IT'S PROBABLY CERTAIN

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1 Introduction

This paper deals with a subclass of epistemic modals called 'modal adverbs' i.e. the adverbs *possibly, probably, certainly* and their relation to the corresponding modal adjectives *possible, probable,* and *certain*[1].

Sentences containing modal adverbs such as '*the dog is possibly on the lawn*' seem on a first glance to be equivalent to ones containing modal adjectives as *'it's possible that the dog is on the lawn*'. The immediate impression of both sentences is that one is a variant of the other, both convey the possibility that the dog is on the lawn. And indeed, the literature by and large does not distinguish between modal adverbs and modal adjectives as well (cf. Ernst, 2009; Jackendoff, 1972; Jacobson, 1978; Kratzer, 1981; Perkins, 1983). However, what seems at first glance to be the case turns out to be more complicated than expected.

Modal adverbs differ from modal adjectives in many respects, as shown in section 2. In order to account for these differences there is a need to reanalyze the components of epistemic modality. Section 3 discusses the classical theory of modality (inter alia Kratzer 1981; 1991; 2012) and predictions derived from this theory with regards to epistemic modals, as well as other theories that attempt to account for the differences between modal adverbs and adjectives, and problems thereof. Section 4 presents the proposed theory, in which the differences between modal adverbs and modal adjectives stem from different uses of epistemic modality – expressive and descriptive. Modal adverbs pertain to the former while modal adjectives to the latter. The section discusses the properties of expressives (Potts 2007) and shows the patterns of modal adverbs and modal adjectives accordingly. The formal account is presented, in terms of a probabilistic speech act based context update theory, and the data presented in section 2 is accounted for. Section 4 also presents preliminary results from an experiment, conducted by

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[1] This paper does not deal with non-epistemic interpretations of modal adjectives.

Wolf, Cohen and Simchon, which examines Nilsen's contrast, discussed in section 2. Section 5 concludes the paper.

2 Data

The first and most recognizable feature of modal adverbs is their *Speaker Orientedness* (cf. Jackendoff, 1972) i.e. utterances containing modal adverbs convey that the person whose judgment is reflected by these adverbs is the speaker. This feature does not standardly manifest in utterances containing modal adjectives, as can be seen in the following example (Nuyts 2001):

   (1)   A: It is probable that they have run out of fuel.
          B: Who says so?

   (2)   A: Probably they have run out of fuel.
          B: #Who says so?

While the question in (1) is quite natural, i.e. the hearer wants to know whose judgment is conveyed by the speaker's assertion (while it may be the speaker's, it doesn't have to be), the question in (2) doesn't sound quite right. This is due to the intuition that in the modal adverb case it seems clear[2] whose judgment it is.

    The classical theory of modality, due to Angelika Kratzer (inter alia 1977, 1981, 2012), discussed ahead, offers a unified account of modality. Indeed, this is one of its greater strengths. In accord with this unified account, the common assumption regarding modal adverbs and modal adjectives (e.g. Ernst, 2009; Jackendoff, 1972; Jacobson, 1978; Perkins, 1983) is that they are different grammatical variations on the same semantic meaning. However, as claimed by Bellert (1977) and explored in Nilsen (2004) and Piñón (2006, 2009) modal adverbs are not semantically synonymous with modal adjectives, a fact which is manifested by different behavior patterns in various linguistic constructions. The following subsections discuss the various ways in which modal adverbs differ from modal adjectives.

2.1 Embedding

While modal adjectives are easily embedded under negation, modal adverbs are very difficult (Bellert 1977) [3]:

   (3)   a.   It's impossible/not possible that
              It's improbable/not probable that
              It's uncertain/not certain that   ,John has/will come.

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[2] While modal adverbs have a strong tendency to be speaker oriented, it's important to note that this tendency is context-dependent, as is the case for all modals.

[3] Bellert also uses the pair *evident/evidently.* This is replaced by *certain/certainly* here, in order to try and keep the evidential component away.

b. $\left\{\begin{array}{l}\text{\#Impossibly/Not possibly}\\ \text{\#Improbably/Not probably}\\ \text{\#Uncertainly/Not certainly}\end{array}\right\}$,John has/will come.

While modal adjectives are easily embedded under questions, modal adverbs are very difficult (Bellert 1977):

(4) a. Is it $\left\{\begin{array}{l}\text{possible}\\ \text{probable}\\ \text{certain}\end{array}\right\}$ that John has/will come?

b. #Has/Will John $\left\{\begin{array}{l}\text{possibly}\\ \text{probably}\\ \text{certainly}\end{array}\right\}$ come?[4]

The third embedding difficulty of modal adverbs, noted in Piñón (2006), is in the antecedent of conditionals:

(5) a. If it is $\left\{\begin{array}{l}\text{possible}\\ \text{probable}\\ \text{certain}\end{array}\right\}$ that the socialists will win the elections, the rich will worry about a luxury tax.

b. #If the socialists $\left\{\begin{array}{l}\text{possibly}\\ \text{probably}\\ \text{certainly}\end{array}\right\}$ win the elections, the rich will worry about a luxury tax.

However, modal adverbs are good in the consequent of conditionals:

(6) If the socialists win the elections, the rich will $\left\{\begin{array}{l}\text{possibly}\\ \text{probably}\\ \text{certainly}\end{array}\right\}$ worry about a luxury tax.

These data are strengthened by an observation of Papafragou (2006), originally made with regards to modal auxiliaries but very much applicable to our case as well – while modal adjectives are easily embeddable under factives, modal adverbs are not so easy:

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[4] It's important to note that stressing the modal adverb in these examples results in higher acceptability. While I shall not deal with focus in this paper (but cf. Döring (2012) for an account of focus sensitivity in modal adverbs), I suggest that the reason for the higher acceptability stems from the main effect of focus which is bringing a discourse item from the background to the foreground of the assertion, i.e. from non-at-issueness to at-issueness.

(7)   a. It is surprising that it is $\left\{\begin{array}{l}\text{possible} \\ \text{probable} \\ \text{certain}\end{array}\right\}$ the socialists will win the elections.

       b. #It is surprising that the socialists will $\left\{\begin{array}{l}\text{possibly} \\ \text{probably} \\ \text{certainly}\end{array}\right\}$ win the elections.

2.2   Agreements and Disagreements

Agreement and disagreement cases offer a good diagnostic of the different discourse effects of modal adverbs and adjectives, since agreements and disagreements can target the whole asserted proposition and not just parts of it.

Papafragou (2006) uses an assent-dissent diagnostic on modal auxiliaries. This test can easily be converted to show the differences between modal adverbs and modal adjectives. The tests show a tendency for assents and dissents of utterances containing modal adverbs to target the prejacent[5] and utterances containing modal adjectives to target the entire proposition including the modal adjective:

(8)   A: It's possible/probable/certain that John is at home.
       B: That's not true/I agree.
       = It's not true/The hearer agrees that it's possible/probable/certain John is at home.
       ≠ It's not true/The hearer agrees that John is at home.

(9)   A: John is possibly/probably/certainly at home.
       B: That's not true/I agree.
       ≠ It's not true/The hearer agrees that John is possibly/probably/certainly at home.
       = It's not true/The hearer agrees that John *is* at home.

An example which demonstrates this point modified from MacFarlane (2011), originally used with the modal auxiliary *might* and the epistemic hedge 'for all I know'. Here, replacing the (expressively used) *might* with the modal adverb *probably* shows the difference from the corresponding modal adjective:

(10)   **First case**: You overhear George and Sally talking in the coffee line. Sally says, "It's probable that Joe is in Boston right now". You think to yourself: I know that Joe isn't in Boston, because I just saw him an hour ago here in Berkeley.
       Question: Did Sally speak falsely?

(11)   **Second case**: Scene as before. Sally says, "Joe is probably in Boston right now". You think to yourself: Joe can't be in Boston; I just saw him an hour ago here in Berkeley.

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[5] A term adopted from Horn (1996) and von Fintel (1997), originated in medieval times, meaning the asserted proposition precluding said adverb/adjective.

Question: Did Sally speak falsely?

The intuition is that the second case is closer to being a falsehood than the first. Sally seems more committed to the claim that John is in Boston in the second case, while her statement in the first case seems to only report a likelihood. Thus, the second case is more open to dissent than the first.

To these conversational examples I wish to add another – the 'reason to assert' test:

(12) Scenario: A reality show in which 15 participants are competing for the role of 'Israel's next top barista'. One of the participants got voted out, leaving 14.

Option A:
Spectator 1: It's possible that John will be Israel's next top barista.
Spectator2: Why do you say that?
Spectator1: Well, Shirley was just voted out.

Option B:
Spectator 1: John will possibly be Israel's next top barista.
Spectator2: Why do you say that?
Spectator1: #Well, Shirley was just voted out.

It seems that the fact that one participant was voted out is in itself not reason enough to assert the modal adverb possibility claim, which is puzzling if modal adverbs convey possibilities and nothing else.

2.3 Nilsen's Contrast

The following contrast is presented in Nilsen (2004):

(13) a. It's possible that Le Pen will win even though he certainly won't.

b. #Le Pen will possibly win even though he certainly won't.[6]

If modal adjectives and modal adverbs are grammatical variants of the same semantic meaning, i.e. if there is a single scale running from possibility to certainty and both modal adverbs and modal adjectives occupy it, then both sentences should be equally bad since a certainty that something won't happen means there is no possibility it will happen. However, since the conjunction of the modal adjective *possible* with the negated modal adverb *certainly not* is better than the conjunction of the modal adverb *possibly* with the same negated modal adverb as in the first example, this is clearly not the case.

The next section discusses theories that attempt to account for these data and problems with these theories.

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[6] Note that the difference is much stronger if the sentence is turned to the past: 'It was possible for Le Pen to win, even though he certainly didn't' vs. *'Le-Pen possibly won even though he certainly didn't'.

3   Previous Theories

3.1   Modality, the Classical Theory

As stated in the beginning of this paper, modal adverbs and modal adjectives are a subclass of epistemic modals. Hence, the classical theory of modality, Angelika Kratzer (inter alia 1977, 1981, 2012), is a good place to start. The classical theory provides a uniform account for all types of modality. This account treats all modals as truth-conditional quantifiers over possible worlds (cf. Hintikka, 1961; Kripke, 1963). Possibility modals are existential quantifiers and necessity modals are universal. The domain of quantification is determined by two contextually supplied conversational backgrounds, the *modal base* and the *ordering source*. A conversational background is a function from worlds to sets of propositions. Once conversational backgrounds are established, a set of propositions corresponding to these conversational backgrounds are defined. This set determines an accessibility relation from each possible world to a set of possible worlds which are the domain of quantification for the modal. For example, with regards to the epistemically modalized utterance:

(14) The dog might be on the lawn.

The established modal base is epistemic, hence the contextually determined set of propositions stand for what is known in the world in which the speaker uttered the sentence. These propositions can include, for example:

(15) a. The dog tends to be on the lawn.

b. The dog wasn't seen in the house.

c. The kids like to play with the dog.

d. The kids went outside.

Applying an intersection on this set results in a set of worlds in which all these propositions are true, and these are the epistemically accessible worlds which provide the domain of quantification. And, since the utterance contains a possibility epistemic modal, the utterance is true iff there is at least one possible world within the modal base in which the dog is on the lawn. But this is not enough. There are many possible worlds in which all the propositions of the modal base are true, some more feasible than others. For example a world in which dogs and kids have stable behavioral patterns is more likely than a world in which dogs and kids change tendencies regularly. Thus, there should be some way to represent the more likely worlds within the modal base[7]. Kratzer therefore employs a second conversational background, the *ordering source*, which imposes an ordering on the modal base, i.e. some worlds are better than others. In our example, the ordering source can be *stereotypical*, which means the set of propositions that

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[7] Of course, another important motivation for the dual conversational backgrounds is in order to account for cases of deontic modality, but this type of modality is not discussed here.

describe what is normally expected to happen in the world. These propositions can include, for example:

(16) a. Dogs have stable non-changing tendencies.

b. Kids have stable non-changing tendencies.

Formally, a possibility epistemically-modalized sentence is represented as:

(17) $w \in [| \Diamond \varphi |]f,g$ iff there is a $w' \in BESTg(w) (\cap f(w))$ s.t. $w' \in [| \varphi |]f,g$

In prose, an epistemic possibility is true in a world *w* with respect to a modal base *f* and an ordering source *g* if and only if there is an accessible world *w'* which is a member of the best epistemically accessible possible worlds of the modal base, in which φ is true[8]. And epistemic necessity is similarly represented, only the prejacent is true in every epistemically accessible best world.

For the purposes of the rest of the paper, the most important aspects of Kratzer's theory are its uniform nature, i.e. that all modals have the same logical form, and that all modals are truth conditional, i.e. part of the propositional content of utterances. These aspects, which are a clear advantage, can also be a disadvantage in the case of modal adverbs and adjectives, which do not seem to fit the classical template. The next subsections discuss attempts to account for the differences between modal adverb and modal adjectives.

3.2 Bellert (1977)

Bellert (1977) accounts for the differences between modal adverbs and modal adjectives in terms of different relations to the prejacent. Modal adverbs are predicates over the truth of the prejacent while modal adjectives are predicates over facts/events/state of affairs *within* the proposition. Thus, sentences with modal adjectives convey one proposition while utterances with modal adverbs convey two propositions – the prejacent and a metalinguistic proposition about the truth of the prejacent.

According to Bellert this is the reason why modal adjectives can be negated and participate in questions while modal adverbs cannot. Repeating (4):

(18) Is it $\left\{ \begin{array}{l} \text{possible} \\ \text{probable} \\ \text{certain} \end{array} \right\}$ that John has/will come?

(19) #Has/Will John $\left\{ \begin{array}{l} \text{possibly} \\ \text{probably} \\ \text{certainly} \end{array} \right\}$ come?

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[8] Assuming that there is always such a set, by adopting the limit assumption (Stalnaker 1968).

The pronoun *it* in (18) refers to the event of John's coming and the question is about the possibility/probability/certainty of this event occurring. It doesn't make sense to ask about the truth of a proposition and qualify this truth at the same time. By the same token, the next example is infelicitous since it isn't possible to qualify the truth of a negated proposition:

(20)
$$\left\{ \begin{array}{l} \text{\#Impossibly/Not possibly} \\ \text{\#Improbably/Not probably} \\ \text{\#Uncertainly/Not certainly} \end{array} \right\}, \text{John has/will come.}$$

As an indication for the existence of two propositions in the case of modal adverbs (the prejacent and a metalinguistic proposition about the truth of the prejacent), Bellert claims that it's possible to turn sentences with modal adverbs into two separate statements when the first of which, containing the adverb, is an explicit statement about the truth of the other, while this can't be done with modal adjectives:

(21) It is possibly/probably/certainly true that John has/will come.

(22) #The truth that John has come is possible/probable/certain.

Bellert's account has several problems, discussed in Piñón (2006, 2009). The first of which is that (23) is more acceptable than (21) even though both are sentences containing modal adjectives in which there are two statements, the first of which is a statement about the truth of the other:

(23) It is a possible/probable/certain truth that John has come.

The second is a problem about Bellert's requirement that adverbs modify the *truth* of a proposition while modal adjectives modify the facts/events/state of affairs *within* the proposition (cf. Bellert (1977: 343). However, (24) is still not an acceptable sentence:

(24) #The fact/event/state of affairs that John has come is probable/possible/certain.

3.3 Nilsen (2004)

Nilsen (2004) notes that modal adverbs are barred from the same linguistic environments that Negative Polarity Items (NPI) such as *yet*, *ever*, and *any* are acceptable in, i.e. downward entailing (DE)[9]. This holds for the previously discussed examples in the section on embedding. Negation is, of course, DE. So are antecedents of conditionals (cf. Kadmon & Landman, 1993; Linebarger, 1987), questions (cf. van Rooy, 2003) and factive presuppositions (Kadmon and Landman 1993).

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[9] A linguistic environment is DE when it reverses the semantic strength relation between expressions that are placed in it. For example, negation is DE because the semantic relation between the expressions 'The dog barked' and 'The dog barked loudly' (the latter is semantically stronger than the former since it entails the former) is reversed under negation – 'The dog didn't bark' entails 'The dog didn't bark loudly'.

Nilsen provides another example for a DE operator that can embed modal adjectives but not modal adverbs, *never*:

(25) a. #Stanley never possibly/probably/certainly ate his Wheaties.

b. It was never possible/probable/certain that Stanley ate his Wheaties.

Following these data, Nilsen posits that modal adverbs are in complementary distribution with NPI and are thus Positive Polarity Items (PPI). Nilsen explains the differences between modal adverbs and modal adjectives in terms of levels of plausibility (cf. Chierchia, 2004), i.e. the degree by which a proposition *p* is accepted in an information state. In the case of *certainly* and *possible* these levels are:

(26) $[|certainly|] = \lambda p.\ f(p) \geq high$

(27) $[|possible|] = \lambda p.\ f(p) \geq low$ (Nilsen, 2004:830-831)

When *f* stands for an entrenchment function (cf. van Rooy, 2006) that provides the degree of plausibility of a proposition and *high* and *low* stand for a contextually-determined numerical value. As a constraint on these degrees, if the plausibility degree of a proposition is *low* then the plausibility degree of its negation is *high* and vice versa. Let's take a moment to dwell on this constraint since it will be important later on. Say that the scale of degrees runs from 0 to 1, and that the degree of *low* is 0.1 and *high* is 0.9. Then the constraint on plausibility states that if a person has a *low* belief (i.e. 0.1) that a proposition *p* is true, he has a *high* belief (i.e. 0.9) that *p* is false, which is consistent.

Modal adverbs are PPI, therefore the domain upon which *possibly* is defined shrinks, which in turn strengthens the degree of plausibility:

(28) $[|possibly|] = \lambda p.\ f(p) > low$

Thus, Nilsen accounts for the contrast in (13), repeated here:

(29) It's possible that Le Pen will win even though he certainly won't.

(30) #Le Pen will possibly win even though he certainly won't.

(29) constitutes an assertion that Le Pen will win with a plausibility of equal to or greater than *low* and Le Pen will not win with a plausibility of equal to or greater than *high*. This is consistent due to the abovementioned constraint that if the plausibility of a proposition in an information state is *low* then the plausibility of its negation in the same information state is *high*. (30) on the other hand, is inconsistent, since it constitutes an assertion that Le Pen will win with a plausibility of *strictly* greater than *low* and Le Pen will not win with a plausibility of equal to or greater than *high*.

Nilsen's account has several problems. First, in his account of *certainly* modal adverbs should be stronger than modal adjectives. Thus the degree of *certainly* in Nilsen should not be as stated in (26) repeated here as (31), but as (32):

(31) $[|certainly|] = \lambda p.\ f(p) \geq high$

(32) [|*certainly*|] = λp. *f*(p) > *high*[10]

However, this does not account for Nilsen's contrast. Recall the constraint on degrees of plausibility - if the plausibility degree of a proposition is *low* then the plausibility degree of its negation is *high* and vice versa. However, using the same abovementioned numerical degrees, now it turns out that the representation of (29) is that Le Pen will win with a plausibility of equal to or greater than *0.1* and Le Pen will not win with a plausibility of strictly greater than *0.9*, which is inconsistent.

The second problem is that Nilsen's account crucially depends on the claim that modal adverbs are semantically stronger than the corresponding modal adjectives. This claim is challenged in Piñón (2006, 2009):

(33) a. It's possible that the socialists won. Indeed, it's even certain that they won.

b. The socialists possibly won. Indeed, they even certainly won.

c. It's possible that the socialists won. Indeed, they even certainly won.

d. #It's possible that the socialists won. Indeed, they even possibly won.

e. #It's certain that the socialists won. Indeed, they even certainly won.

The above sentences all have two parts, when the second part in each sentence is marked for greater semantic strength by the *indeed...even* phrase. According to Nilsen's account, all the above sentences, including the ones that contain a pair of a modal adjective and the corresponding modal adverb, should be felicitous since the latter are stronger than the former. This is clearly not the case.

A similar argument is found in Ernst (2009):

(34) a. She didn't buy a book at Borders—I'd go so far as to say she didn't buy any book (at Borders).

b. (With her income,) She wouldn't buy a car, wouldn't buy a bicycle—I'd go so far as to say she wouldn't even buy a little plastic scooter.

c. For her vacation, it's possible that she'd go to Albany, more possible that she'd go to Boston—and I'd go so far as to say that she'd possibly go to Paris.

Ernst's claim is slightly different than Piñón's. The contrast is not between felicitous and infelicitous utterances, but rather between the first two utterances which exhibit a strengthening pattern and the last utterance which does not. This lack of strengthening indicates that modal adverbs are not semantically stronger than modal adjectives.

The third problem is empirical. Nilsen expects the upward entailing *often* and *always* to allow modal adverbs within their scope, and the downward entailing *rarely* and *never* to block them. He provides the following examples (Nilsen's [15] and [16]) to attest to that:

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[10] Or, more plausibly, ≥ *very-high*.

(35) a. His retaliations killed or endangered innocents and often possibly had little effect in locating terrorists.

   b. ??His retaliations killed or endangered innocents and rarely possibly had an effect in locating terrorists.

(36) a. This is a fun, free game where you're always possibly a click away from winning $1000!

   b. ??This is a fun, free game where you're never possibly further than a click away from winning $1000!

However, performing a simple *Google* search turns out the following results:

(37) a. "*often possibly*" = 292,000

   b. "*always possibly*" = 172,000

   c. "*rarely possibly*" = 25,900

   d. "*never possibly*" = 803,000

While *often possibly* is more frequent than *always possibly*, the pattern is the opposite for *always possibly* and *never possibly*, which means we can't draw definite empirical conclusions which is not a good sign for Nilsen's account. The following are online examples with the DE operators outscoping the modal adverb:

(38) a. "The *fungus* forms an underground sphere, an ascocarp that breaks the surface to form a crown-shaped cup, pale on the inside with a roughly hairy dark brown outside layer. The cups are 5-7 cm across and up to 5cm tall. Like most cup fungi the flesh is brittle. It is a vernal species associated with cedar trees and very *rarely possibly* with yew."[11]

   b. "I can never possibly express my gratitude, so let me say simply, thank you. Sincerely, Hillary Rodham Clinton."[12]

It's important to note, though, that other factors may affect the acceptability of modal adverbs under DE operators, for example if these operators are in turn also embedded under an operator such as the modal *can*. This issue is not explored here.

3.4 Ernst (2009)

Ernst's account agrees with the basic idea in Nilsen (2004) i.e. that modal adverbs (as a subset of *speaker oriented adverbs*) are positive polarity items. However, it differs with regards to the

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[11] Retrieved from:
http://www.wbrc.org.uk/WORCRECD/32/Westwood_Brett_Bingham_John--Two_uncommo.html

[12] Retrieved from:
http://www.theatlantic.com/politics/archive/2008/06/clintons-e-mail-to-supporters/53423/

formal treatment of polarity. Adopting Giannakidou (1999) (non)veridicality approach, Ernst claims that modal adverbs, and PPI in general, encode the speaker's commitment to the truth of the asserted proposition as part of their lexical meaning. While the goals of Ernst's paper are less to account for the differences between modal adverbs and modal adjectives, and more to account for the relative order of different speaker oriented adverbs and their relation to negation, it raises points which are important to discuss.

Ernst explains the embedding data, i.e. the reason why modal adverbs are bad under negation, conditionals and questions, by the following licensing conditions:

(39) a. A positive *polarity* item A is blocked in the local scope of a nonveridical operator.
b. In certain cases, A may be licensed indirectly despite being in the local scope of a nonveridical operator in a sentence S, iff S gives rise to a positive implicature φ.

Nonveridicality is formally defined in the following manner:

(40) Let c = <cg(c),W(c),M, s, h,w_o, f, . . .> be a context.

(i) A propositional operator *Op* is *veridical* if it holds that: $[Op\ p]_c = 1 \rightarrow [p]=1$ in some epistemic model M*(x)* ∈ c; otherwise *Op* is nonveridical.

(ii) A nonveridical operator *Op* is antiveridical iff it holds that: $[Op\ p]_c = 1 \rightarrow [p] = 0$ in some epistemic model M*(x)* ∈ c.

In prose, an operator is veridical if, when combined with a proposition this combination yields *truth* in some epistemic model (i.e. the beliefs of the speaker), otherwise nonveridical. An operator is antiveridical if, when combined with a proposition this combination yields *falsehood* in an epistemic model. Thus, according to these definitions, negation is both nonveridical and antiveridical. Conditionals are therefore nonveridical since if a conditional is true the antecedent or consequent don't have to be, and questions are nonveridical since questioning a proposition *p* does not entail ¬*p*. Thus the embedding facts are explained.

Another good point raised in the paper, which is related to the discussion in chapter 3, is the subjective-objective distinction. As recalled, Ernst's claim is that modal adverbs encode the speaker's commitment to the truth of the asserted proposition. An important aspect of this commitment is the property of *subjectivity*. Ernst follows Lyons (1977) Nuyts (2001) and Papafragou (2006) among others and claims that epistemic modal adverbs (and epistemic modals in general) can be used either subjectively or objectively. However there is a tendency:

> *"epistemic modal adverbs like possibly, as well as modals such as may/might, tend to be subjective, while the corresponding adjectives and nouns are objective." (Ernst, 2009: 522)*

While I'm in agreement with most of the points raised in Ernst (2009), the veridicality approach to speaker oriented adverbs is at times too strong and at other times too weak. Too strong, because of the requirement for nonveridical operators to block speaker oriented adverbs. Actually there are nonveridical operators that allow modal adverbs – for example *can't* and

might. As recalled, a nonveridical operator is an operator that if its combination with a proposition yields *truth*, then the bare proposition is not necessarily true. This is the case with both *can't* and *might*, since if the dog can't - or might - be on the lawn it's not necessarily true that the dog is on the lawn. Combined with *possibly:*

(41) a. The dog can't possibly be on the lawn.

    b. The dog might possibly be on the lawn.

The account is too weak because it does not account for the fact that some operators are veridical yet block modal adverbs. For example, *certain* and *certainly* which are veridical (if it is true that it is certain (/certainly) that the dog is on the lawn, then it's true that the dog is on the lawn). Combined with *possibly*:

(42) a. #Certainly, the dog is possibly on the lawn.

    b. #It is certain that the dog is possibly on the lawn.

3.5 Piñón (2006, 2009)

Piñón (2006) offers an analysis in which modal adjectives modify propositional content while modal adverbs modify assertions. As initial evidence for the assertion-modification aspect of modal adverbs, Piñón mentions their ability to replace affirmative answers to yes/no questions:

(43) Did the socialists win the elections?

    a. Yes.

    b. Possibly/Probably/Certainly.

    c. ?It's possible/#It's probable/#It's certain.

The naturalness of using modal adverbs without any other sentential material, as opposed to modal adjectives, suggests that modal adverbs have a component of assertive force that modal adjectives lack. As for the manner by which modal adverbs modify assertions, Piñón draws from illocutionary logic (cf. Searle & Vanderveken, 1985; Vanderveken, 1990, 1991) and proposes that modal adverbs modify the *sincerity condition* of assertions, i.e. how sincere the speaker is in terms of believing in the propositional content she asserts. Formally:

(44) a. Ax (p) 'x asserts p'
    b. sincerity(p, p', x, A) 'p is a sincerity condition of an assertion by x of p' '

Thus, the representation of standard non-modalized assertions is:

(45) assert $\leadsto \lambda$p [A$_x$(p) $\wedge$ sincerity ($\exists d$ [believe (d, x, p) $\wedge d \geq$ high], p,x,A)

When x is the person who performs the assertion, p is the asserted proposition, and d is the degree of belief of x in p. The following is an example of an assertion and its representation:

(46) a. John: The socialists will win.
   b. s-w: the-socialists-will-win

   assert(s-w) ~> A*$_{John}$*(s-w) $\wedge$ sincerity ($\exists d$ [believe (d, *John,* s-w) $\wedge$ $d \geq$ high],
   s-w, *John ,A*)

The formula states that John asserts the proposition 'the socialists will win', with a sincerity condition that has a degree of belief which is equal to or greater than *high*, when *high* stands for some numerical value and is assumed to be the default degree of belief for assertion. Modal adverbs modify assertions:

(47) a. John: The socialists will possibly win.
   b. s-w: the-socialists-will-win

   possibly(s-w) ~> A*$_{John}$*(s-w) $\wedge$ sincerity ($\exists d$ [believe (d, *John* , s-w) $\wedge$ $d \geq$low],
   s-w, *John ,A*)

The formula states that John weakly asserts (see ahead) the proposition 'the socialists will win', with a sincerity condition that has a degree of belief which is equal to or greater than *low*. Note that the modal adverb directly modify the speech act, i.e. instead of *assert*(p) there is *possibly*(p)[13], so we are not dealing with a full assertion but some weaker for of one. The second thing to note is that the modal adverb is not part of the propositional content, i.e. the proposition that the speaker (weakly) asserts is the same proposition that is asserted in the case of the standard non-modalized utterance. Thus the only difference between standard assertions and modal adverb assertions lie in the degree of belief of the speaker. For standard assertions it is *high*, for possibility modal adverbs it is *low*, for necessity modal adverbs (i.e. *certainly*) it is *very high*. Piñón doesn't state the degree for *probably* but we can reasonably assume some degree between 0 and 1, i.e. above 0.5 (cf. Lassiter, 2011; Yalcin, 2010)[14].

The difference between modal adverbs and modal adjective is represented at the content level:

(48) a. John: It's possible that the socialists will win.
   b. s-w: the-socialists-will-win

   assert(It's possible *that* the socialists will win) ~>

   A*$_{John}$*($\lozenge$ s-w) $\wedge$ sincerity ($\exists d$ [believe (d, *John* , $\lozenge$ s-w) $\wedge$ $d \geq$ high], $\lozenge$s-w, *John ,A*)

The formula states that John asserts the proposition 'it is possible that the socialists will win', with a sincerity condition that has a degree of belief which is equal to or greater than *high*. Note

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[13] It is not clear whether Piñón considers this modification to be an assertion or a different type of speech act.

[14] Both Lassiter (2011) and Yalcin (2010) provide a parallel account of *probable* and *probably*, without addressing the differences between the modal adverb and the modal adjective.

that the modal adjective *is* part of the propositional content, i.e. the proposition that the speaker (fully) asserts is different from the one asserted using the corresponding modal adverb. Piñón (2006) accounts for Nilsen's contrast in the following manner:

(49) a. It's possible that the socialists will win the elections, even though they certainly won't.

b. Ax($\lozenge$s-w) $\wedge$ sincerity ($\exists d$ [believe(d,x, $\lozenge$s-w)$\wedge$ $d$$\geq$ high], $\lozenge$s-w,x,A) $\wedge$

Ax($\neg$ s-w) $\wedge$ sincerity ($\exists d$ [believe(d,x, $\neg$s-w)$\wedge$ $d$$\geq$ very-high], $\neg$ s-w,x,A)

(50) a. #The socialists will possibly win the elections, even though they certainly won't.

b. Ax(s-w) $\wedge$ sincerity ($\exists d$ [believe(d,x,s-w)$\wedge$ $d$$\geq$ low], s-w,x,A) $\wedge$

Ax($\neg$ s-w) $\wedge$ sincerity ($\exists d$ [believe(d,x, $\neg$ s-w)$\wedge$ $d$$\geq$ very-high], $\neg$ s-w,x,A)

The formula in (49) states that the speaker asserts the proposition *it's possible that the socialists will win*, with the degree of belief, 'greater than high', and asserts the proposition *the socialists will not win*, with the degree of belief 'greater than very high'. Since the first conjunct's propositional content refers to the existence of a possible world where the socialists win, and the second conjunct's content is that in the actual world the socialists do not win, there is no contradiction between the two propositional contents, and the sentence is felicitous.

The formula in (50) states that the speaker asserts the proposition *the socialists will win*, with a degree of belief 'greater than low', and asserts the proposition *the socialists will not win*, with a degree of belief 'greater than very high'. This results in a clash between a proposition and its negation. The speaker cannot be considered to be sincere if she asserts both a proposition and its negation. Thus, the corresponding sentence is infelicitous.

I believe Piñón's account is on the right track and provides an elegant explanation for the differences between modal adjectives and modal adverbs. However, it does little to account for their similarities. Consider (47) and (48) again, in which possibility is expressed in completely different manners. In the former, possibility is expressed by a modal operator, while in the latter it is expressed by a degree of belief. Yet, surely, it is a very similar notion in both, as evidenced by the same lexical root, shared by *possible* and *possibly*. Thus, Piñón's theory leaves a very fundamental morphological fact completely coincidental. Hence, there is a need for a theory that maintains Piñón's insight while also preserving the big advantage of the classical account, i.e. the ability to provide a unified formal explanation for modality rather than split epistemic modality into two different lexical items.

4   Modal Adverbs as Negotiation Chips

The account proposed in this paper is that modal adverbs are 'negotiation chips' – discourse items that affect the likelihood that an utterance will be accepted by other conversational participants and updated into the common ground. The manner by which modal adverbs achieve this goal is modifying the sincerity condition of assertion by expressing the speaker's degree of belief in the asserted proposition.

4.1   Modal Adverbs are Expressive

An important feature of the proposed account is that modal adverbs are expressed rather than propositionally proposed, i.e. they belong to a dimension of meaning separated from the one usually dealt with by truth-conditional formal semantics. There are two different modes of expression, termed descriptive vs. expressive (Kaplan 1999; Potts 2007) at-issue content vs. conventional implicature content (Potts 2005) or truth-conditional vs. use-conditional (Gutzmann 2012; Recanati 2006).

Expressives have six properties, discussed in Potts (2007). All six are manifested in modal adverbs as opposed to modal adjectives, as will be shown ahead. The properties are (Potts, 2007: 166):

A. **Independence**: Expressive content contributes a dimension of meaning that is separate from the regular descriptive content.
B. **Nondisplaceability**: Expressives predicate something of the utterance situation.
C. **Perspective dependence**: Expressive content is evaluated from a particular perspective. In general, the perspective is the speaker's, but there can be deviations if conditions are right.
D. **Descriptive ineffability**: Speakers are never fully satisfied when they paraphrase expressive content using descriptive, i.e., nonexpressive, terms.
E. **Immediacy**: Like performatives, expressives achieve their intended act simply by being uttered; they do not offer content so much as inflict it.
F. **Repeatability**: If a speaker repeatedly uses an expressive item, the effect is generally one of strengthening the emotive content, rather than one of redundancy.

A. Independence

The first property of expressives is the most basic one, from which all the other properties are derived. Expressive meaning resides in a dimension separate from regular truth conditional meaning (but cf. Gutzmann (2012) on mixed expressive-descriptive expressions which contribute both truth-conditional and expressive content). Thus, assertions containing expressive content such as (51) operate on two levels – the descriptive truth-conditional level in which the propositional content is the prejacent of the epithet 'that bastard', and the expressive non-truth-conditional level in which the expressive content is the negative stance expressed by the speaker towards Kresge (Potts, 2007: 168):

(51) That bastard Kresge is famous.
     Descriptive: Kresge is famous.
     Expressive: Negative stance - Kresge is a {bastard/bad in the speaker's opinion}.

As a result of this separation if the hearer agrees with (51), this agreement is perceived as targeting solely the descriptive content. In other words, this type of agreement incurs no commitment for an expression of a negative stance towards Kresge by the hearer. This example brings to mind Papafragou's (2006) *assent/dissent* diagnostic (cf. section 2.2). And indeed, the next examples show that modal adverbs pattern with expressives since it is felicitous for the

hearer to assent to or dissent from the speaker's assertion without assenting to or dissenting from the modal adverb, while this is not the case when modal adjectives are involved:

(52) Sue: John will probably be the next chairman.
  Dave(a): That's true/I agree, he will be.
  Dave(b): That's not true, he won't!
  Dave(c): #That's true/I agree but he won't be the next chairman.

(53) Sue: It's probable that John will be the next chairman.
  Dave(a): #That's true/I agree, he will be.
  Dave(b): #That's not true, he won't!
  Dave(c): That's true/I agree but he won't be the next chairman.

B. Nondisplaceability

Expressives can't be displaced from their immediate linguistic environment (thus, this property is connected to *immediacy*). This is due to the fleeting temporal nature of emotive expression as opposed to descriptive statements. Therefore, trying to linguistically displace expressives using modals, conditionals or reports of past events, is bound to fail, i.e. leads to infelicity.
Potts' examples (2007: 170):

(54) a. That bastard Kresge isn't late for work. (#He's a good guy.)

  b. It's just false that that bastard Kresge is late for work. (#He's a good guy.)

  c. #If that bastard Kresge arrives on time, he should be fired for being so mean.

  d. Maybe that bastard Kresge will be late again. (#Then again, maybe he's not a bastard.)

Applying similar examples to modal adverbs and adjectives, shows that while modal adjectives can be displaced, there are cases in which modal adverbs exhibit an even stronger resistance to displaceability than the expressives in the previous example. This is in line with Potts' claim:

For some classes of lexical item, nondisplaceability is so strong that even syntactic embedding is impossible (Potts 2007: 169).

(55) a. #John won't probably be the next chairman.[15] (#He will possibly be the next chairman.)

  b. It's just false that John will probably be the next chairman. (?He will possibly be the next chairman.)

  c. It's just false that it is probable that John will be the next chairman. (It is possible).

  d. #If John will probably be the next chairman, I will be nice to him.

---

[15] Stressing the modal adverb brings it from not-at-issueness to at-issueness and turns the utterance felicitous. The intended reading is unstressed.

    e. If it's probable that John will be the next chairman, I will be nice to him.

    f. #Maybe John will probably be the next chairman. (#Then again, maybe only possibly.)

    g. Maybe it's probable that John will be the next chairman. (Then again, maybe it's only possible.)

C. Perspective dependence

Under default conditions, expressives are bound to the perspective of the speaker. Thus, it is infelicitous to follow an assertion containing expressives with a remark that the speaker doesn't share the point of view expressed:

(56) a. #That bastard Kresge is famous, but I personally think that he's a good guy.

    b. #John will probably be the next chairman, but I personally think that he won't.

    c. It's probable that John will be the next chairman, but I personally think that he won't.

D. Descriptive ineffability

Native speakers find it very difficult to translate expressive terms into descriptive ones, for example trying to explain what 'damn' means in words is pretty hard. Gutzmann (2012) states that the theoretical status of descriptive ineffability as a property of expressive content is not sound. It has been criticized by Geurts (2007) since descriptive ineffability can be found all over the lexicon, thus not unique to expressives. That being said, it is probably not a coincidence that the meaning of modal adjectives is not under dispute in the literature while the meaning of modal adverbs is, i.e. it's a result of the difficulty characterizing modal adverbs in descriptive theoretical terms.

E. Immediacy

Expressives have immediate effect and are thus bound to the utterance situation:

(57) a. That bastard Kresge was late for work yesterday (= the speaker believes *today* that Kreske is a bastard) #but he's no bastard today, because today he was on time.

      Potts (2007: 180)

    b. John was possibly late yesterday (= the speaker believes *today* that John was possibly late yesterday) #but today we found out that he had actually come on time but had forgotten to punch in his work card.

    c. It was possible that John was late yesterday (= the speaker believed *yesterday* that there was a possibility John was late) but today we found out that he had actually come on time but had forgotten to punch in his work card.

F. Repeatability

Repeatability: If a speaker repeatedly uses an expressive item, the effect is generally one of strengthening the emotive content, rather than one of redundancy (Potts (2007: 182):

(58) a. Damn, I left my keys in the car.

    b. Damn, I left my damn keys in the car.

    c. Damn, I left my damn keys in the damn car.

It is hard to repeat a modal adverb many times in the same sentence. However, stacking different lexical items that share the same modal meaning is possible, and in this case the effect is indeed strengthening: this should not be the case if modals behave compositionality since stacking possibility modals results in a remote possibility[16] which results in a weakened effect rather than a strengthene one:

(59) a. The dog is possibly on the lawn.

    b. Maybe the dog is possibly on the lawn.

    c. Maybe the dog might possibly be on the lawn.

Modal adjectives, on the other hand, can be stacked, and the effect is compositional:

(60) a. It's possible that the dog is on the lawn.

    b. It's possible that it's possible the dog is on the lawn.

    c. It's possible that it's possible that it's possible that the dog is on the lawn.

The next section discusses the formal account of modal adverbs as 'negotiation chips', i.e. modifiers of the degree of strength of assertion. Treating assertion as a speech act with different levels of meaning bears similarities to Potts' (2007) account of the expressive dimension and Gutzmann's (2012) account of use-conditional meaning. It might be possible in principle to treat all epistemic modals as expressives (with varying degrees of expressiveness) and to have a formal account along the lines of Potts and Gutzmann, but as the theories stand at this point it's unclear how to do so. Furthermore, the formal account presented ahead is suitable to show both the differences between modal adverbs and modal adjectives and their similarities.

4.2 Formal Account

The account proposed here is based on Wolf (2014), in which a new theory of conversation is put forth. This theory minimally modifies Stalnaker's (1978) system such that in addition to the common ground, the conversational context registers assertions which were previously performed and are currently under negotiation. Each of these assertions is an expression of an information state (represented in probabilistic terms) of some conversational participant with regards to a proposition. It is represented by the following assertion operator:

(61) $A_x <S,C>$

---

[16] $\Diamond\varphi$ stands for 'there is a possibility that φ' while $\Diamond\Diamond\varphi$ stands for 'there is a possibility that there is a possibility that φ' etc.

In prose, the speaker *x* asserts propositional content *C* with a degree of strength *S*. The assertion operator itself is represented by the following probability function:

(62) Ax P(φ) = v

In prose, *P* is the probability function which yields some probability value *v* when applied to the propositional content φ. This value is defined on the speaker's information state i.e. the probability space of the speaker *x* and stands for the degree of belief of *x* in φ, which is the degree of strength for the sincerity condition of assertion. This degree of strength serves as *the* degree of strength *S* of the assertion.

While an assertion is under *negotiation*, i.e. from the moment the assertion is performed and until it is accepted or rejected by conversational participants, it resides in the *Negotiation Zone* (NZ). The NZ is a set of assertion operators pertaining to various propositions. The manner by which conversational participants decide whether to accept or reject assertions is through an activation of a *mixture model*:

$$P(\varphi) = \sum_{i=1}^{n} w_i P_i(\varphi)$$
(63)

If the value of the mixture model surpasses some contextual threshold of acceptance, by assumption *high*, then the assertion is accepted and φ is updated into the common ground, i.e. the probability value assigned to φ becomes 1, and all information states in which the probability of φ is less than 1 are removed from the common ground.

The difference between the standard Stalnakerian context update and the probabilistic context update proposed here, is as follows – figure 1 depicts a standard context update in which proposition φ is added to the common ground thereby intersecting with the initial context set:
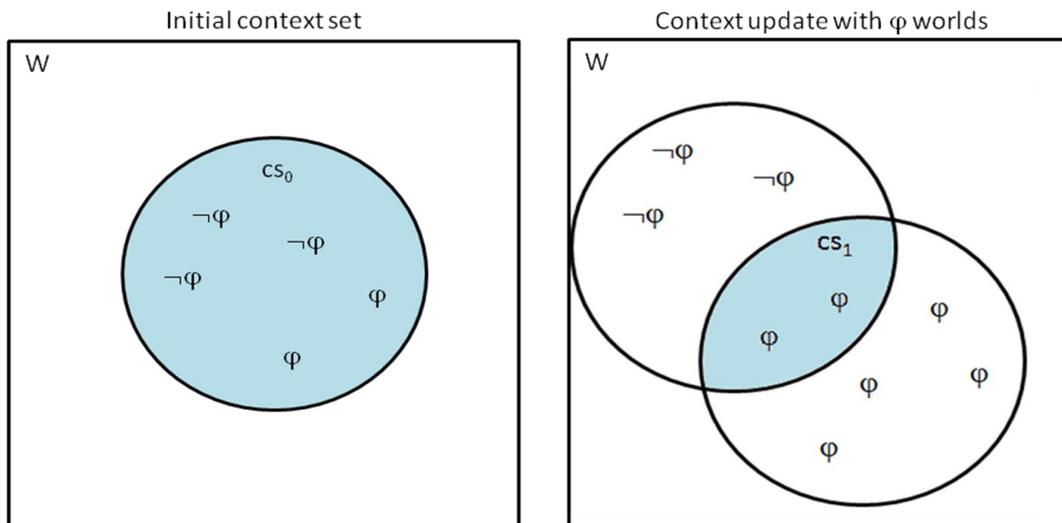

Figure 1: Stalnakerian context update

The figure on the left depicts the initial context set as a set of worlds. Since nothing is known about φ, some of the worlds in the context set φ worlds and others are ¬φ worlds. The figure on

the right depicts the new state of discourse once φ is accepted into the common ground – the proposition φ, which is the set of φ worlds, is intersected with the initial context set to yield the new one.

The initial context set in this paper is richer - it is composed of probability spaces, hence a more accurate representation of the initial probabilistic context set is:
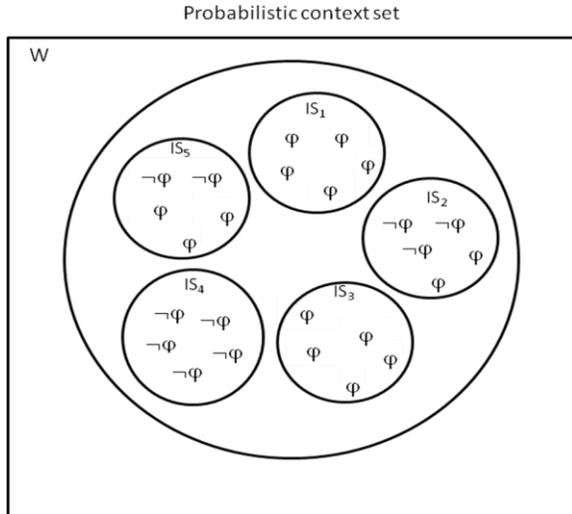

Figure 2: Probabilistic context set

As can be seen, the probabilistic context set contains probability spaces rather than possible worlds, when each probability space is an information state *IS*.

Thus, when a speaker asserts a standard non-modified assertion the representation is:

(64) The dog is on the lawn
A_x P (on-the-lawn(the-dog)) $\geq$ high

In prose, the speaker asserts the propositional content 'the dog is on the lawn' with a degree of strength which is equal to or greater than *high*.

If this assertion is accepted and updated, this assertion's Context Update Effect (henceforth CUE) will be removing all information states except from IS_1 and IS_3 from the context set, since those are the information states in which the propositional content has a probability of 1.

Now for an assertion containing the modal adjective *possible*:

(65) It's possible that the dog is on the lawn.
A_x P (P(on-the-lawn(the-dog)) > 0) $\geq$ high

The speaker asserts the propositional content 'it's possible that the dog is on the lawn', represented in probabilistic terms, i.e. 'the probability that the dog is on the lawn is greater than 0', with a degree of strength which is equal to or greater than *high*. Note that the degree of strength for a modal adjective-modified assertion is the same as the degree of strength for non-modified assertion, thus the chances of this assertion to be accepted by the hearer(s), everything else being equal, are the same as the chances of any non-modified assertion. Also note that the type of modal adjective does not affect the degree of strength but only the propositional content. If this assertion is accepted and updated, this assertion's CUE will be removing IS_4 from the

context set, since this is the only information state in which the propositional content has a probability of 0.

The following are representations of the other modal adjectives-modified utterances:

(66) It's probable that the dog is on the lawn.
A_x P (P(on-the-lawn(the-dog)) > 0.5) ≥ high

(67) It's certain that the dog is on the lawn.
A_x P (P(on-the-lawn(the-dog)) = 1) ≥ high

As discussed previously, I assume, following Yalcin (2010) and Lassiter (2011), that the degree assigned to *probable* is greater than 0.5. I also assume that the degree assigned to *certain* is the same as the degree assigned to necessity modals, i.e. 1 which corresponds to full certainty. The CUE of (66) is to remove all information states except from IS_1, IS_3, and IS_5 from the context set, and the CUE of (67) is to remove all information states except from IS_1, and IS_3 from the context set. Note that the CUE of (67) and (64) is the same, but the conversational impact is different. In (64) the speaker proposes to make the propositional content common ground, and in (67) the speaker claims that this propositional content is already common ground. Also note the entailment patterns – the stronger claims (67) and (64) illocutionary entail the weaker ones (66) and (65) since the CUE of the former is a subset of the CUE of the latter.

The representations of modal adverbs' modified assertions are:

(68) The dog is possibly on the lawn.
A_x P (on-the-lawn(the-dog)) > 0

(69) The dog is probably on the lawn.
A_x P (on-the-lawn(the-dog)) > 0.5

(70) The dog is certainly on the lawn.
A_x P (on-the-lawn(the-dog)) = 1

The formulas state that the speaker asserts the propositional content 'the dog is on the lawn' with the degrees of strength equal to or greater than 0 (for *possibly*), to 0.5 (for *probably)* and equal to 1 (for *certainly*). Note the difference between modal adjectives and modal adverbs – the former modify the propositional content while the latter modify the degree of assertion. Note the similarity between modal adjectives and modal adverbs – both are represented by the same degrees of probability, since the lexical root of both is the same. The difference is a matter of scope – modal adverbs modify the whole speech act and therefore scope over the propositional content, and modal adjectives modify the propositional content and therefore have narrow scope.

There are differences in terms of conversational effects as well. If accepted, the CUE of all of the modal adverbs-modified assertions is the same as the CUE of non-modalized assertions, i.e. removing all information states except from IS_1, and IS_3 from the context set. However, asserting a modal adverbs-modified utternce without the coresponding degree of belief is insincere. Thus, only IS_1, and IS_3 can sincerely assert (70), only only IS_1, IS_3 and IS_5 can sincerely assert (69) and only IS_1, IS_3, IS_5 and IS_2 can sincerely assert (68).

4.3   Explaining the Data

Embeddings:

Modal adverbs are speech-act modifiers, and as such operate on a realm beyond the propositional one dealt with in standard semantic theories. In Wittgensteinian terms, they are not part of the utterance *radical.* Thus, following the classical literature on speech acts, it is not surprising that these instances of speech act modification do not interact with truth-conditional propositional material. As Lewis (1970) puts it:

> *"...the entire apparatus of referential semantics ...pertains to sentence radicals and constituents thereof. The semantics of mood is something entirely different."*

Or recently, in Potts (2005: 42):

> *"CIs [conventional implicatures] never appear in the scope of other operators. This imparts the sense that they always have widest scope. But, as with the indexicals of Kaplan (1989), it seems more accurate to think of them as scopeless."*

The account proposed in this paper as well as the data show that in some cases an interaction between modal adverbs and propositional operators such as negation is not possible, but when this interaction is possible modal adverbs have wide scope. Accordingly, in terms of the formal account, modal adverbs have wide scope over the propositional content and can't be embedded under propositional modifiers.

However, it should be noted that in some cases (cf. Krifka 2001) speech act modifiers *can be* embeddable. Thus, the claim in this paper is not that modal adverbs are entirely non-embeddable, but that they are as hard to embed as other speech act modifiers.

Consequents of conditionals:

While modal adverbs are hard to embed under antecedents of conditionals, they are ok in consequents. Repeating (6):

(71) If the socialists win the elections, the rich will $\begin{Bmatrix} \text{possibly} \\ \text{probably} \\ \text{certainly} \end{Bmatrix}$ worry about a luxury tax.

In order to account for that, I adopt Cohen's (2010) theory of conditionals as illocutionary operators, in which conditionals modify the strength of the sincerity condition of the speech act. I.e. when a speaker asserts the conditional $\varphi > \psi$, she asserts ψ with a sincerity condition that the belief in the conditional probability $P(\psi \mid \varphi)$ is *high*.

(71) can be represented in terms of the assertion operator, but since the first part of the assertion operator i.e. the asserted content is different from the second part of the assertion operator i.e. the degree of strength, we need to drop the shorthand used so far and return to the original formulation of the assertion operator:

(72) $A_x <S,C>$

First, a representation of a standard non-modified conditional:

(73) If the socialists win the elections the rich will worry about a luxury tax.
$A_x < P$ (worry(the-rich) | win(the-socialists)) $\geq$ high, worry(the-rich) >

Now, a representation of the conditional consequent modified by a modal adverb:

(74) If the socialists win the elections the rich will possibly worry about a luxury tax.
$A_x < P$ (worry(the-rich) | win(the-socialists)) > 0 , worry(the-rich) >

The formula states that the speaker asserts the propositional content 'the rich will worry about a luxury tax' with the degree of belief that the probability that the rich will worry about the luxury tax given that the socialists win is low, specifically equal to or greater than 0.

According to this account, a modal adverb can't modify the antecedent of a conditional since the antecedent is itself a speech-act modifier, hence there is a type clash. Modal adverbs can, however, modify the consequent since unlike the antecedent, the consequent is the asserted proposition.

Agreements and disagreements:

Agreements and disagreements concern the asserted propositional content and not the expressive degree of strength of this assertion. Therefore, agreements and disagreements target the prejacent of modal adverb assertions while they target the entire modalized utterance when modal adjectives are concerned.

Nilsen's contrast:

Repeating the examples in (13):

(75) It's possible that Le Pen will win even though he certainly won't.

(76) #Le Pen will possibly win even though he certainly won't.

These examples are represented in the following manner respectively:

(77) Ax P (P(win(Le-Pen))> 0) $\geq$ high $\wedge$ Ax P ($\neg$win(Le-Pen)) $= 1$

(78) Ax P(win(Le-Pen)) $> 0 \wedge$ A_x P ($\neg$win(Le-Pen)) $= 1$

The difference between the two assertions stems from the interplay between modification of the propositional content and modification of the speech act. In (75) the speaker asserts the propositional content 'it's possible that Le Pen will win' with the default degree of assertion *high*, and asserts the propositional content 'Le Pen will not win' with the degree of assertion 1 which corresponds to certainty. In (76) the speaker asserts the propositional content 'Le Pen will win' with the default degree of assertion *high*, and asserts the propositional content 'Le Pen will not win' with the degree of assertion 1 which corresponds to certainty.

The intuition to explain is that (75) is not perfect but still acceptable while (76) is downright infelicitous. The reason for the infelicity of the latter is that it is unassertable, i.e. the speaker can't sincerely assert a proposition with a degree of belief of greater than 0 and its negation with a degree of belief of 1. It follows that a speaker *can* assert contradictory propositional contents if the degrees of belief do not contradict themselves, as in the following:

(79) Le Pen will possibly win even though he probably won't.

This prediction is borne out as (79) is indeed better than (76).

As for (75), this is an assertable utterance since the speaker may have a full personal belief that a proposition is false, while acknowledging that other conversational participants, i.e. other information states within the context set may believe to at least a *low* degree of certainty that this proposition is true. Note, however, that this is consistent only on the level of assertability, since the CUE of both propositional contents is contradictory and hence both cannot be updated at the same time. This is why even though (75) is better than (76), it is still not a completely felicitous utterance in itself.

But theory is one thing and empirical evidence is another. Since the empirical claim of the theory proposed here is that (75) is infelicitous, contra to Nilsen's theory, and this claim cannot be settled entirely by intuition (as they appear to differ here), we need to put the theory to the empirical test. For this purpose, an experiment is currently being conducted (Wolf, Cohen, and Simchon, 2015), utilizing acceptability judgments (7 point Likert scale) of Nilsen-type sentences. Example items taken from 32 modified Nilsen-type sentences:

(80) 16 adjective-adverb pairs:
It's possible that John the actor will accept the job but he will certainly refuse it.

(81) 16 adverb-adverb pairs:
Jane the professor will possibly remember the citation but she will certainly forget it.

Example items taken from 32 control sentences:

(82) 16 control items with felicitous utterances:
a. It's possible that John the priest will bless the couple but he will possibly curse them.
b. Margaret the collector will clean the antiques but she will hide them

(83) 16 control items with Infelicitous utterances:
a. David the lawyer will certainly include the clause but he will certainly remove it.
b. Maria the farmer will cultivate the land but she will neglect it.

The preliminary results of the experiment are depicted in the following figure:
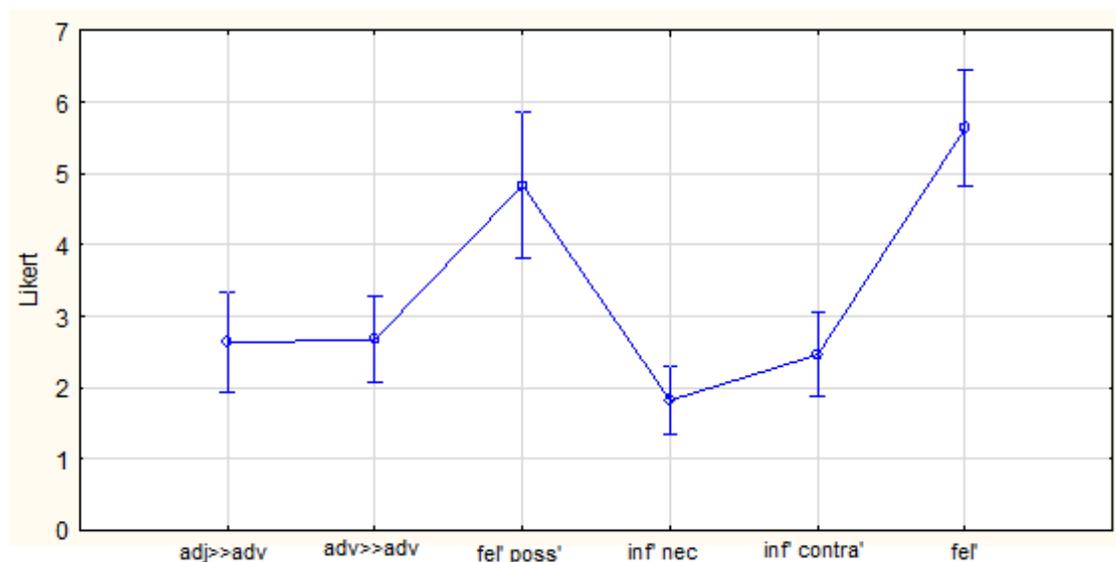
As can be seen, the adjective>>adverb and adverb>>adverb couples pattern with the contradictory items (infelicitous necessity and infelicitous contradictory). However – there is no significant difference between adjective>>adverb and adverb>>adverb themselves.

This result suggests that Nilsen's contrast is not so contrastive after all. Of course, further research is needed in order to substantiate these preliminary results (for more recent data, cf. Wolf, Cohen and Simchon, to appear).

5 Conclusion

I have argued that modal adverbs differ from modal adjectives and that this difference stems from modal adverbs being expressive and modal adjectives being descriptive subclasses of epistemic modals. Modal adjectives constitute descriptive claims about possibilities, asserted in a default manner. Modal adverbs on the other hand are 'negotiation chips' which affect the likelihood of an assertion to be accepted by the hearer, asserted with a lesser or stronger speech act force. Possibility modal adverbs are used as hedges that allow the speaker to assert a proposition with a lesser force, thereby insuring the speaker from losing credibility in case of a falsehood. Certainty modal adverbs are asserted with a stronger force and convey an added degree of commitment to the asserted proposition, thereby signaling the hearer to modify her willingness to accept it.

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References

Bellert, Irena. 1977. On semantic and distributional properties of sentential adverbs. *Linguistic Inquiry* 8(2):337–351.

Chierchia, Gennaro. 2004. Scalar implicatures, polarity phenomena and the syntax/pragmatics interface. In *Structures and Beyond*, ed. Adriana Belletti, 39–103. Oxford: Oxford University Press.

Cohen, Ariel. 2010. Conditionals as illocutionary operators. In *6th International Symposium of Cognition, Logic and Communication Formal Semantics and Pragmatics: Discourse, Context, and Models*. Riga.

Döring, Sophia. 2012. The Focus sensitivity of sentence adverbs. In *Proceedings of ConSOLE XIX*, 201–214.

Ernst, Thomas. 2009. Speaker-oriented adverbs. *Natural Language & Linguistic Theory* 27(3):497–544.

von Fintel, Kai. 1997. Bare plurals, bare conditionals, and 'only'. *Journal of Semantics* 14(1):1-56.

Geurts, Bart. 2007. Really fucking brilliant. *Theoretical Linguistics* 33:209-214.

Giannakidou, Anastasia. 1999. Affective dependencies. *Linguistics and Philosophy* 22:367-421.

Gutzmann, Daniel. 2012. *Use-Conditional Meaning:Studies in Multidimensional Semantics*. PhD dissertation. University of Frankfurt.

Hintikka, Jaakko. 1961. Modality and quantification. *Theoria* 27:119-128.

Horn, Larry. 1996. Exclusive company: 'Only' and the dynamics of vertical inference. *Journal of Semantics* 13:1-40.

Jackendoff, Ray. 1972. *Semantic Interpretation in Generative Grammar* (Studies in Linguistics Series 2). Cambridge, MA: The MIT Press.

Jacobson, Sven. 1978. On the use, meaning, and syntax of english preverbal adverbs. *Acta Universitatis Stockholmiensis. Stockholm Studies in English* 44:5-160.

Kadmon, Nirit, and Fred Landman. 1993. Any. *Linguistics and Philosophy* 16:353-422.

Kaplan, David. 1989. Demonstratives. In *Themes from Kaplan*, ed. Joseph Almog, John Perry, and Howard Wettstein, 481–563. Oxford University Press.

———. 1999. *The Meaning of Ouch and Oops: Explorations in the Theory of Meaning as Use*. Ms., UCLA.

Kratzer, Angelika. 1977. What 'must' and 'can' must and can mean. *Linguistics and Philosophy* 1:337-355.

———. 1981. The Notional category of modality. In *Words, Worlds, and Contexts: New Approaches in Word Semantics*, ed. Hans-Jürgen Eikmeyer and Hannes Rieser, 38-74. Berlin: Walter de Gruyter.

———. 1991. Modality. In *Semantik/Semantics: An International Handbook of Contemporary Research*, ed. Armin von Stechow and Dieter Wunderlich, 639-50. Berlin: Walter de Gruyter.

———. 2012. *Modals and Conditionals: New and Revised Perspectives*. Oxford: Oxford University Press.

Krifka, Manfred. 2001. Quantification into question acts. *Natural Language Semantics* 9:1-40.

Kripke, Saul A. 1963. Semantical analysis of modal logic I: Normal modal propositional calculi. *Zeitschrift Für Mathematische Logik Und Grundlagen Der Mathematik* 9:67-96.

Lassiter, Daniel. 2011. *Measurement and Modality: The Scalar Basis of Modal Semantics*. PhD dissertation, New York University.

Lewis, David. 1970. General semantics. *Synthese* 12:18-67.

Linebarger, C. Marcia. 1987. Negative polarity and grammatical representation. *Linguistics and Philosophy* 10(3):325-387.

Lyons, John. 1977. *Semantics*. Cambridge: Cambridge University Press.

MacFarlane, John. 2011. Epistemic modals are assessment-sensitive. In *Epistemic Modality*, ed. Andy Egan and Brian Weatherson, 144–178. Oxford University Press.

Nilsen, Øystein. 2004. Domains for adverbs. *Lingua* 114(6):809-847.

Nuyts, Jan. 2001. *Epistemic Modality, Language, and Conceptualization: A Cognitive-Pragmatic Perspective* (Human Cognitive Processing 5). John Benjamins.

Papafragou, Anna. 2006. Epistemic modality and truth conditions. *Lingua* 116(10):1688-1702.

Perkins, Michael R. 1983. *Modal Expressions in English*. London: Pinter.

Piñón, Christopher. 2006. Modal adverbs again. In *Honoring Anita Mittwoch on Her 80th Birthday, Syntax, Lexicon, and Event Structure*, 1-6. The Hebrew University of Jerusalem.

———. 2009. The Thing about Modal Adverbs. *Snippets* 20.

Potts, Christopher. 2005. *The Logic of Conventional Implictures*. Oxford Stu. Oxford: Oxford University Press.

———. 2007. The Expressive dimension. *Theoretical Linguistics* 33:165-198.

Recanati, François. 2006. Pragmatics and semantics. In *The Handook of Pragmatics*, 442-462.

Searle, John R and Daniel Vanderveken. 1985. *Foundations of Illocutionary Logic*. Cambridge: Cambridge University Press.

Stalnaker, Robert. 1968. A theory of conditionals. In *Studies in Logical Theory*, ed. Nicholas Rescher, 98–112. Oxford: Blackwell.

———. 1978. Assertion. In *Pragmatics* (Syntax and Semantics 9), ed. Peter Cole, 315–332. New York: Academic Press.

Van Rooij, Robert. 2003. Negative polarity items in questions: Strength as relevance. *Journal of Semantics* 20(3):239-273.

———. 2006. *Attitudes and Changing Contexts*. Springer Netherlands.

Vanderveken, Daniel. 1990. *Meaning and Speech Acts. Volume 1: Principles of Language Use.* Cambridge: Cambridge University Press.

———. 1991. *Meaning and Speech Acts. Volume 2: Formal Semantics of Success and Satisfacton*. Cambridge: Cambridge University Press.

Wolf, Lavi. 2014. *Degrees of Assertion*. PhD dissertation, Ben-Gurion University of the Negev.

Wolf, Lavi, Ariel Cohen and Almog Simchon. 2015. *An Experiment on Modal Adverbs and Adjectives with Regards to Nilsen's Contrast*. Ms., Ben-Gurion University of the Negev.

Wolf, Lavi, Ariel Cohen and Almog Simchon. To appear. Modal Adverbs and Modal Adjectives. *Proceedings of Sinn und Bedeutung 20*, Tübingen 2015.

Yalcin, Seth. 2010. Probability Operators. *Philosophy Compass* 5:916-937.