

Only if: If only we understood it

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Abstract. I argue that the puzzle that *only if* conditionals continue to pose is solved if their bare conditional prejacent is analyzed as having existential force. The existential conditional I propose is also argued to help shed light on the semantic behavior of conditionals under negative quantifiers and to explain why we often feel that the negation of an entire conditional is equivalent to the negation of its consequent.

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1. Introduction¹

1.1. The problem

Owing to work reaching as far back as the Middle Ages (Horn 1989), we have a deep understanding of the semantics and pragmatics of *only*. And in some form or other the interpretation of conditionals has exercised logicians, philosophers and linguists since Aristotle. Given how much we know about the semantic contributions of *only* and that of *if* it should be trivial to compositionally analyze their joint appearance in examples like those in (1):

- (1) a. You only succeed if you work HARD. (CAPS=focus)
b. Only if you work HARD do you succeed.

It turns out, however, that once we put together what we think we independently know about *if* with what we know about *only* we fall short of deriving the truth conditions of *only if* (McCawley 1974, Barker 1993, von Stechow 1997 and Dekker 2001). Does this mean that what we think about *only* is not right, or that what we think about *if* is not right? In this paper I argue that the *only if* puzzle indicates that what we think about *if* is not all there is to *if*.

1.2. The meaning of *only*

As is well known, *only* requires a focus in its overt c-command domain and its interpretation is sensitive to where that focus is assigned (Rooth 1985). Thus, (2a) rules out that trees that are not Ginko trees reach said level of beauty, and smelliness, and (2b) excludes that Beat hikes in the French, Italian, Austrian or German Alps.

- (2) a. Only GINKO trees are this pretty in the fall, and smell this bad.
b. Beat only hikes in the SWISS Alps.

¹ I am grateful for comments I received from members of the audience at Sinn und Bedeutung 19 in Göttingen and from Martin Hackl, Simon Mauck, Aynat Rubinstein and Barry Schein.

As (2) also illustrates, *only* can combine with elements of different syntactic types. This behavior can be captured through a series of related meanings for *only* (Rooth 1985), or, alternatively, one can abstract away from *only*'s surface position and analyze it as a propositional operator that combines with a prejacent (von Stechow 1997). On this now widely adopted view, stated in (3), *only* presupposes its prejacent and negates all alternative propositions derived by substituting the focused element in the original sentence with elements of like semantic type. The alternative propositions excluded are ones not already entailed by the one expressed by the prejacent.² Thus, (4) presupposes that Gisela went to Berlin and negates all the relevant alternatives, e.g. (5):

$$(3) \quad [[\textit{only}]] (A_{\langle st, t \rangle}) (p_{\langle st, t \rangle}) = \lambda w: p(w) = 1. \forall q \in \text{NW}(p, A): q(w) = 0 \\ \text{NW}(p, A) = \{q \in A: p \text{ does not entail } q\} \quad (\text{Fox 2006})$$

(4) Gisela *only* went to BERLIN.

(5) It is **not** the case that Gisela went to **Prague**. It is **not** the case that Gisela went to **Bern**. It is **not** the case that Gisela went to **Vienna**. It is **not** the case that Gisela went to **Vaduz**. It is **not** the case that Gisela went to **Bern and Berlin**. Etc.

1.3. The meaning of bare conditionals

Turning now to *if*, it is widely assumed that *if p q* has universal force.³

(6) Universal Conditional:
If p q is true iff all *p*-cases are *q*-cases.

The universal conditional underlies many different analyses. But the essence of the claim is independent of whether *if* is seen as a mere device to mark the restrictor of a tacit universal modal operator, as in the Lewis/Kratzer restrictor analysis (e.g. Kratzer 2012), or whether *if* is treated as a genuine two place operator (e.g. Gillies's 2010 iffiness). Nor is the basic idea tied to whether the antecedent is seen to be quantifying over all antecedent worlds (C.I. Lewis's 1918 strict conditional) or just those that are minimally different from the evaluation world (D. Lewis's 1973 variably strict conditional). Finally, the universality of conditionals is also

² It is a matter of some debate whether the prejacent is really just presupposed, as assumed in (3), or whether it is semantically entailed in a pragmatically special, backgrounded or "assertorically inert" manner (e.g. Atlas 1993, Herburger 2000, Horn 2002). For the purposes of this discussion it does not matter and I adopt the first option. Another question that has recently been raised is whether the alternatives that are relevant for *only* should be defined over sentences rather than propositions (Katzir and Fox 2011). While this is an important question, I think that we can also safely set it aside here.

³ Horn (2000) traces this view back to Wallis (1687), who equates *si* to *omnis casus quo*.

independent of whether the cases that conditionals quantify over are conceived of as possible worlds, situations, n-tuples or events. Setting all these “details” aside, under the account in (6) the bare conditional in (7) has the logical form in (8):

(7) If you work hard you succeed.

(8) $[\forall x: R(x) \wedge \text{you-work-hard}(x)] \text{you-succeed}(x)$
 ‘All relevant cases where you work hard are cases where you succeed.’

1.3. The *only if* puzzle

Though the analyses of *only* and *if* just summarized seem well motivated, when we combine them to derive the meaning of *only if* we do not obtain the result we would hope for; (1a,b) are predicted to be true as soon as not *all* failures to work hard lead to success. This, however, is too weak to capture that they are felt to be false as soon as *any* instance of not working hard results in success (McCawley 1974, Barker 1993, von Stechow 1997). Put differently, if p' is a relevant focus alternative to p that is negated by *only*, see (3), the resulting negation is a rather weak one since p' is also universally quantified:

(9) $\neg[\forall x: p'\text{-case}(x)] q\text{-case}(x)$

Since the problem stems from the relative semantic weakness of negation taking scope over a universal quantifier (‘not all’) it stands to reason that the solution to the *only if* puzzle will require that negation not take scope over a universal quantifier. One possibility, discussed in section 2, is to posit the Conditional Excluded Middle (CEM). Noting that this option is not without problems I then explore the alternative possibility that the negation in *only if* conditionals does take wide scope over a quantifier, but the quantifier is existential (section 3). Section 4 argues that the existential conditional proposed in section 3 appears not just under *only* but more generally in downward entailing contexts, including the scope of negative quantifiers and negation itself. The specifics of the analysis of conditionals are laid out in section 5.

2. The *only if* puzzle and CEM

2.1. CEM 1: Stalnaker conditional

The exclusionary force of *only if* would be accounted for if the negation of a conditional amounted to the negation of its consequent. There is of course an analysis of conditionals which is designed to have this very property:

(10) Stalnaker conditional: (Stalnaker 1968, 1980)
If p q is true iff in the closest world where p is true q is true also.

If-clauses on this account are akin to singular definite descriptions, picking out the unique closest world where the antecedent is true. Given that the outer negation of a sentence with a singular definite description is equivalent to its inner negation (see (11)), the Stalnaker conditional renders the negation of an entire conditional equivalent to the negation of its consequent. This is an intended result as it captures that in many instances the negation of a conditional seems indeed equivalent to the negation of its consequent. From (11) it follows that the Law of the Excluded Middle in (12a) amounts to the Conditional Excluded Middle (CEM) in (12b):

$$(11) \quad \neg[\lambda x: F(x)] G(x) \Leftrightarrow [\lambda x: F(x)] \neg G(x)$$

$$(12) \quad \begin{array}{ll} \text{a.} & [\lambda x: p\text{-case}(x)] q\text{-case}(x) \vee \neg[\lambda x: p\text{-case}(x)] q\text{-case}(x) & \text{Excluded Middle} \\ \text{b.} & [\lambda x: p\text{-case}(x)] q\text{-case}(x) \vee [\lambda x: p\text{-case}(x)] \neg q\text{-case}(x) & \text{CEM} \end{array}$$

Since on the Stalnaker conditional the negation of a conditional is equivalent to the negation of its consequent, it would seem well equipped to capture exclusionary force of *only if* conditionals (Barker 1993). Applied to (1a,b) it would give us for instance (14):

$$(13) \quad \neg [\lambda x: p'\text{-case}(x)] q\text{-case}(x) \Leftrightarrow [\lambda x: p'\text{-case}(x)] \neg q\text{-case}(x)$$

(14) In the closest world where you **work little** you do **not** succeed. In the closest world where you **work when you feel like it** you do **not** succeed. In the closest world where you **do not work at all** you do **not** succeed. Etc.

Unfortunately, however, treating conditional antecedents as singular definite descriptions also has some drawbacks. One common objection is that there is not always a single closest world in which the antecedent is true, as for instance in (15), where there is a tie between worlds in terms of closeness (Lewis 1973, Uniqueness Assumption):

- (15) a. If Bizet and Verdi had been compatriots, Bizet would have been Italian.
b. If Bizet and Verdi had been compatriots, Verdi would have been French.

Another concern is that there may not always be a finite set containing the closest antecedent worlds (Lewis 1973, Limit Assumption):

(16) If this line ____ were over one inch long...

In light of this, Lewis (1973) proposes the variable strict analysis, according to which a counterfactual conditional is true exactly when the consequent is true in some close antecedent world and when there are no closer antecedent worlds where the consequent is not true. Because the closeness of worlds continues to matter, important results of Stalnaker's analysis are preserved (failure of Strengthening of the Antecedent and Contraposition). Yet, at the same time, since *if*-clauses are not analyzed as picking out the unique closest antecedent world, ties between worlds, as in (15), and an infinity of ever closer antecedent worlds, as in (16), cease to pose

problems. But, of course, the variably strict conditional is a version of the universal conditional, and consequently does not validate CEM. Lewis does not think this a bad result, on the contrary.⁴ But if one wants to rely on CEM to solve the *only if* puzzle, Lewis's variable strict analysis is of little help.

2.2. CEM 2 and *only if*: von Fintel (1997)

To be able to appeal to CEM to explain *only if*, and still keep a version of Lewis's variably strict analysis, von Fintel (1997) proposes to analyze *if*-clauses as generic quantifiers. Unlike universal quantifiers, generic operators show homogeneity under negation (Fodor 1970, Löbner 1983). (17), for instance, does not deny that all (normal) dogs like thunder. Rather, it denies that any do:

(17) Dogs don't like thunder.

The homogeneity of generic noun phrases in negated sentences means that a generic version of the universal conditional validates CEM:

(18) $\neg [\text{GEN}x: p\text{-case}(x)] q\text{-case}(x) \Leftrightarrow [\text{GEN}x: p\text{-case}(x)] \neg q\text{-case}(x)$

Because von Fintel's (1997) generic conditional supports CEM it seems well positioned to capture the exclusionary force of *only if* while simultaneously steering clear of the problems of that beset the Stalnaker conditional. But the analysis also raises some questions.

2.3. Challenges for CEM accounts of *only if* conditionals

One worry one might have about any account of *only if* that exploits CEM, including the generic one, is that CEM does not seem to be valid in the general case. This is why Barker (1993), who observes that CEM would help with the *only if* puzzle, does not adopt such an account. Apart from the possible collapse between *would* and *might* conditionals that CEM may or may not give rise to (Lewis 1973, Stalnaker 1980, see also footnote 3), there are other examples where CEM does not hold; (19a) is judged false when uttered by someone looking at a coin about to be flipped, but so is (19b), contra CEM (Leslie 2009).⁵

⁴ Lewis notes that CEM results in an unwanted collapse of the semantics of *might* and *would* conditionals. This is so because on the reasonable assumption that *might* and *would* are duals, *if p then might q* is equivalent to *it is not the case that if p then it would be that not q* ($\phi \diamond \rightarrow \psi \Leftrightarrow \neg \phi \square \rightarrow \neg \psi$). If one then assumes CEM, *if p then might q* ($\phi \diamond \rightarrow \psi$) is rendered equivalent to *if p then would q* ($\phi \square \rightarrow \neg \neg \psi$). This is an unwelcome result as *might* and *would* conditionals can clearly mean different things. In response, Stalnaker (1980) argues that *might* is not really the dual of *would*. I will not further discuss this issue here but hope to address it in future research.

⁵ A possible way out may be to say that (19a) and (19b) are not both false, but indeterminate and should be accounted for in terms of supervaluations (Stalnaker 1980, Klinedinst 2010).

- (19) a. This fair coin will come up heads if flipped. F
 b. This fair coin will not come up heads/will come up tails if flipped. F

Another potential problem, particular to von Stechow's (1997) account, is that generic quantification appears a bit too weak to capture the exclusionary force of *only if* (Cohen 2004): If some non-generic cases of goofing off lead to success are the sentences in (1) not false?

Finally, CEM accounts of *only if* also run into difficulties as far as the presuppositions of *only if* conditionals are concerned. If an *only if* conditional presupposes a bare conditional prejacent then if the prejacent is generically quantified, (1a,b) are predicted to presuppose that all (normal) hard work leads to success. But while (1a,b) assert that hard work is a *necessary* condition for success, they do not presuppose that all (normal) instances of hard work will be rewarded by success. In other words, they do not presuppose that normal hard work is a *sufficient* condition for success and are not synonymous with an *if and only if* conditional. Similarly, the coherence of (20a), which contrasts with the incoherence of (20b), shows that the *only if* conditional does not presuppose that hard work is a sufficient condition for success.^{6 7}

- (20) a. You succeed only if you work hard. But sometimes when you work hard you don't succeed. Coherent
 b. You succeed if and only if you work hard. #But sometimes when you work hard you don't succeed. Contradictory

To summarize, while the generic conditional adroitly avoids the problems with the Stalnaker conditional, it does not seem to fully capture the exclusionary force of *only if* conditionals, nor does it make correct predictions regarding the presuppositions of *only if* conditionals.

⁶ This observation can already be found in McCawley (1974: 634), who notes that "it [= (i)] no more commits the speaker to the believe that he will leave in all such cases than (3c) [= (ii)] commits him to the belief that all Southerners voted for Hubert." I address the parallels between bare plurals and conditionals under *only* illustrated here in a bit more detail in section 4.2.

- (i) Tom will leave only if John comes back by midnight.
 (ii) Only Southerners voted for Hubert.

⁷ I think an account of *only if* that relies on the Stalnaker conditional would also be subject to a version of this criticism because it, too, would predict that an *only if* conditional presupposes a "regular" conditional; it would presuppose that in the closest world where you work hard you do indeed succeed. Since the closest world where you work hard is also the world that is relevant for the *if and only if* conditional (20a) and (20b) would be falsely predicted to be equivalent.

3. Existential conditionals under *only*

At this point, I would like to explore a different possibility, namely that along with the universal conditional we have an existential one:⁸

- (21) Universal conditional:
In certain contexts, *if p q* is true iff all *p*-cases are *q*-cases.
- (22) Existential conditional:
In certain contexts, *if p q* is true iff some *p*-cases are *q*-cases.

My first goal is to show that *if p q* under *only* is the existential conditional. I then argue that this is also true more generally of conditionals appearing in negative or downward entailing contexts.

3.1. Exclusionary force of *only if*

As soon as we assume that the *if*-clauses under *only* are existential quantifiers their exclusionary force directly follows from the semantics of existential quantification in the scope of negation. The alternatives to (1a,b) that are negated by *only* then amount to something the following:

- (23) It is **not** the case that in **some (any)** cases where you work a little you succeed. It is **not** the case that in **some (any)** cases where you work when you feel like it you succeed. It is **not** the case that in **some (any)** cases where you do not work at all you succeed. Etc.

3.2. Existential presuppositions of *only if* sentences

Not only does the existential conditional predict the exclusionary force of *only if*, it also makes interesting predictions regarding their presuppositions. Though (1a,b) do not presuppose that all hard work leads to success, they do presuppose something, namely that *some* instances of hard work are rewarded with success. This is why (1a,b) can be used to encourage somebody to work hard; hard work at least gives you a shot at success even if it does not guarantee it. Consider also:

- (24) Only if you drink kale juice do you live to be 130.

(24) is bizarre because it presupposes that in some instances where you drink kale juice you live to be 130 (suggesting furthermore, as many conditionals do, that there is a causal link between antecedent and consequent). For all we know, that is not true; there is no case where you drink kale juice and live to be 130, simply because the chances to live to a 130 are practically zero to

⁸ The possibility of an existential conditional is also toyed with in McCawley's (1974) and von Stechow's (1997) discussion of *only if* conditionals. It is not adopted because it conflicts with the universal (generic) conditional and because neither author seems to be comfortable positing an ambiguity. I have no such qualms.

begin with. In sum, analyzing the preajcent of an *only if* conditional as an existential conditional not only captures its exclusionary force it also predicts the existential presuppositions we find.

4. Additional support for the existential conditional

4.1. Negative contexts

Conditionals that appear as the preajcent of *only* are not alone in having existential force. I think the same can be said of conditionals in other negative contexts, in particular conditionals in the scope of negative quantifiers, under *doubt*, and also conditionals under negation.

4.1.1. Scope of decreasing quantifiers

Conditionals in the scope of negative quantifiers are known to pose an interesting challenge. Higginbotham (1986) notes that while in a sentence like (25a) *if* could be translated as a material conditional, this is not true of *if* in (25b); it would mean that there is no student for whom goofing off is a sufficient condition for success or, equivalently, that every student goofs off and fails, cf. (26b):

- (25) a. Every student will succeed if he or she works hard.
 b. No student will succeed if he or she goofs off.

- (26) a. $\forall x(\text{Student}(x) \rightarrow (\text{Work-hard}(x) \rightarrow \text{Succeed}(x)))$
 b. $\neg \exists x(\text{Student}(x) \rightarrow (\text{Work-hard}(x) \rightarrow \text{Succeed}(x)))$
 $\Leftrightarrow \forall x (\text{Student}(x) \rightarrow \neg(\neg \text{Goof-off}(x) \vee \text{Succeed}(x)))$
 $\Leftrightarrow \forall x (\text{Student}(x) \rightarrow (\text{Goof-off}(x) \wedge \neg \text{Succeed}(x)))$

Of course, the material conditional is probably not a good translation for any conditional but the point is that, “paradoxes of the material conditional” aside, it is a far worse translation for (25b) than for (25a). I briefly discuss three different ways of dealing with the contrast in (25) before trying to show how the existential conditional solves the problem.

The first option (Higginbotham 1986) simply says that *if* under negative quantifiers like *no student* does not translate as the material conditional ‘ \rightarrow ’, but as a conjunction ‘ \wedge ’ (cf. also Dekker 2001’s dualization operator). Instead of (26b) the logical form of (25b) would be (27):

- (27) $\neg \exists x (\text{Student}(x) \wedge \text{Goof-off}(x) \wedge \text{Succeed}(x))$

Higginbotham (*ibid.*) worries about the non-compositionality of this analysis, which has the meaning contribution of *if* vary depending on whether it appears in the scope of a universal or a negative quantifier. There is, moreover, an empirical problem to contend with. (28a) and (28b)

are not really equivalent (Leslie 2009):⁹ (28a) is falsified by Meadow, who will get a good grade no matter what, simply because her mobster father pressures the teacher. But if Meadow actually happens to work hard, maybe to spite Dad, she does not falsify (28b):

- | | | | |
|------|----|---|---|
| (28) | a. | No student will succeed if he or she goofs off. | F |
| | b. | No student will succeed and goof off. | T |

An alternative analysis of conditionals under negative quantifiers builds on the theory that *if* itself has no meaning but marks the *if*-clause as a quantificational restrictor, in this case adding to the restriction of the determiner *no*. Von Fintel (1998) argues that this restrictor view explains the difference between (25a,b) by assimilating them to (29a,b), respectively:

- | | | |
|------|----|--|
| (29) | a. | Every student who works hard will succeed. |
| | b. | No student who goofs off will succeed. |

However, as von Fintel and Iatridou (2002) and Higginbotham (2003) point out, the truth conditions of (25b) and those of its putative paraphrase in (29b) do not quite match. Hard-working Meadow will again cause trouble (Leslie 2009); she will falsify (25b) because, with Dad looming over the teacher, there is no way Meadow will fail, no matter what she does or does not do. But, regardless of her father, Meadow will not falsify (29b), simply because she does not actually goof off.¹⁰ It seems that just like the ‘and’ theory, the restrictor theory does not do justice to the fact that conditional antecedents are about possible events or situations, not necessarily actual ones. A way to save the restrictor theory is pointed out in Leslie (2009): modalize the restriction (cf. Klinedinst 2010 for some criticism).

A third way to account for conditionals under negative quantifiers, laid out in Higginbotham (2003) and advocated in von Fintel and Iatridou (2002), relies on CEM and the decomposition of negative quantifiers into a negation and a universal quantifier. Whereas Higginbotham (2003) observes this in connection with the Stalnaker conditional, which, as we saw above, supports CEM, von Fintel and Iatridou (2002) assume the universal conditional and posit CEM on top of it. Thus, given the decomposition of the determiner *no*, (30a) is equivalent to (30b), which in turn

⁹ Leslie attributes counterexamples of this nature to Higginbotham (2003) and von Fintel and Iatridou (2002), who discuss them in connection with the restrictor analysis (see text below).

¹⁰ Or, to give an example from Higginbotham (2003), the truth conditions of (i) depend on how a professor that is in fact not offered a generous pension would react were he or she offered such a pension. For the interpretation of (ii) on the other hand only professors that are actually offered a pension matter.

- | | |
|------|--|
| (i) | Every professor will retire early if offered a generous pension. |
| (ii) | Every professor offered a generous pension will retire early. |

is rendered equivalent to (30c) by CEM. (30c) states that for all students in all cases where they goof off they do not succeed. This captures the desired truth conditions.

- (30) a. [No x : Student(x)] [All w : Goof-off(x , in w)] Succeed (x , in w)
 b. [All x : Student(x)] \neg [All w : Goof-off(x , in w)] Succeed (x , in w)
 c. [All x : Student(x)] [All w : Goof-off(x , in w)] \neg Succeed (x , in w)

Apart from the fact that CEM needs to be posited, the account hinges on the validity of CEM, just like the account of *only if* in terms of CEM did. It is in this connection that Leslie (2009) points to (31), which we already encountered as (19) above, noting, if I understand her correctly, that what arguably corresponds to the embedded conditional in (31), namely (32a), does not obey CEM; the falseness of (32a) does not imply the truth of (32b) because both are in fact false. If, however, the conditional in (32a) does not obey CEM it seems stipulative to say that the same kind of conditional when embedded under *no fair coin* in (31) should obey CEM.

(31) No fair coin will come up heads if flipped.

- (32) a. This fair coin will come up heads if flipped. F
 b. This fair coin will not come up heads/will come up tails if flipped. F

Having briefly considered the *if*-means-‘and’ approach, the restrictor approach, and the CEM approach, I would now like to explore the possibility that the conditionals under negative quantifiers are like those under *only* in having existential rather than universal force¹¹. On this view, (25a), where the conditional appears under the universal quantifier *every student*, has the logical form in (33a), which employs a universal conditional. In contrast, the logical form of (25b), given in (33b), involves the existential conditional:

- (33) a. [Every x : Student(x)] [$\forall w$: Work-hard(x , w)] Succeed(x , w) (=25a)
 b. [No x : Student(x)] [$\exists w$: Goof-off(x , w)] Succeed(x , w) (=25b)

As (33) shows, assuming that the conditional under a negative quantifier like *no student* is existential rather than universal straightforwardly captures its truth-conditions; (33b) says that no student is such that there are *any* instances where he or she goofs off and still succeeds. By providing another instance of the existential conditional it lends further support to the claim that the prejacent of *only if* conditionals is also of this sort.

4.1.2. Conditionals under *doubt*

Continuing our quest of existential conditionals, we can also consider (34):

(34) I doubt that John will succeed if he goofs off. (Fintel and Iatridou 2002)

¹¹ I first heard about this possibility in a class lecture of Barry Schein’s in the early 1990s.

(34) expresses doubt as to whether goofing off and success are compatible, rather than doubt as to whether goofing off is a sufficient condition for success, which would be pragmatically bizarre. I take this to suggest that the conditional here is also existential and that (34) means that the speaker doubts that there is *any* case where John goofs off and succeeds nonetheless.

4.1.3. Conditionals under negation

All conditionals with existential readings encountered so far appear in downward entailing environments of some sort, namely in the scope of *only*, under negative quantifiers like *no student* and under *doubt*.¹² This naturally raises the question whether conditionals that appear under negation also have the existential reading:

- (35) a. It's not the case that John will succeed if he goofs off.
 b. John won't succeed if he goofs off.

Once we assume that (35a,b) are indeed interpreted as in (36), as involving an existential conditional, that is, we can actually explain why the negation of a conditional is often felt to be equivalent to the negation of its consequent: it follows from the logical equivalence between the outer negation of an existential quantifier, cf. (36), and the inner negation of a universal quantifier, cf. (37). The existential conditional derives that the negation of a conditional is equivalent to the negation of the consequent of a conditional—only the two are not the same conditional because they do not have the same quantificational force.

(36) $\neg[\exists w: \text{Goof-off}(j,w)] \text{Succeed}(j,w)$

(37) $[\forall w: \text{Goof-off}(j,w)] \neg \text{Succeed}(j,w)$

But what about counterexamples to CEM like that in (19)/(32)? I would like to venture the following conjecture in this regard:

¹² *Only* is not downward entailing in the classical sense, as was essentially already noted in the Middle Ages (Horn 1989). Rather, it licenses a downward instance to the extent that the presupposition/backgrounded entailment of the subset case is added as a premise to the argument (von Stechow 1999). (i) thus downward entails (ii) if we add a premise that somebody entered the race early. Similarly, *doubt* is also not downward entailing unless we add some further stipulations. These matters aside, however, they are negative in the relevant sense.

- (i) Only Socrates entered the race.
 (ii) Only Socrates entered the race early.

- (38) Instances where the negation of a conditional is not felt to be equivalent to the negation of the consequent arise when the negated conditional is used to deny a universally quantified conditional, inheriting, because of the denial, its universal force.

Recall that (39) is false. Its negation must therefore be true (Excluded Middle).

- (39) If this fair coin is flipped it will come up heads. F

But, crucially, ‘its negation’ means that what is negated has the same quantificational force as the original. It is when (40a,b) are used to deny (39) that they are true because they are then similar in meaning to (40c) and interpreted as in (41):

- (40) a If a fair coin is flipped it will not come up heads. T
 b. It’s not the case/true that if a fair coin is flipped it will come up heads. T
 c. If a fair coin is flipped it will not necessarily come up heads. T

- (41) $\neg[\forall w: [Ax: \text{Fair-coin}(x)] \text{Flipped}(x,w)] \text{Land-heads}(x, w)$ T

Note that on this interpretation the negation of (39) is not equivalent to (41), which is false:

- (42) If this fair coin is flipped it will come up not heads/tails. F

In other words, we do not get a CEM-like effect when the negation of a conditional is the denial of a conditional, including its universal force. It is when the sentences in (40) are interpreted in a “regular” way—as existential conditionals under negation, as in (43)—that they are also false and equivalent to (42), creating the appearance of CEM:

- (43) $\neg[\exists w: [Ax: \text{Fair-coin}(x)] \text{Flipped}(x,w)] \text{Land-heads}(x, w)$ F

Doubt should also lend itself to denying a previous utterance. Indeed, when used as a denial (44B) can be taken to say that not all cases of tossing the coin are ones where it lands heads.

- (44) A: If this fair coin is flipped it will come up heads.
 B: I DOUBT that if this fair coin is flipped it will come up heads. It may also come up tails.

To summarize, I propose that conditionals under negation have existential force. This explains the impression that speakers have that the negation of a conditional is equivalent to the negation of its consequent—it is only an impression because we are not really speaking of the same conditional—one is universally quantified, the other existentially. What look like counterexamples to CEM are instances where the negated conditional has the same universal force as the non-negated conditional. This typically arises in contexts of denial.

4.2. Bare plurals under *only* and negation

Bare plurals offer a further argument for analyzing *only if* in terms of an existential conditional. Already McCawley (1974) and von Stechow (1997) draw a parallel between bare conditionals under *only* and bare plurals under *only*, noting in particular that even bare plurals that normally have quasi-universal readings, e.g. subjects of individual level predicates, show existential reading under *only*. For instance, (45b) does not presuppose that adults in general eat arugula:

- (45) a. Adults eat arugula.
b. Only adults eat arugula.

If the ambiguity of bare plurals stems from an ambiguity between a quasi-universal and an existential operator, as is widely assumed, (45) offers more evidence for there being a preference for an existential reading of an ambiguous \forall/\exists quantifier under *only*. Pushing the parallel between bare conditionals and bare plurals even further, we can now also try to actually *explain* the homogeneity of bare plurals; the impression of homogeneity arises because a sentence like *Dogs don't bark* means something along the lines of 'It is not the case that there are any normal dogs that bark.' In other words, the bare plural under negation is existential. Exceptions to this generalization should be instances where a previous sentence with a generic reading is denied.¹³

5. Analysis

5.1. *If*-clauses as plural definite descriptions

I have argued that bare conditionals can have existential along with their more familiar universal readings. It would, however, be too simple to analyze the antecedents themselves as ambiguous

¹³ One may wonder if this suggestion might also extend to the homogeneity shown by plural definite descriptions. It would if plural definite descriptions are also ambiguous between universal and existential readings, as argued in Krifka (1996) in connection with (i) and (ii):

- (i) The windows are open. (some)
(ii) The windows are closed. (all)

Krifka (*ibid.*) suggests in this context that if grammar does not fix the interpretation, semantic strength in a particular context is a determining factor. This would explain the existential readings in downward entailing contexts. However, one difference between plural definite descriptions and bare conditionals and bare plurals that suggests that maybe the ambiguity of definite descriptions is, at best, not quite the same, is that under *only*, unlike under *not*, definite descriptions do not seem to show an existential reading. (iii) seems to entail that all women attended the meeting.

- (iii) Only the women went to the meeting.

between universal or existential quantifiers. Schein (2003) offers various arguments showing that *if*-clauses are plural definite descriptions of possible events and adverbs of quantification are interpreted *in-situ* as taking scope over the consequent (see also Schlenker 2003 and Bhatt and Pancheva 2006). (46) on this analysis is interpreted as in (47):

(46) If you work hard you usually succeed.

- (47) [$\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))$] (a)
 [Most $e': X(e')$] [$\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e') \rightarrow R(e'', e'))$] (b)
 [$\forall e''': X'(e''')$] *you-succeed*(e''') (c)
- ‘The events where you work hard are such that (a)
 for most among them there are related events (b)
 all of which are events where you succeed.’ (c)

The analysis of conditionals that I am adopting is ‘iffy’ (Gillies 2010) in that *if* has meaning and is not just the marker of a quantificational restriction:

- (48) $[[if]] = \lambda f_{\langle e, t \rangle}. \lambda g_{\langle E, t \rangle}. [\iota E: \forall e (E(e) \leftrightarrow f(e)=1)] g(E)=1$

Another important aspect of Schein’s (2003) analysis is how it deals with the non-monotonicity of conditionals. Rather than restricting the interpretation of the antecedent to the closest case(s) (Stalnaker/Lewis similarity measure), non-monotonicity is attributed to a tacit *ceteris paribus* clause that is sandwiched between antecedent and consequent (between what corresponds to lines (b) and (c) in (47)). Conditional antecedents consequently provide downward entailing contexts (as on the universal conditional, and unlike on the variably strict one). This straightforwardly explains the appearance of NPIs (Schein 2003) and the interpretation of disjunction in *if*-clauses (Herburger and Mauck 2015). At the same time, the *ceteris paribus* clause explains failures of Strengthening of the Antecedent and Contraposition. It is for reasons of space that I do not include the *ceteris paribus* clause.

5.2. The tacit adverb—an ambiguous silent *ever*

With *if*-clauses denoting plural definite descriptions, on the account that I adopt the difference between universal and existential conditionals does not reside in the quantificational force of the antecedent but rather in the quantificational force of a tacit adverb taking scope over the consequent. On the universal reading, *If you work hard you succeed* has thus the logical form in (49a), on the existential reading that sketched in (49b):

- (49) a. [$\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))$] (a)
 [$\forall e': X(e')$] [$\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e') \rightarrow R(e'', e'))$] (b)
 [$\forall e''': X'(e''')$] *you-succeed*(e''') (c)

- b. $[\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))]$ (a)
 $[\exists e': X(e')]$ (b)

One can think of this difference as one where bare conditionals contain a tacit adverb *ever* that, similar to the overt adverb *ever*, is ambiguous between a universal reading ('always') and an existential reading ('sometimes'), where the latter is an NPI and restricted to downward entailing contexts. The existential reading of overt *ever*, is illustrated in (50) and the first three lines of (52), the universal reading of the overt *ever*, which is somewhat limited in distribution (but not like an NPI), is shown in (51) and the last line of (52):

- (50) a. I don't think I have ever seen as stunning a hibiscus plant as this one. \exists
 b. Don't ever try this at home! \exists
- (51) a. Ever the optimist, he said that everything would work out just fine. \forall
 b. I will stay here forever. \forall
- (52) If ever two were one, then surely we. \exists
 If ever man were lov'd by wife, then thee; \exists
 If ever wife was happy in a man \exists
 [...] \exists
 That when we live no more, we may live ever. \forall
 (To my Dear and Loving Husband, Ann Bradstreet)

Since *only* (like negation and *doubt*) licenses NPIs, it follows that conditionals under *only* (like those under negation and *doubt*) exhibit the existential reading. The account also makes an interesting prediction: when an *only if* conditional contains an overt adverb, the quantificational force of the conditional should not necessarily be existential but rather correspond to that of the overt adverb, whatever it may be. This prediction seems right; (53) rules out that the events where one does not work hard are such that all, most, many etc. of them lead to success:

- (53) Only if you work HARD do you always/usually/often/etc. succeed.
- (54) ONLY $[\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))]$ (a)
 $[\text{All/Most/Many } e': X(e')] [\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e'') \rightarrow R(e'', e'))]$ (b)
 $[\forall e'': X'(e'')] \text{you-succeed}(e'')$ (c)

Conditionals with overt adverbs embedded under negative quantifiers, *doubt* and negation show similar behavior. Thus, (55a) says that for no student is it the case that the events where he or she studies very little are such that all/most/many of them result in events of getting an A.

- (55) a. No student always/usually/often/etc. gets an A if he or she studies very little.
 b. I doubt that Meadow always/usually/often/etc. gets a D if she studies very little.
 c. Meadow does not always/usually/often/etc. get a D if she studies very little.

Finally, since plural definite descriptions show homogeneity effects, one may wonder if by adopting the Schein-Schlenker analysis of *if* we do not already get CEM and thereby already solve the problem of *only if* and conditionals in downward entailing contexts. A moment's reflection, however, shows that that is not really the case. Whether we derive a CEM-like effect or not really depends on whether the adverb is existential (CEM-effect) or universal (no CEM-effect). Note also that the weak presuppositions of *only if* conditionals—the examples in (1) presuppose that *some* instances of hard work lead to success, not that all do—independently show that we need the existential conditional.

5.3. Afterthought: The relation between antecedent and consequent events

Among the many loose ends I have undoubtedly left, there is one I want to tie up a bit before I conclude. When propositional logic is all we have the best we can do to translate *only if* q p is $p \rightarrow q$, that is, the same as *if* p q . Matters of compositionality aside, this works reasonably well for examples where temporal/causal order does not matter, as for instance in (56):

- (56) a. If Socrates is a man he is mortal.
b. Only if he is mortal is Socrates a man.

When, however, temporal or causal order matters, as it often does, we find that *only if* q p is clearly not equivalent to *if* p , q (McCawley 1993):

- (57) a. If you heat butter, it melts.
b. Only if butter melts do you heat it.
- (58) a. If you're insured, you have nothing to worry about.
b. You're insured only if you have nothing to worry about.

The reason the equivalence fails seems to be that, generally, *if*-clauses, whether they are under *only* or not, describe matters that are temporally or causally prior to those described by the consequent clauses. This suggests that the relation R in the logical forms above at least can be understood as 'Follow' (Schein 2003).

6. Conclusion

Only if conditionals become less puzzling once we assume that the prejacent of *only* in these instances is a bare conditional with an existential reading. This reading also appears under negative quantifiers, verbs like *doubt* and negation. The impression that the negation of an entire conditional is equivalent to the negation of that very same conditional's consequent is but an impression; we are really dealing with an existentially quantified conditional when the negation takes scope over the entire conditional and a universally quantified one when the negation takes scope only over the consequent. Instances where a negation takes scope over a universally quantified conditional involve denial negation. *If*-clauses themselves are plural definite

descriptions of possible events, and the difference in quantificational force between universal bare conditionals and existential ones lies in a tacit and ambiguous adverb of quantification ‘ever’.

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