Almost: Scope and Covert Exhaustification

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1. Introduction

The modifier *almost* indicates, intuitively, that the constituent it modifies is at least close to being true, but is not in fact true.

(1)   *John ate **almost** all the cookies*.

> (i) John ate close to all of the cookies.   (PROXimal component)
>
> (ii) John did not eat all the cookies.   (NEGative component)

While PROX is clearly part of the semantic contribution of *almost*, the status of the negative inference in (1ii) has been the subject of debate since since at least Sadock (1981). He proposed that NEG should be derived as a conversational implicature, while Hitzeman (1992) and Horn (2002, 2011) have convincingly argued that NEG must be an entailment. However, there are cases which pose a serious problem for the latter analysis: when *almost* is embedded under another operator, NEG seems to disappear.

In this paper I adopt an analysis of *almost* which derives both PROX and NEG as part of the truth-conditional contribution, and offer an account of the unexpected absence of NEG. I focus specifically on cases where *almost* associates with a top-of-the-scale item, *all*, and is embedded under an entailment-reversing operator. The solution relies on scope interactions with these operators, which can be independently motivated by cases of *almost* combining with negative polarity items. The final piece of the puzzle, made necessary by the strong associate of *almost*, is an abstract operator *exh* similar in meaning to *only*, which rescues certain configurations from logical contradiction and yields the desired meaning.

The following section briefly presents previous analyses of *almost* and the evidence for NEG being an entailment of *almost*, and §2 presents the problematic case. A semantics for *almost* is proposed in §3, and its predictions are laid out in §3.1. §4 presents evidence of scope interaction between embedded *almost* and downward entailing operators, with §4.1 exploring the consequences of inverse scope for the puzzle presented in §2 and finding that a contradiction arises. The solution to this contradiction is presented in §5: a covert exhaustification operator *exh*. §6 discusses another possible reading for embedded *almost*, and two possible ways to capture it within the analysis proposed. Finally, §7 concludes.

2. The negative inference associated with *almost*

Whether the negative inference in (1ii) is part of the truth-conditional contribution of *almost* has been extensively debated. Sadock (1981) proposed that NEG is a conversational implicature, arising due to Grice's Maxim of Quantity. However, as Horn (2002) points out, NEG fails to display one of the hallmark properties of conversational implicatures: it is not cancellable by following discourse. For example, a classic quantity implicature is the inference from *some* to *not all*. In (2a), the implicature that "Bill did not eat all of the cookies" can be cancelled by the continuation in the second conjunct.

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(2)   a. Bill ate **some** of the cookies, and (in fact) he ate all of them.

   b. John ate **almost** all the cookies, # and (in fact) he ate all of them.

However, (2b) shows that it is not possible to cancel NEG in this way, suggesting that this negative inference is semantically entailed rather than pragmatically implicated.

The entailment analysis of NEG is adopted by Hitzeman (1992); Sevi (1998); Rapp & von Stechow (1999); Horn (2002, 2011), yet its predictions are not always straight-forwardly borne out. Nouwen (2006) points out that NEG seems to be absent in certain cases, for example in the scope of a necessity modal.

(3)   If you want to pass the exam, you must answer almost all the questions.   (Nouwen, 2006)
   ⇏ You must not answer all the questions.[1]

In (3), there is no inference that the requirement includes not answering all of the questions, which is what would be expected from a simple decomposition of *almost* into two conjuncts, roughly equivalent to *most but not all*. Nouwen takes this as tentative evidence against the idea that the negative inference is an entailment of *almost*. Here I present a similar case which seems to further weaken the entailment hypothesis. When *almost* is embedded in a downward-entailing environment, such as the antecedent of a conditional, NEG seems to disappear (not unlike the scalar implicature of *some*). Consider (4):

(4)   *John and Bill are practicing archery.*

   If Bill hits almost all of the targets, John will give him 5$.

   Bill does superbly, hitting all 10 of the targets in the range.

Intuitively, Bill is entitled to receive his 5$. This suggests that the fact that *Bill hit all of the targets* makes the antecedent of (4) true, which again is unexpected if NEG is part of the semantic contribution of *almost*.

(5)   a. Predicted by entailment analysis of (4):
      ⇒ If Bill hits **most but not all** of the targets, John will give him 5$.

   b. Intuitive meaning of (4):
      ⇒ If Bill hits **most or all** of the targets, John will give him 5$.

If the meaning were as in (5a), then John would not necessarily be obligated to pay the $5, since the conditional only specifies the outcome in case hits *most but not all* targets. The intuition that John must pay if Bill hits *all* the targets suggests a meaning more like (5b), which requires that in all worlds where Bill hits *most or all* targets, John gives him $5.

Even if the predicted negative inference is made salient in the context, it still does not seem to be relevant to the antecedent. Consider a case with a different bet:

(6)   *John makes another bet: he bets that Frank will **not hit all** of the targets. Bill tries to describe the situation by saying:*

   If Frank hits almost all of the targets, John will give him 5$.

The intuition is that Bill's statement does not accurately describe the bet in this scenario. This again shows that the predicted meaning of the type in (5a) is not the interpretation of (6), since that meaning would make it compatible with the bet. On the other hand, the intuitive meaning proposed in (5b) *would* be at odds with the bet, explaining why Bill's statement in (6) is inaccurate.

Given that the negative inference of *almost* is absent in conditional antecedents, can NEG still be analyzed as part of the truth-conditional contribution of *almost*? I propose that it can, and that the absence of NEG is only apparent.

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[1] It worth noting that this inference would be pragmatically odd, since answering *all* the questions should be better than answering just most. Hence, this example shows that the negative inference *can* go missing rather than that it is completely gone in these constructions.

However, there are some cases in which the (5a) reading of (4) is possible, and for some speakers may be more salient than (5b).

(7)   If Bill hits almost all of the targets, John will give him 5$. But if Bill hits *all* the targets, John won't have to pay him.

For speakers who find this continuation felicitous, the meaning of (4) must be (5a), since the continuation contradicts (5b). The availability of this reading will be addressed in §6.

3. A semantic account of the negative inference

Penka (2006) notes that focus sensitive operators *only* and *even* are parallel to *almost* in that they are cross-categorial in terms of their surface syntactic distribution, and derive part of their import from the constituent they modify. They are also necessarily associated with a scalar ordering among alternatives, just as *almost* requires an ordering to determine a measure of "closeness". She proposes a denotation for *almost* inspired by previous treatments of scalar operators (Rooth, 1985; Schwarz, 2005), which I adopt here with some notational simplification:

(8) $\llbracket \text{almost}_{\approx} \rrbracket = \lambda w \lambda p_{\langle s,t \rangle} . \underbrace{\neg p(w)}_{\text{NEG}} \, \& \, \underbrace{\exists q \in \approx [q(w)]}_{\text{PROX}}$

Almost takes as arguments a proposition p and a set of propositions $\approx$. This assumes that despite its surface position, *almost* always has a propositional node for a sister at LF, which I refer to as its **prejacent**.[2] The surface position of *almost* marks the constituent which is replaced to calculate the alternatives in $\approx$; this expression is the **associate** of *almost*.[3] Let's see this in action for a simple case:

(9)   John ate almost$_{\approx}$ **all** of the cookies.
      LF: almost$_{\approx}$ [John ate **all** of the cookies]

In (9), *all* is the associate of *almost*, while its prejacent is *John ate all the cookies*. The value of $\approx$ is a set of propositions of the form *that John ate x of the cookies*, where *x* is drawn from the focus alternatives of *all*, which in this case are drawn from its Horn scale.

(10) $\approx^4 = \{$that John ate **all** of the cookies, that John ate **most** of the cookies, that John ate **many** of the cookies$\}$

The propositions in $\approx$ stand in entailment relations with one another, shown schematically in (11). The leftmost proposition in each line is an alternative, which is followed by the propositions in $\approx$ which it entails.

(11) Entailment between $\approx$-alternatives in (10)

a. J ate all the cookies $\Rightarrow$	J ate most of the cookies $\Rightarrow$	J ate many of the cookies
b.	J ate most of the cookies $\Rightarrow$	J ate many of the cookies
c.		J ate many of the cookies

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[2] See Morzycki (2001) for discussion of the cross-categorial nature of *almost*, and possible alternatives for capturing this behaviour.

[3] I assume, after Penka (2006), that the associate of *almost* is focus-marked, and the alternatives in $\approx$ are drawn from the focus-semantic value of the prejacent, in the sense of Rooth (1985).

[4] For the sake of simplicity, I use $\approx$ both as a variable ranging over sets of propositions, as in (8), as well as to represent the actual value assigned to $\approx$ for a given sentence.

Among these alternatives, the prejacent of *almost* (11a) is the strongest, as it entails every other alternative in ≈. Applying *almost* to its prejacent yields the two conjuncts given in (12). For clarity of presentation, PROX is presented as a disjunction rather than the equivalent existential statement from the denotation in (8).

(12) NEG : ¬ J ate **all** of the cookies
    PROX : J ate **all** of the cookies ∨ John ate **most** of the cookies ∨ John ate **many** of the cookies
        ≡ that John ate **many** of the cookies

The NEG component negates the prejacent, and so prevents alternative (11a) from fulfilling PROX. However, it is still compatible with either (11b) or (11c) being true, so the meaning is logically consistent. The meaning calculated in (12) can be paraphrased as *John didn't eat all the cookies and he ate many or most of the cookies*, which fits the intuitive meaning of (9).

When *almost* modifies an expression which is the weakest of its scale-mates, the denotation in (8) will yield a logical contradiction. As Penka (2006) notes, this provides a possible account of the incompatibility of *almost* with existentials, as shown in (13).

(13) * John ate almost **some** of the cookies.
    LF: almost≈ [John ate **some** of the cookies]

The alternatives to the prejacent in (13) are formed by replacing *some* with other expressions on the Horn scale to which it belongs, such as *many* and *most*.[5] Unlike in (11), the prejacent is entailed by all of the alternatives in ≈, as shown in (14). Hence, the prejacent is the weakest proposition in ≈.

(14) Entailment between ≈-alternatives in (13)

a.		J ate some of the cookies
b.	J ate many of the cookies ⇒	J ate some of the cookies
c. J ate most of the cookies ⇒	J ate many of the cookies ⇒	J ate some of the cookies

Combining *almost* with its prejacent in (13) results in the following truth-conditions:

(15) NEG: ¬ J ate **some** of the cookies
    PROX: John ate **some** of the cookies ∨ John ate **many** of the cookies ∨ John ate **most** of the cookies
        ≡ John ate **some** of the cookies

As we noted for (12), the truth of PROX reduces to the truth of the weakest alternative, which in this case is *that John ate some of the cookies*. However, this also happens to be the prejacent of *almost*, and the prejacent is negated by NEG. This results in a logical contradiction. Following Gajewski (2002), I assume that LFs which are contradictory by virtue of their logical structure (rather than their content) are ungrammatical, and (13) is indeed ungrammatical.[6]

3.1. Predictions of this analysis

So far, the denotation proposed in (8) has correctly predicted that in simple sentences, *almost* can associate with universal quantifiers but not with existential quantifiers, because the latter results in a logically contradictory meaning.

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[5] Note that in (10), I have excluded Horn-scale items lower than *many* simply as an arbitrary cut-off for what constitutes "close to" *all*, hence why *some* is absent despite it being part of the same Horn-scale as *all*.

[6] This logical contradiction is not necessarily the only reason (13) is ungrammatical: *almost* is also picky with respect to the "preciseness" of the quantifiers it associates with, cf. **almost many* versus *almost half* (Hitzeman, 1992).

(16)   ✓ almost [∀$_F$ [. . .]]
        * almost [∃$_F$ [. . .]]

This is due to the fact that a sentence of type in (13) is entailed by all of the alternatives in the set of ≈-alternatives, but is not directly due to the association of *almost* with an existential quantifier. The prediction in (16) is only a specific case of a broader generalization on the distribution of *almost*: it can combine with a strong prejacent but not a weak one. [7]

(17)   ✓ almost [. . .]$_{strong}$
        * almost [. . .]$_{weak}$

If (17) is correct, it fails to derive the claim that *almost* can only modify quantifiers with universal force. *Almost* should be compatible with existential quantifiers so long as the prejacent it ultimately takes as its argument is not weak. As Penka (2006:282) points out, this would be the case if an entailment-reversing operator should intervene between *almost* and its existential associate at LF. Such a configuration is schematized in (18).

(18)   ✓almost [OP$_{DE}$ [∃$_F$ [. . .]]$_{weak}$]$_{strong}$

The following section shows that there are cases where *almost* associates with an existential quantifiers (namely NPI *any*), and that these cases follow straightforwardly from the denotation in (8) if *almost* is assumed to take wide scope, creating the configuration in (18).

4. The scope of *almost*

Almost has been widely used as a diagnostic for universal force of polarity items, under the assumption that it is incompatible with existential quantifiers (Carlson, 1980). However, Horn (2005) suggests that the apparent incompatibility of *almost* with existential NPI *any* is actually incompatibility between *almost* and negation. He provides numerous examples of *almost* + *any*$_{NPI}$:

(19)   a. In a story that didn't see almost any coverage here. . .

       b. Global warming: we didn't see almost any snow in the winter.

       c. I'm in the 5th week and I didn't see almost any results.

       d. I don't pay almost a single cent for any of my art work.   (Horn, 2011:5)

Assuming an existential semantics for NPI *any* (Ladusaw, 1979; Carlson, 1980), this combination is predicted by our denotation to be contradictory unless the prejacent of *almost* includes the negation that licenses *any*$_{NPI}$. The first potential LF in (20a), modulo the higher negation, mirrors (13) and shares its contradiction problem, while (20b) is parallel to (9).

(20)   a. * ¬ [almost$_≈$ [we saw any$_F$ snow in the winter]]

       b. ✓almost$_≈$ [¬ [we saw any$_F$ snow in the winter]]

Consider the meaning predicted by (20b). The alternatives in the ≈ set, given in (21), include negation. Because negation is an entailment-reversing operator, the prejacent is the strongest proposition in ≈ even though it contains a weak quantifier.

(21)   ≈ = {that we didn't see any snow in the winter, that we didn't see much snow in the winter, that we didn't see lots of snow in the winter}

Consequently, the combination of *almost* with its prejacent will proceed similarly to (9) and yield a logically consistent and intuitively correct meaning, shown in (22).

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[7]   Strictly speaking, it predicts that only *non-weak* prejacents can combine with *almost*, not only strong prejacents. That is, as long as ≈ contains at least one alternative that does not entail the prejacent, no contradiction should arise.

(22) NEG : ¬ We didn't see any snow in the winter

   PROX : We didn't see any snow in the winter ∨ We didn't see much snow in the winter ∨ We
            didn't see lots of snow in the winter
            ≡ We didn't see lots of snow in the winter.

What the cases in (19) show is that more general prediction in (17) captures the distribution of *almost* better than (16) if we assume that *almost* takes wide scope with respect to entailment reversing operators. The following section will show how this inverse scope can also help resolve a different problem, viz. the apparent disappearance of the the negative inference in (4). However, this will require one additional assumption about the prejacent of *almost*.

4.1. The puzzle again: wide scope almost

Recall that the puzzling fact about (4) was that the negative inference that usually accompanies *almost* seemed to disappear:

(4) If Bill hits almost all the targets, John will give him 5$.

(5)   a. Predicted by entailment analysis of (4):
            ⇒ If Bill hits **most but not all** of the targets, John will give him 5$.

         b. Intuitive meaning of (4):
            ⇒ If Bill hits **most or all** of the targets, John will give him 5$.

The meaning in (5a) is what is predicted if *almost* is interpreted within the scope of the antecedent, applying to the prejacent *Bill hits all of the targets*. However, if *almost* is actually taking wide scope in these cases, as we saw for (20), then the prejacent would be the entire conditional rather than simply the proposition in the antecedent, as shown in (23).

(23) LF for (4): almost$_\approx$ [If Bill hits all$_F$ the targets, John will give him 5$]

Calculated at the level of the entire conditional, the alternatives in ≈ stand in the entailment relations shown in (24), because the conditional antecedent is downward monotone.

(24) Entailment between ≈-alternatives in ≈ for (23)

a.				If … all …
b.		If … most … ⇒		If … all …
c. If … many … ⇒	If … most … ⇒			If … all …

This shows that all of the alternatives in ≈ entail that if Bill hits all the targets, John will give him $5. No matter which of the alternatives fulfills the proximal component of *almost*, (24a) will be entailed, accounting for the intuition that Bill is indeed owed $5 if he manages to hit all of the targets. Consider the predicted meaning of (23):

(25) NEG: ¬ If Bill hits **all** the targets, John will give him $5

   PROX: If Bill hits **all** the targets, John will give him $5
            ∨ If Bill hits **most** the targets, John will give him $5
            ∨ If Bill hits **many** the targets, John will give him $5
            (≡ If Bill hits **all** the targets, John will give him $5)

The existential PROX reduces to the weakest disjunct, which in this case is the prejacent. As predicted by (17), this leads to a logical contradiction, which should be ungrammatical. Hence, this cannot be the correct LF for (4), but I propose that *almost* does indeed take wide scope.

Inspired by the account of Crnič (2013) for another alternative-evaluating propositional operator, *even*, I propose that the prejacent in (23) can be covertly strengthened in order to rescue this type of contradictory LF.

5. Covert exhaustification

Recent work on scalar implicatures has led to the proposal of a covert operator, similar in meaning to *only* (Fox, 2007; Fox & Spector, 2009; Chierchia et al., 2011; Sauerland, 2012). This operator strengthens its prejacent with respect to a set of alternatives by conjoining the negation of all propositions which are not entailed by the prejacent. I adopt a simplified semantics for this operator, *exh*, based on Crnič (2013):

(26) $[\![\mathbf{exh}_C]\!]= \lambda w \lambda p.\ p(w)\ \&\ \forall q \in C[p \nsubseteq q \rightarrow \neg\, q(w)]$

(27) John ate some cookies.
LF: exh_C [John ate **some** of the cookies]

(28) C = {that John ate **some** of the cookies, that John ate **all** of the cookies}
$[\![(27)]\!]$= John ate some of the cookies & ¬ John ate all of the cookies

In addition to strengthening the meaning of its prejacent, it also yields a proposition that is not entailed by any of the alternatives in C. This can resolve the contradiction that we encountered in (23):

(23) LF for (4) with wide scope *almost*:
almost$_\approx$ [If Bill hits all$_F$ the targets John will give him 5$]

(29) LF for (4) with covert exhaustification of the prejacent:
almost$_\approx$ [exh$_C$[If Bill hits all$_F$ the targets John will give him $5]]

The prejacent of *exh* in (29) is entailed by all its alternatives, as we saw from the table in (24). However, once its meaning is strengthened, the problematic entailments in among the alternatives in (24) are broken. (30) shows the result of exhaustifying the proposition *If Bill hits all the targets, John will give him 5$*.

(30) $[\![\text{exh}_C[\text{If Bill hits all}_F \text{ the targets, John will give him 5\$}]]\!]$=
Only if Bill hits all$_F$ the targets, John will give him 5$

Now the prejacent of *almost* in (29) includes *exh*, and so will the alternatives that make up $\approx$:[8]

(31) $\approx$ = { that only if Bill hits all$_F$ the targets, John will give him 5$, only that if Bill hits most$_F$ of the targets, John will give him 5$], that only if Bill hits many$_F$ of the targets, John will give him 5$]}

The alternatives in $\approx$ are no longer related by entailment, as shown in (32).

(32) Entailment between LFs for (31) alternatives

a.   exh[If . . . all . . .]
⇑⇓
b.   exh[If . . . most . . .]
⇑⇓
c. exh[If . . . many . . .]

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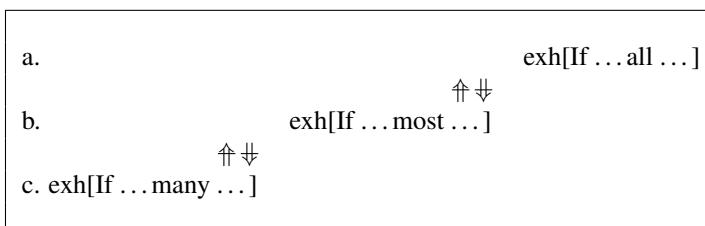
[8] The propositions are given using "only" in order to approximate the exhaustified meaning.

The PROX component of *almost* requires that one of these alternatives hold. NEG only rules out the prejacent. Hence, PROX and NEG are not in contradiction at they were in (25).

But if the entailments among alternatives have been broken, why do we infer *close to all **or all*** from (4)?

Even though *exh* strengthens its prejacent, it still entails its prejacent. For each alternative, the non-exhaustified meaning still entails *[If … all …]*.

(33)   Entailments of each alternative LF in (31)

a. exh[If … all …]			⇒ If … all …
⇑⇓			
b. exh[If … most …]		⇒ If … most …	⇒ If … all …
⇑⇓			
c. exh[If … many …]	⇒ If … many …	⇒ If … most …	⇒ If … all …

No matter which alternative ends up fulfilling PROX, it will entail [If … all …].

6. The *most but not all* reading in embedded contexts

The proposal outlined above has explained why the negative inference of *almost* appears to go missing when it is embedded under a downward-entailing operator. However as noted in §2, the negative inference can sometimes be interpreted within the conditional antecedent if required by the context, as in (34), repeated from (7) above.

(34)   a. If Bill hits almost all of the targets, John will give him 5$.

b. … But if Bill hits *all* the targets, John won't have to pay him.

For the second sentence in (34b) to make sense, it must be that in (34a) *almost all* is interpreted as *most but not all* rather than as *most or all*. Under the present proposal, there are two potential ways to capture this second sense. The first possibility is that *almost* still scopes over the entire conditional, but the rescuing *exh* applies only to the antecedent. The second possibility is that *almost* takes scopes locally over the proposition in the antecedent, which would mean that scoping out of a DE environment is a strong preference of *almost* rather than a requirement. The two possibilities lead to different sets of alternatives for *almost*, and therefore different truth-conditions. I outline both possibilities below.

6.1. Embedded exh

This analysis above assumed that a rescuing *exh* takes scope over the entire conditional, but in fact *exh* can also rescue high-scope *almost* if its scope is only over the clause embedded in the antecedent. This would break the entailments among the alternatives evaluated by *almost* and yields the *most but not all* interpretation required for the continuation in (34).

(35)   LF for (4) with covert exhaustification of the antecedent:
       almost$_\approx$ [If [exh$_C$ Bill hits all$_F$ the targets] John will give him $5]

The LF in (35) will lead to mutually exclusive alternatives, given in (36)

(36)   ≈ = { that if Bill hits all the targets, John will give him 5$, that if Bill hits most & *not all* of the targets, John will give him 5$, that if Bill hits many & *not most & not all* of the targets, John will give him 5$}

And the predicted meaning of *almost* combined with its prejacent in (35) will be the following:

(37) NEG: ¬ If Bill hits **all** the targets, John will give him $5

    PROX: If Bill hits **all** the targets, John will give him $5
        ∨ If Bill hits **most & not all** the targets, John will give him $5
        ∨ If Bill hits **many & not most & not all** the targets, John will give him $5

For (37) to be true, either the *most but not all* or *many but not most/all* propositions must be the ones to fulfill PROX, which are both compatible with the (34b) continuation. Because of the high-scoping NEG, it cannot be true that *If Bill hits all the targets, John will give him $5*. This is compatible with the continuation in (34b), and in fact should make the continuation redundant (since it is now entailed).

6.2. Local scope for almost

Allowing *almost* to take scope over just the embedded proposition in (34a) would allow the antecedent to have a meaning just like the one calculated in (9), where *almost all* is interpreted as *most but not all*, without requiring a covert *exh*.

(38) LF for (34a) with embedded *almost* :
    If almost$_{\approx}$ [Bill hits all$_F$ the targets], John will give him 5$

And since the negative inference of *almost* is embedded, the resulting meaning will not entail (34b), since it says nothing about the truth of *If Bill hits all the targets, John will give him $5*. The conditional requires only that the consequent be true in cases where Bill hits many or most but not all of the targets.

(39) Predicted meaning for (38):
    If [¬ Bill hits all the targets & Bill hits [many ∨ most ∨ all] the targets], John will give him $5.

This set of truth-conditions is not related by entailment to the one predicted by an LF with embedded *exh*. If it is the case that John pays out $5 whether Bill hits many, most or all of the targets, then (39) is true while (37) is false. On the other hand, if John pays out $5 just in case Bill hits exactly many of the targets, but not if he hits most or all of the targets, then (37) is true while (39) is false.

Intuitions on which of these two LFs is responsible for the reading in (34) are unclear, and beyond the scope of this paper. I leave this for future work, and also note the possibility that both readings may in fact be available.

7. Conclusion

In this paper I have shown that it is possible to maintain an analysis of *almost* which includes the negative inference as part of its truth-conditional contribution. The fact that this inference appears to be absent when *almost* is embedded in a downward-entailing environment, such as a conditional antecedent, is due to *almost* taking scope above the entailment-reversing operator. In the specific case of *almost* combining with a strong associate like *all*, this scope reversal creates a contradictory LF, which I have proposed can be rescued by strengthening the prejacent of *almost* with the covert operator *exh*, in the spirit of Crnič (2012). Finally, I suggested two possible analyses for the dispreferred but still available interpretation in which the negative inference is present: either the rescuing *exh* operator takes scope over the embedded proposition, or *almost* takes scope locally within the downward-entailing environment.

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Proceedings of the 32nd West Coast Conference on Formal Linguistics

edited by Ulrike Steindl, Thomas Borer, Huilin Fang, Alfredo García Pardo, Peter Guekguezian, Brian Hsu, Charlie O'Hara, and Iris Chuoying Ouyang

Cascadilla Proceedings Project   Somerville, MA   2015

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Kilbourn-Ceron, Oriana. 2015. *Almost*: Scope and Covert Exhaustification. In *Proceedings of the 32nd West Coast Conference on Formal Linguistics*, ed. Ulrike Steindl et al., 121-130. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #3163.