scenario, the number of events for which the disjunction is true has to be compared with the number of events for which the disjunction in (ii) below is true, which is equivalent to the material implication contained in (4) above, not with the number of events for which just the second disjunct of (ii) is true:

(ii) For most events e ((e is not an event where a man buys a horse) ∨ (e is part of an event where the man in e pays for the horse in e by cheque)) of the conditional sentence in (1a) does *not* predict that (1a) is true in this scenario, contrary to what Kratzer claims. Material implication predicts that (1a) is *false*, which is in accordance with the intuitive evaluation of the sentence in this scenario.

An anonymous reviewer asks for independent evidence that Kratzer's truth conditions for conditionals embedded under *most of the time* are inadequate and that truth conditions dependent on a comparison with contextually relevant alternative conditionals are adequate. This request cannot be fulfilled by showing that Kratzer's argument leads to false predictions, since this is precisely the point of her argument – as the material implication approach is allegedly wrong right from the start. The point of the present paper is to show that Kratzer's construal of the material implication analysis for conditionals embedded under *most of the time* is inadequate and that there is a construal that makes correct predictions. Here are some more examples.

(5) Most of the time, if Federer plays a tennis match, he loses it.[5]

This is intuitively false. Kratzer's argument amounts to saying that the material implication analysis makes a false prediction since, under that analysis, (6a) is much more often true than (6b), thus predicting (5) to be true.

(6) a. If Federer plays a tennis match, he loses it.
b. Federer wins a tennis match.

My argument amounts to saying that the material implication analysis makes a correct prediction since (7a) is less often true than (7b), thus predicting (5) to be false.

(7) a. If Federer plays a tennis match, he loses it.
b. If Federer plays a tennis match, he wins it.

Now consider (8).

(8) Most of the time, if Federer plays a tennis match while handcuffed, he loses it.

This is intuitively true. Under Kratzer's construal, material implication makes a correct prediction since (9a) is much more often true than (9b), thus predicting (8) to be true. But note that, intuitively, there is clearly something wrong in comparing the number of events for which (9a) is true with the number of events for which (9b) is true, at least for the reason that one would not expect the handcuffing to play no role for the counting of the (9b)-events.

(9) a. If Federer plays a tennis match while handcuffed, he loses it.
b. Federer wins a tennis match.

Under the approach taken in the present paper, material implication also makes a correct prediction since (10a) is more often true than (10b), thus predicting (8) to be true.

(10) a. If Federer plays a tennis match while handcuffed, he loses it.
b. If Federer plays a tennis match while handcuffed, he wins it.

And consider (11).

[5] The name *Federer* here and below refers to the tennis player Roger Federer, who "has been No. 1 in the ATP rankings a record total of 310 weeks – including a record 237 consecutive weeks – and has finished as the year-end No. 1 five times. Federer has won 103 ATP singles titles, the second-most all-time behind Jimmy Connors and including a record six ATP Finals" (https://en.wikipedia.org/wiki/Roger_Federer; accessed 2020/01/07).

(11) Most of the time, if Federer plays a tennis match while handcuffed, he wins it.

This is intuitively false. Under Kratzer's construal, material implication makes a false prediction since (12a) is much more often true than (12b), thus predicting (11) to be true.

(12) a. If Federer plays a tennis match while handcuffed, he wins it.
b. Federer loses a tennis match.

Under the approach taken in the present paper, material implication makes a correct prediction since (13a) is less often true than (13b), thus predicting (11) to be false.

(13) a. If Federer plays a tennis match while handcuffed, he wins it.
b. If Federer plays a tennis match while handcuffed, he loses it.

All this means that Kratzer's construal of the material implication analysis of conditionals embedded under *most of the time* does not account for the difference in evaluation between (5) and (8) and (8) and (11), whereas the alternative proposed in the present paper does, which constitutes evidence that the latter one is to be preferred over the former one.

3 A discussion of modified horse sale arguments

A modification of Kratzer's argument does appear to go through, though, for another quantifying adverbial than *most of the time* or *mostly*, namely *sometimes*. Let us consider a scenario where there are 1000000 events of some kind or other, of which 2000 are horse sales, of which all are settled by cheque, i.e. none settled by cash. Intuitively, (14) is false in this scenario.

(14) Sometimes (i.e. 'For some events e'), if a man buys a horse, he pays cash for it.

Indeed, material implication predicts otherwise. It predicts that the conditional within the scope of the adverbial is false for 2000 events, that is, it predicts that the sentence is sometimes (i.e. 1000000 - 2000 = 998000 times) true, contradicting the intuition for (14). Even so, this does not constitute an argument that proves the inadequacy of the material implication approach, as will now be shown.

Let us look at what the quantified expression *sometimes' (P → Q)* in general denotes in terms of set theory. Given the domain of events $D = P_{true} \cup P_{false} \neq \emptyset$, if P_{true} is the set of events for which P is true, P_{false} the set of events for which P is false, Q_{true} the set of events for which Q is true and Q_{false} the set of events for which Q is false, the material implication $P \rightarrow Q$ denotes the set E of events in (15).

(15) $E = (P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false})$

P_{true} and P_{false} are disjoint and together exhaust D; the same holds for Q_{true} and Q_{false}. The quantified expression *sometimes' (P → Q)*, then, denotes the set $\mathcal{S}$ of sets of events for which (16) holds.

(16) $\mathcal{S} = \{E \mid E = (P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false}) \neq \emptyset\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \setminus (P_{true} \cap Q_{false})) \cup (P_{false} \setminus (P_{true} \cap Q_{false})) \neq \emptyset\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \setminus (P_{true} \cap Q_{false})) \cup P_{false} \neq \emptyset\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = ((P_{true} \setminus P_{true}) \cup (P_{true} \setminus Q_{false})) \cup P_{false} \neq \emptyset\}$

$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \setminus Q_{false}) \cup P_{false} \neq \varnothing\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \cap Q_{true}) \cup P_{false} \neq \varnothing\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = P_{true} \cap Q_{true} \neq \varnothing \vee E = P_{false} \neq \varnothing\}$

This means that a communicator who utters a conditional sentence in the scope of *sometimes* can be taken to intend to convey $P_{true} \cap Q_{true} \neq \varnothing$ or $P_{false} \neq \varnothing$ or $P_{true} \cap Q_{true} \neq \varnothing \wedge P_{false} \neq \varnothing$. Now, if it is mutually manifest to the communicator and the interpreter that $P_{false} \neq \varnothing$,[6] as it is for an interpreter of an utterance of (14) who is informed about the scenario mentioned, the communicator can be taken to intend to convey $P_{true} \cap Q_{true} \neq \varnothing$.[7] This is false in the scenario for (14), which explains, on the basis of an inferential pragmatic consideration, the apparent contradiction between our intuition about (14) and the prediction generated by the material implication analysis of it.[8]

This analysis has the advantage of providing an immediate account of the fact that it is possible to convey 'Trump never considers the environmental risks of fracking' by uttering (17).

(17) Sometimes, if Trump considers the environmental risks of fracking, Bolsonaro considers the environmental risks of the destruction of the Amazon rainforest.

For this to happen, the communicator needs to assume that the interpreter brings the assumption 'Bolsonaro never considers the environmental risks of the destruction of the Amazon rainforest' to bear on the interpretation of (17). For then, $P_{true} \cap Q_{true} = \varnothing$, which deductively yields $\mathcal{S} = \{E \mid E = P_{false} \neq \varnothing\}$ from (16).

The modification of Kratzer's argument appears to go through for *never* as well.[9] Yet again, this does not entail that the material implication approach is inadequate. Consider (18) in the same scenario as provided for (14).

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[6] On mutual manifestness see Sperber & Wilson (1995: 38-46, 60-64).

[7] This follows in any Gricean (Grice 1989) or post-Gricean theory of inferential linguistic pragmatics (such as Levinson 2000, Sperber & Wilson 1995) from the pragmatic principles that model what one can informally call the requirement for informativity or relevance of utterances. In other words: if uttering *s* may in principle convey 'p' or 'q', then an addressee is entitled to assume that a communicator intends to convey 'p' if in a specific communicative situation it is mutually manifest to communicator and addressee that 'q'. *Pace* anonymous reviewer I do assume that this follows straightforwardly from the principle of informativity or relevance. It explains straightforwardly, for instance, the inference that the speaker of (i) below intends to convey 'You are permitted to go in now' rather than 'You are able to go in now' in situations most typically associated with utterances of (i).

(i) You can go in now.

That is, a speaker may in principle intend to convey 'Addressee is permitted …' or Addressee is able …' by uttering (i); but since it it mutually manifest in those kinds of situations that the addressee is able to go in, it is the permission meaning that the addressee assumes the speaker to have intended.

[8] An anonymous reviewer asks for evidence that the manifestness of $P_{false} \neq \varnothing$ plays a role in the interpretation of such sentences. This request misses the point of the argument. I show that *sometimes'* $(P \rightarrow Q)$ involves $P_{false} \neq \varnothing$ in a certain way, and I show that considering the mutual manifestness of $P_{false} \neq \varnothing$ explains the apparent contradiction just mentioned in the main text above. That is, considering the mutual manifestness of $P_{false} \neq \varnothing$ is what I propose as a theoretical solution for an apparent problem, not a premise in need of evidence in an argument.

[9] *Sometimes* and *never* are the adverbials which Lewis (1975: 11) says prevent a material implication analysis of conditionals in their scope.

(18) The following is never true: If a man buys a horse, he pays cash for it.[10]

Intuitively, (18) is true in this scenario. However, material implication predicts that the conditional within the scope of the adverbial is false for 2000 events and true for 998000 events, thus not never true, contradicting intuition. In terms of set theory, the quantified expression *never′* $(P \rightarrow Q)$ in general denotes the set $\mathcal{S}$ of sets of events for which (19) holds.

(19) $\mathcal{S} = \{E \mid E = (P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false}) = \varnothing\}$
$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \cap Q_{false}) \cup P_{false} = \varnothing\}$ (cf. (7) up to the last but one line)
$\Leftrightarrow \mathcal{S} = \{E \mid E = (P_{true} \cap Q_{true}) = \varnothing \wedge E = P_{false} = \varnothing\}$

This means that a communicator who utters a conditional sentence in the scope of *never* can be taken to intend to convey $P_{true} \cap Q_{true} = \varnothing \wedge P_{false} = \varnothing$ in principle. Now, in the respective scenario it is mutually manifest to the communicator and the interpreter that $P_{false} \neq \varnothing$. Consequently, (19) denotes the empty set on the assumption that $D = P_{true} \cup P_{false}$ is the set of 1000000 events in all. In order for an utterance of (18) to be true, $\mathcal{S}$ must not denote the empty set $\varnothing$, but the set $\{E \mid E = \varnothing\}$. The only set D for which $\mathcal{S} = \{E \mid E = \varnothing\}$ in this scenario is the set where D equals P_{true}, i.e. where D is the set of the 2000 horse sales settled by cheque. On the inferred assumption that this is the domain of events D with respect to which the communicator utters (18), the material implication analysis of (18) is true, which accounts for the intuition about it in the given scenario. This account holds analogically for all cases of an (indicative) conditional sentence *if P (then) Q* in the scope of *never* when it is mutually manifest to communicator and interpreter that $P_{false} \neq \varnothing$.[11]

In both cases just discussed – *sometimes′* $(P \rightarrow Q)$ and *never′* $(P \rightarrow Q)$ – the mutual manifestness of $P_{false} \neq \varnothing$ leads to the inferentially gained conclusion that the former yields (20a) and the latter (20b).

(20) a. $\mathcal{S} = \{E \mid E = (P_{true} \cap Q_{true}) \neq \varnothing\}$
b. $\mathcal{S} = \{E \mid E = (P_{true} \cap Q_{true}) = \varnothing\}$

This is equivalent to Lewis's (1975: 11) observation that the meaning of a conditional sentence *if P (then) Q* in the scope of *sometimes* or *never* is *sometimes′* $(P \wedge Q)$ and *never′* $(P \wedge Q)$ respectively. On the present approach, this is inferentially derived on the basis of a material implication analysis given that it is mutually manifest to communicator and interpreter that $P_{false} \neq \varnothing$.

An anonymous reviewer argues:

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[10] I use this example in order to avoid a discussion of the potential cause or effect on meaning of *do*-support cum subject-*do* inversion in (ia) and a discussion of whether or under what circumstances (ib) is a grammatical sentence.

(i) a. Never, if a man buys a horse, does he pay cash for it.
b. *(?)Never, if a man buys a horse, he pays cash for it.

Interestingly, Lewis (1975: 9) uses an example with *do*-support and inversion, in line with common English usage (see Jacobsson 2007), while Kratzer (2012: 89) uses (ib) above, referring to Lewis (1975). Neither comments on this issue.

[11] Because of the unidiomatic nature of the type of construction of (18) and the complications hinted at in footnote 10, I refrain from analysing what happens in cases where it is not mutually manifest that $P_{false} \neq \varnothing$.

> [P]ragmatic effects explain why it is bad to assert certain kinds of sentences. But they tend to be silent on whether it is okay to believe (or assign high credence to) the propositions expressed by those sentences. And it seems just as bad to believe that sometimes if a man buys a horse he pays cash for it as it does to assert it (when one knows that sometimes a man buys a horse but never does a man pay cash for it).

Let us assume *P* to be the proposition 'a man buys a horse' and *Q* the proposition 'he pays cash for it', with *he* referring to the man who buys a horse and *it* referring to the horse that the man buys. Then, as shown in (16) above, 'sometimes if a man buys a horse he pays cash for it', i.e. *sometimes'* $(P \rightarrow Q)$, denotes the set $\mathcal{S}$ of sets of events *E* for which holds:

(21) $\mathcal{S} = \{E \mid E = P_{true} \cap Q_{true} \neq \varnothing \vee E = P_{false} \neq \varnothing\}$

where P_{true} is the set of events for which *P* is true, Q_{true} is the set of events for which *Q* is true and P_{false} the set of events for which *P* is false. Now, let us also assume, as the reviewer suggests, that I know "that sometimes a man buys a horse but never does a man pay cash for it". Do I believe *sometimes'* $(P \rightarrow Q)$? If I were to believe that, I would have to believe that the events that constitute the world in which sometimes a man buys a horse but never does a man pay cash for it, constitute a set *W* that is a member of $\mathcal{S}$. However, the set *W* is certainly not a member of $\{E \mid E = P_{true} \cap Q_{true} \neq \varnothing\}$; *W* is certainly not a member of the set of non-empty sets of events for which *P* and *Q* are both true. Nor is *W* a member of $\{E \mid E = P_{false} \neq \varnothing\}$; *W* is not a member of the set of non-empty sets of events for which *P* is false, for *W* is a set of events for some of which *P* is false and some others of which *P* is true. Hence, the material analysis predicts that I do not believe 'sometimes if a man buys a horse he pays cash for it' given that I know that sometimes a man buys a horse but never does a man pay cash for it, contrary to what the reviewer assumes.

How are conditionals in the scope of *mostly* or *most of the time*, as in Kratzer's (2012) original sentence (1a), to be analysed in terms of a set theoretic version of the material implication approach? The quantified expression *mostly'* $(P \rightarrow Q)$ denotes the set $\mathcal{S}$ of sets *X* of events for which (22) below holds, where $\# X$ symbolises the cardinality of some set *X* and where *A* is a (proper or improper) subset of $D = (P_{true} \cup P_{false})$ different from the set denoted by the conditional in the scope of *mostly* or *most of the time*, i.e. different from $(P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false})$. That is, *A* is the denotation of a contextually relevant alternative to the conditional in the scope of *mostly* or *most of the time*, whose cardinality has to be smaller than the cardinality of $(P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false})$ for (1a) to be true. From a purely truth-conditional perspective, *mostly'* $(P \rightarrow Q)$ is true if, and only if, (22) is true for every *A* (hence $\forall A$), but in communicative uses of corresponding sentences, *A* is constrained to be the denotation of a pragmatically (comprising considerations of information structure) determined alternative to the conditional in the scope of *mostly* or *most of the time*. (That information structure plays a role as well becomes obvious when considering that the utterance of *Most of the time, if a man buys a horse* HE *pays cash for it (not his wife)* triggers different assumptions about *A* than the original example, where *cash* is implicitly assumed to be the carrier of the main sentence accent.[12])

(22) $S = \{E \mid \forall A\ (\# E = \#\ ((P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false})) > \# A)\}$
$\Leftrightarrow S = \{E \mid \forall A\ (\# E = \#\ ((P_{true} \cap Q_{true}) \cup P_{false}) > \# A)\}$
$\Leftrightarrow S = \{E \mid \forall A\ (\# E = \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \# A)\}$[13]

What set this denotes is dependent on the identity of *A* as well as the number of events in the respective sets. The identity of *A* has to be pragmatically established. In any scenario, if $A = D = P_{true} \cup P_{false}$, then $\#\ (P_{true} \cap Q_{true}) + \# P_{false} > \# A$ is false.[14] Consequently, *mostly'* $(P \rightarrow Q)$ is always false from a purely truth-conditional perspective under the assumption that *A* ranges over all (proper or improper) subsets of *D* that are different from $(P_{true} \cup P_{false}) \setminus (P_{true} \cap Q_{false})$. Since a communicator is commonly not expected to intend to express a necessarily false proposition, the assumption that *A* is restricted is mutually manifest. In Kratzer's original horse sale scenario, the most accessible assumption concerning the range of *A* is that it is restricted to the denotation of *If a man buys a horse, he pays for it by cheque*. Hence, given that R_{false} is the set of events for which *he pays for it by cheque* is false, $A = (P_{true} \cup P_{false}) \setminus (P_{true} \cap R_{false})$. Thus:

(23) $\#\ (P_{true} \cap Q_{true}) + \# P_{false} > \# A$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ ((P_{true} \cup P_{false}) \setminus (P_{true} \cap R_{false}))$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ ((P_{true} \setminus (P_{true} \cap R_{false})) \cup (P_{false} \setminus (P_{true} \cap R_{false})))$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ (((P_{true} \setminus P_{true}) \cup (P_{true} \setminus R_{false})) \cup P_{false})$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ ((P_{true} \setminus R_{false}) \cup P_{false})$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ ((P_{true} \cap R_{true}) \cup P_{false})$
$\Leftrightarrow \#\ (P_{true} \cap Q_{true}) + \# P_{false} > \#\ (P_{true} \cap R_{true}) + \# P_{false}$
$\Leftrightarrow 10 + 998000 > 1990 + 998000$
$\Leftrightarrow 998010 > 999990$

which is false, making *mostly'* $(P \rightarrow Q)$ false as well, as already argued in section 2 above.

4 Horse sale arguments do not invalidate the material conditional approach

In sum, Kratzer (1986, 1991, 2012) errs in assuming that her horse argument proves that "there are indicative conditionals that cannot be analyzed as material conditionals" (Kratzer 2012: 91). Moreover, given that inferential pragmatic processes as modeled in Gricean and post-Gricean pragmatic theories are always involved in natural language

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[12] The influence of focus on quantification in conditional sentences is well known; see Krifka (1992: 230-233) and the literature mentioned there.

[13] In terms of the cardinality of sets, (16) is equivalent to (ia) and (19) is equivalent to (ib).

(i) a. $S = \{E \mid \# E = \#\ (P_{true} \cap Q_{true}) + \# P_{false} > 0\}$
b. $S = \{E \mid \# E = \#\ (P_{true} \cap Q_{true}) + \# P_{false} = 0\}$

From this perspective, the inferences mentioned in the context of the discussion of (16) and (19) above hinge on the mutual manifestness of the fact that $\# P_{false} > 0$ in the given scenario.

[14] In the following exchange, $A = D$ for wise guy B:

(i) A: Most of the time, if a man buys a horse, he pays cash for it.
B: No, certainly not. Most of the time, in fact all of the time, something just is the case.

On wise guy interpretations see Ariel (2002).

interpretation by humans, it appears that Lewis's (1975) comments on conditional sentences in the scope of *sometimes* or *never* do not prove that the denotation of conditional sentences cannot generally be material implication. These claims by Kratzer and Lewis do not provide a solid foundation for strands of argument to the effect that the restrictor approach to the meaning of conditionals is to be preferred over the material implication approach.

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